

Supplemental Effect of Plant Extracts of *Lepidium sativum* and *Brassica juncae* Seeds on Milk Production and Composition of Awassi Ewes

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ABSTRACT

This experiment was conducted to study the effect of dried plant extract (DPE) *Lepidium sativum* and *Brassica juncae* seeds on milk yield, chemical composition and nutritional properties in Awassi ewes' milk. Twenty ewes (3-4 years old and body weight (35-40 kg) were assigned randomly into 5 groups (n = 4). The DPE was prepared by dissolving 1.5 gm from ground dried extract material in one liter drinking water. Treatments were 0 (0-DPE), 2.5 (2.5-DPE), 5 (5-DPE), 7.5 (7.5-DPE) and 10 (10-DPE) ml of the solution which was added daily to 10 ± 0.5 liters of drinking water. Treated water and feed were provided *ad libitum* during the experimental period (10 weeks). Results showed that milk yield increased by 15% in ewes fed 7.5-DPE compared to ewes fed 0-DPE; whereas milk protein and fat contents were not affected. The cholesterol level decreased (14.9-18.9ml/g) in all treated groups compared with the control group. Milk content of vitamins B12, B6 and amino acids (lysine, cystine, and methionine) increased (P<0.05) in DPE groups compared with 0-DPE group. Also CLA increased by 11-34%. From the results obtained in this study, it could be concluded that supplementing lactating Awassi ewes diet with 7.5-DPE in drinking water improved milk yield and composition.

Keywords: Awassi Sheep Milk, Amino Acids, CLA, Cholesterol and Vitamins B12, and B6.

INTRODUCTION

Awassi sheep is an indigenous breed in the Middle East use for milk and meat production. Raising sheep for meat and dairy products is an important part of the Jordanian agricultural sector. The estimated number of sheep in Jordan was 2,320,000 head and fresh milk produced from cattle and sheep is 345,000 tons which covered about 57% of Jordanian milk self sufficiency (DOS, 2011). In intensive dairy flocks, the ewe's milk is collected from ewes after lamb weaning

until the end of milking season and in general; Awassi sheep suffers from fluctuation in milk production throughout the milking period (Ali *et al.*, 2005). *Brassica juncae* is a brown mustard and believed to be the earliest domesticated condiment plant (Usfoelda *et al.*, 2010). The leaves, seeds and stems of this mustard variety are edible (Ufelle *et al.*; 2011) and has been shown to reduce the severity of asthma and digestion stimulant (Charis (2000). The plant has been reported to have antinciceptive and anti-hyperglycemic (Rahmaatullah *et al.*, 2010) *Lepidium sativum* is a fast growing annual herb that is native to west Asia (GoKavi *et al.*, 2004). Previous studies indicated that the seeds of such plants had a favorable effect on nutrient digestibility, live weight and feed efficiency of cows (El-Saadany *et al.*, 2001 Mohamed and El-Saidy, 2004). Abo El-Nor *et al.* (2007) indicated that *Lepidium sativum* improved the productive performance of lactating buffaloes. *Lepidium sativum* is also

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recommended in the treatment of hypertension, and renal diseases (Kirter and Basu, 2005 Tahraoui *et al.*, 2007). Therefore the objectives of this study were to evaluate the use of these natural plants (*Lepidium sativum* and *Brassica juncea*) that are widely grown in Jordan as a diet supplement on milk production, composition and nutritional properties of Awassi ewes.

Materials and Methods

Preparation of plant dried extract

Dried Plant Extract (DPE) was prepared by soaking 11% of ground seeds and 39% of the plant shrubs in an equal amount from *Lepidium sativum* and *Brassica juncea*. The mixture was soaked for 48 hr in hot water (40-60°C), strained through cheese cloth and let dried for overnight in a drying oven at 106± 2°C. The dried extract was then collected and stored under refrigerator until preparation of the Stock solution by dissolving 1.5 g in one liter of animal drinking water. (Patel *et al.*, 2009)

Flock management

The experiment was conducted using 20 mature Awassi ewes aged 3-4 years with 35-40 kg body weight. The ewes were distributed randomly into five groups four each. Each group was housed separately in identical pens. All ewes were raised under identical conditions at the University of Jordan experimental research station (Al-Mwagar, Sahab, Jordan). The ewes were placed for two weeks prior to the experiment under the same feed as an adaptation period. The groups were then given DPE at levels of 0, 2.5, 5, 7.5 and 10 ml from the stock solution added to 10 liters of drinking water which was given for each group ad lib, representing 0-DPE, 2.5-DPE, 5-DPE, 7.5-DPE, and 10-DPE groups.

In the current study, the lambing season of the ewes was in January. Daily milk production per ewe was recorded for 70 days at the beginning of April until the first week of June 2010. Ewes were milked by hand two times daily at 7:00 am and 3:00 pm.

Milk was mixed thoroughly and then 20 ml samples were

taken for analysis. Milk samples were analyzed for crude protein (CP) using a Kjeldahl method (AOAC, 2000; Foss Electric, Denmark) and fat by using Gerber techniques volumetric method (Funke Gerber, DIN, Art. 3154. Germany). Milk contents of amino acids (Lysine, Methionine and Cystine) and cholesterol were determined using kits purchased from r-biopharm (GmbH, Germany). Conjugated linoleic acid (CLA) was determined using gas chromatography (GC-210, Shimadzu, Japan) equipped with flame ionization detector (FID), GC solution software, and capillary column (TR-CN100, 60 m x 0.25 mm x 0.2 µm). Daily milk yield was recorded until the end of the experiment.

Statistical Analysis

The results of the experiment were analyzed by one way ANOVA using the General Linear Model (GLM) procedure of the SAS 2001 at 95% confidence interval with $P \leq 0.05$ being considered as significantly different.

Results and Discussion

Addition DPE supplement to the drinking water of Awassi ewes at level 7.5-DPE caused an increase in milk yield by 15% compared with the control treatment 0-DPE, 2.5-DPE, 5-DPE, or 10-DPE (Table 1). Milk yield increased ($P < 0.05$) in 7.5-DPE compared to the control treatment but the changes were negligible with treatments 5-DPE and 10-DPE, while the yield was negatively affected in treatment 2.5-DPE against the control. This difference indicates clearly that the maximum effects of DPE supplement on milk production is 7.5 level with no further improvement with higher or lower levels used. Also, milk fat and protein did not differ significantly between treatments and control. In agreement, Abo El-Nor *et al.* (2007) reported that fat content was slightly decreased in animal group provided diet with medical plants seeds (*Fenugreek* seeds, *Caraway*, black seeds, *lepidium sativum*).

In the current study, 0-DPE group showed a significant increase in milk cholesterol (19.4) but significant decrease in

2.5, 5, 7.5 and 10-DPE. (18.9, 16. 6.8 and 6.5), respectively.

The results demonstrated that supplementation of DPE in drinking water lowers cholesterol concentration by 14.9 to 18.9 mg/100g of milk. These values represent a decrease of 23.1 and 2.5% for treatments 7.5-DPE and 2.5-DPE respectively, when compared to the control. These results are in agreement with those reported by Al-Hamedan (2010)

who found a significant decrease in hypercholesterolmicin rats given *Lepidium sativum*.

It is obvious from the result that CLA concentration was improved with DPE addition when compared to the control treatment (Table 1). The level of CLA increased by 34% for treatment 7.5-DPE against 30 and 11% for treatment 10-DPE and 2.5-DPE, respectively.

Table 1: Milk yield and composition produced by Awassi ewes treated with DPE.

	Treatments				
	DPE-0	DPE-2.5	DPE-5	DPE-7.5	DPE-10
Milk yield L/wk/ewe ¹	1.9 ± 0.16 ^a	1.8 ± 0.611 ^a	1.9 ± 0.115 ^a	2.2 ± 0.26 ^b	1.9 ± 0.125 ^a
Crude protein, %	6.2 ± 0.35 ^b	5.9 ± 0.273 ^a	6.9 ± 0.44 ^a	6.8 ± 0.31 ^a	6.5 ± 0.112 ^a
Fat, %	7.930 ± 0.51	7.700 ± 0.113	8.060 ± 0.40	8.060 ± 0.13	8.210 ± 0.222
Cholesterol mg/100g	19.422 ± 0.714 ^a	18.935 ± 0.611 ^{ab}	16.077 ± 0.530 ^b	6.8 ± 0.13 ^c	6.5 ± 0.315 ^c
CLA mg/g	6.107 ± 0.183 ^c	7.018 ± 0.364 ^b	6.820 ± 0.157 ^b	8.193 ± 0.092 ^a	7.941 ± 1.086 ^{ab}

¹ Weekly production of milk per ewe. ² Values are means of four replicates. ³ means within row of different superscript are significantly (P<0.05) different

Vitamin B12 and B6 content in milk increased (P<0.05) in treated DPE groups compared to control group (Table 2). This could be attributed to the improvement in digestibility due to seed content of saponins which stimulate anaerobic fermentation of organic matter that improve efficiency of utilization of nutrients. In addition it increased bacterial number in the rumen (Valdez *et al.*, 1986; Ali *et al.*, 2005). This increase provides a key factor in improving Awassi

milk quality through milk composition. The changes in milk vitamins concentration strengthen the effect of feed additives on some of the milk composition. All treatments were synthesized B12 B6 better than untreated control group. The increase in vitamin B12 was higher produced by treatment (2.5-DPE) while vitamin B6 was higher synthesized by treatment 4 (7.5-DPE) of 22.5 and 114.9% for B12 and B6, respectively.

Table 2: B12 and B6 content of the whole Milk of Awassi ewes supplemented with DPE.

Treatment	Treatments				
	DPE-0	DPE-2.5	DPE-5	DPE-7.50	DPE-10.0
B6 (mg/100g)	0.094 ^d ± 0.004	0.195 ^b ± 0.014	0.095 ^d ± 0.008	0.202 ^a ± 0.006	0.101 ^c ± 0.003
B12 (mg/100g)	0.403 ^d ± 0.013	0.490 ^a ± 0.014	0.401 ^d ± 0.021	0.431 ^c ± 0.011	0.450 ^b ± 0.021

¹ weekly production of milk per ewe. ² values are means of four replicates. ³ means with different superscript are significantly (P<0.05) different

Lysine and Methionine levels increased in all treatments (Table 3). On the other hand, Cystine increased in all treatments except in treatment 2.5-DPE, which was similar to the control with a concentration of 0.038 mg/100g. In treatment 4, milk showed the highest amount of methionine by an increase of 41% compared to the control. These results are in compliance with that was reported by Volanis, *et al.* (2004), who found that addition of sliced orange silage in the feed as a replacement for a part of maize and oat lead to an increase of 12% and 16% in milk yield and fat content, respectively.

Conclusion

Awassi ewes diets supplemented with 7.5-DPE in drinking water improved milk yield and composition. Milk contents of vitamins B12, B6, amino acids (lysine, cystine and methionine), and conjugated linoleic acid were also improved; while the cholesterol level decreased.

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Table 3: Amino acid composition (mg/100 g) of whole milk taken from Awassi ewes treated with DPE.

	Treatments				
	DPE-0	DPE-2.5	DPE-5	DPE-7.5	DPE-10
Methionine	0.058 ^d ± 0.010	0.077 ^b ± 0.011	0.064 ^c ± 0.010	0.067 ^a ± 0.007	0.082 ^a ± 0.009
Cystine	0.038 ^c ± 0.001	0.038 ^c ± 0.001	0.045 ^a ± 0.008	0.045 ^a ± 0.062	0.040 ^b ± 0.003
Lysine	0.341 ^b ± 0.021	0.406 ^a ± 0.013	0.398 ^a ± 0.016	0.347 ^b ± 0.011	0.342 ^b ± 0.012

¹ weekly production of milk per ewe.² values are means of four replicates. ³ means with different superscript are significantly (P<0.05) different

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