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Full Length Research

Olive cake usage as an alternative to cotton seed meal in dairy goat feeding

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This study was carried out on 23 heads of Damascus (Shami) goats to investigate the utilization of olive cake in (OC) dairy goat feeding as an alternative to cotton seed meal (CSM) at Research Farm of Mustafa Kemal University. Animals, having similar live weight and homogenity for milk yield according to the first lactation (202.2 ± 10.30 kg per lactation), were assigned into three groups. Goats in each group were fed with 1 kg of concentrate in different composition in addition to pasture per day. Each concentrate of the groups had got same ingredients in similar amount except for olive cake and cotton seed meal. At the end of the study it was determined that the replacement of olive cake to cotton seed meal decreased fat (P<0.05) and protein (P<0.01) percentage of milk without affecting milk yield (P>0.05). In conclusion, we can suggest that lactating Damascus goats could be fed with 10% OC and 10% CSM diets without any negative effects on milk composition and yield. Also usage of olive cake was recommended in goat diets because of its cost.

Key words: Shami goats, olive cake, cotton seed meal, milk production.

INTRODUCTION

Goat is mainly raised in the Mediterranean region of Turkey and there are 6.517.464 heads of goats according to animal production data (Anonymous, 2005). About 95% of this population consists of low producing Hair Goat breed. Goat production is one of the major sources of income in the region. The farmers entirely depend on goat production for a living. Although goats are very crucial for the farming families, they nevertheless destroy the forestry. Therefore, in order to prevent forestry from been damaged by the goat, the Ministry of Forestry brought new legislations on goat keeping at villages in or nearby forest areas. Regarding to these situations, farmers need some new solution to maintain goat product on. It is well known that goat production is done generally in extensive or very rarely in semi-intensive systems mainly because of the high feeding cost. In extensive system, there are some shortages of energy and protein requirements of goats especially during the lack of grazing and insufficient vegetative period of pasture. Pressed olive cake derived from processed olive commonly called “prina” especially in Aegean and Mediterranean regions of Turkey could be consumed for heating purposes. Consuming the seed inside olive cake for industrial heating could be considered as a regular process, but protein ingredient of the remaining pulp, except for the seed, is a beneficial nutrient source for livestock (Beken, 2009).

The most common used protein source in the Mediterranean region, when any concentrate supplements are given to goats, is cotton seed meal. Recent researches have focused on cheaper and easy obtainable alternative feedstuffs as protein source. In the Mediterranean region, olive cake is one of the important by-products from oil industry and mainly used as a house heating material. The main objective of the present study is to investigate the utilization of olive cake in goat breeding as an alternative to cotton seed meal.

MATERIALS AND METHODS

This study was carried out on 23 heads (Group A; n=7, Group B and C; n=8) of Damascus (Shami) goats at the Research and Training Farm of Agriculture Faculty of Mustafa Kemal University in Antakya province of Turkey. The experimental goats had twin kids and were in second lactation. Animals, with similar live weight, homogenity for milk yield according to the first lactation (202.2 ± 10.30 kg per lactation), were assigned into three groups.

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Table 1. Composition of the diets given to experimental animals.

Ingredients (Percentage of the total amount)	Group A	Group B	Group C
Cotton seed meal (918 g DM, 2025 Kcal ME 129.6 g CF, 20 g EE and 245 g CP kg^{-1})	20	10	0
Olive cake (926 g DM, 1450 Kcal ME, 340 g CF, 45 g EE and 71 g CP kg^{-1})	0	10	20
Barley (900 g DM, 2937 Kcal ME and 100 g CP kg^{-1})	35	35	35
Wheat bran (911 g DM, 2548 Kcal ME and 132 g CP kg^{-1})	30	30	30
Corn (912 g DM, 3080 Kcal ME and78 g CP kg^{-1})	14.7	14.7	14.7
Vitamin and mineral mixture	0.1	0.1	0.1
Salt	0.2	0.2	0.2
Cost of the diet, $/ton (1 $ = 1.50 Turkish Liras)	365	340	315
Composition per kg diet			
Dry matter (DM), g	905.9	906.7	907.5
ME (Kcal) (calculated)	2650.1	2592.6	2535.1
Crude protein (CP), g	135.6	117.6	100.3

Table 2. Chemical composition of the CSM and OC.

Items	CSM (%)*	OC (%)**
Dry matter (DM)	94.52	86.06
Ash	5.96	3.34
Organic matter (OM)	88.56	82.72
Crude protein (CP)	21.50	6.51
Crude fat (EE)	9.16	4.30
NFE	38.40	36.42
Crude fibre	19.48	35.49

*Ustaoğlu, 2007; **Filya ve ark., 2006.

Group A was used as control group and fed with diet containing 20% CSM and 0% OC. Animals in Groups B and C consumed diets containing 10% CSM and 10% OC; 0% CSM and 20% OC, respectively (Table 1). Chemical compositions of the CSM and OC are given in Table 2. All goats were grazed as a flock during the day time. Plant composition of the pasture consisted of *Trifolium fragiferum* L., *Hordeum murinum* L. and *Scolymus* sp. Varieties (Can, 1997). Each group was fed with 1 kg of concentrate formulated as iso-caloric when they were returned to the barn (Table 1). Each diet, with the same ingredients in similar amount except for olive cake and cotton seed meal, was given to the groups. Granulated CSM was added to the diet after extraction using expeller processing. OC was derived from olive oil extraction process and added to the diet. This diet was prepared based on the nutritional requirements of small ruminants recommended by NRC (1981). Water was offered to the animal's *ad-libitum*.

Nutrient compositions of the diet were analyzed for crude fibre by Lepper method and for dry matter, crude protein, crude fat, ash, organic matter and non protein nutrient by Wende method. Samples were oven-dried for 7 - 8 h at 102 ± 2ºC in order to determine dry matter and for 3 - 4 h at 550ºC to determine ash contents. Crude protein analysis was made according to Kjeldahl procedure and crude fat contents were determined by soxhlet procedure. Crude cellulose was obtained by weak acid and weak alkaline treatments. Organic matter content was calculated by subtracting the ash content form total dry matter content. Nitrogen content was calculated by subtracting total nutrients from 100 (Bulgurlu and Ergül, 1978). Milk yield was recorded by the method of A4 in ICAR (International Committee for Animal Recording) for 28 days interval during the first 150 days of lactation (ICAR, 1990). At control days, 200 ml of milk sample was also collected from morning milk of five animals in each group and immediately taken to the laboratory in an icebox. The samples were analyzed for total solids and ash by gravimetric method, fat by Gerber method, titratable acidity as lactic acid using N/10 NaOH and density as described in Turkish Standards No TS1018 (1981). Total protein was determined by phenol titration method according to James (1998). Lactose content of the milk was calculated by subtracting the sum of protein, fat and ash from the total solids content.

Data were processed by One-Way ANOVA and Duncan test of SPSS 13.0 for windows using the following model;

$$Y_{ij} = \mu + \alpha_i + e_{ij}$$

Where, Y_{ij} is the dependent variable, μ the overall mean, α_i the treatments and e_{ij} the residual error.

RESULTS

150-d milk yields, the chemical composition of the milk samples during the trial and initial and final weights of goats were given in Table 3. As seen in Table 3, iso-caloric prepared diets did not affect the final body weight of the groups. The diets had effect on fat ($P<0.01$) and

Table 3. 150-day milk yield and milk composition of the groups and weight of goats at the initial and final of study (mean ± standard error).

Parameters	Group-A	Group-B	Group-C	Sig.
Milk yield (L)	372.4 ± 26.09	320.3 ± 35.64	316.7 ± 5.74	N.S.
Fat (%)	5.0^{a} ± 0.16	4.1^{b} ± 0.12	4.1^{b} ± 0.06	*
Protein (%)	4.5^{a} ± 0.13	4.4^{a} ± 0.13	4.1^{b} ± 0.12	**
Acidity (%)	9.7 ± 0.24	9.9 ± 0.21	10.1 ± 0.29	N.S.
Dry matter (%)	13.0 ± 0.29	12.4 ± 0.36	12.8 ± 0.42	N.S.
Lactic acid (%)	0.2 ± 0.00	0.2 ± 0.00	0.2 ± 0.00	N.S.
Ash (%)	0. 9 ± 0.01	0.8 ± 0.01	0.8 ± 0.01	N.S.
Lactose (%)	2.6 ± 0.34	3.0 ± 0.40	3.7 ± 0.37	N.S.
Initial body weight (kg)	36.1 ± 1.50	36.2 ± 1.23	35.9 ± 1.40	N.S.
Final body weight (kg)	38.7 ± 0.70	38.4 ± 0.70	37.9 ± 0.90	N.S.

Sig., statistic significance; *, P<0.05; **, P<0.01; NS, non significant, a, b with the different superscript in same line indicate significant difference in the same line.

protein percentage (P<0.05) of the milk.

DISCUSSION

As seen in Table 3, although there is no significant differences found between trial groups (P>0.05), Group A goats had the highest milk yield among the groups (P<0.05). This could have been caused by higher lignin content in cellulose of olive cake when compared with that of cotton seed meal (Chiofalo et al., 2004; Krysl et al., 1987).

High lignin content in crude fibre has been reported to decrease digestible cellulose and the acetic acid percentage in volatile fatty acid of rumen. Low level of acetic acid content in rumen may cause fat content of milk to diminish (Fahey and Berger, 1988). On the other hand, Group C goats had the lowest protein percentage among all groups (P<0.01). Increment in olive cake percentage in the diet might have decreased the protein degradability due to the micro organisms in rumen as previously reported by different researchers (Merchen, 1988; Owens and Zinn, 1988). Cabiddu et al. (2003) also reported similar changes in protein level of milk with increasing olive cake percentage in the diet given to Sarda sheep. Milk yield and composition obtained from control group used in this study are in line with those of Keskin et al. (2004).

It was concluded that increment in olive cake percentage in concentrate caused decrease in fat (P<0.05) and protein (P<0.01) percentage in milk without affecting milk yield (P>0.05). Moreover, cost of diet, which contains 20% of olive cake, was 50 USD cheaper than the diet without olive cake (Table 1). In conclusion, we can suggest that lactating Damascus goats could be fed with 10% OC and 10% CSM diets without any negative effects on milk composition and yield. Also usage of olive cake was recommended in goat diets because of its cost.

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