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EFFECT OF CHAMOMILE FLOWER OR BLACK SEED ADDITIVES ON MILK YIELD AND COMPOSITION OF LACTATING GOATS.

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SUMMARY

Fifteen lactating Baladi goats, seven days after parturition, were divided into three groups using complete randomized block design to study the effect of adding chamomile flower (*Mtricaria chamomilla*) or black seeds (*Nigella sativa*) to their rations on milk yield and composition. Experimental rations were, Control, (C), (concentrate feed mixture to fresh Berseem clover (*Trifolium alexandrinum*) at 1 : 1 ratio, on dry matter basis); Treatment I (C plus 5 g/head/day chamomile flower), and Treatment II (C plus 5 g/head/day black seeds). The experiment lasted for 90-days. Individual rumen liquor and blood samples were collected from each animal at 30, 60 and 90 days, while milk was sampled every two weeks during the experimental period for chemical analysis. Experimental additives (chamomile flower and black seeds) increased ($P<0.05$) ruminal total volatile fatty acids (TVFA's), propionate, butyrate and true protein nitrogen concentrations, and decreased ($P<0.05$) ruminal pH values, acetate, ammonia nitrogen and non protein nitrogen concentrations compared with the control. Ruminal microbial counts were not affected by the experimental additives. Chamomile flower significantly increased milk yield and 4% fat corrected milk (FCM) compared to black seeds and the control. Yields of milk components were significantly increased in animals fed chamomile flower. However, milk constituents were insignificantly affected in any of the treatments. Experimental additives significantly increased blood serum glucose and urea concentrations compared with the control. Albumin concentration slightly increased in animals fed chamomile flower compared to the other treatments. Glutamic-oxaloacetate-transaminase (GOT) concentration was significantly decreased by treatments compared to the control, reflecting an improvement in liver function with the experimental additives. Other blood serum parameters were not affected by any of the treatments.

Keywords: *chamomile flowers, black seeds, rumen parameters, blood parameters, milk yield, milk composition, lactating goats.*

INTRODUCTION

Attempts to use natural materials such as medicinal plants or seeds could be widely accepted as feed additives to improve the efficiency of food utilization and animals productive performance (Zeid and Ahmed, 2004 and Abo El-Nor *et al.*, 2007). Chamomile can be used for cold relief, anti-fever, spasms relief, anti-mouth and stomach ulcers and anti-fungal diseases (Abo Zeid 1986). Chamomile has some properties as an anti-inflammatory, anti-septic, and anti-bacterial agent, and known for its spasmolytic activities

(Mericli, 1990). Using chamomile in goat's diets had a positive effect on productive performance, feed conversion and economical efficiency, but it reduced water intake (Zeid and Ahmed, 2004). Adding 2 g chamomile flower/head/day to lamb's rations improved all nutrient digestibilities, feeding values, animal growth and feed efficiency (Maged, 2004). Also, yields of milk, fat and protein were reported to increase by chamomile flower supplementation in goat's rations (Shehata *et al.*, 2004).

Black seeds extract inhibited gram-positive and gram-negative bacteria (Hanafy and Hatem 1991). In addition, it might be useful as a galactogogue for lactating buffaloes (Kholif and Abd El-Gawad, 2001 and Abo El-Nor *et al.*, 2004). A black cumin seed (Nigella sativa) was used as a source of protein and fat for lactating animals especially linoleic and oleic acids where the major unsaturated fatty acids while palmitic acid was the main saturated one. Also, glutamic acid, arginine and aspartic acid were the main amino acids present while cystine and methionine were the minor amino acids (Al-Jassir, 1992). The high level of sitosterol in black seed oil (*Nigella sativa*) could make it the most suitable and effective for lowering blood cholesterol and preventing coronary heart disease (Cheikh-Rouhou, *et al.*, 2008).

The objective of this study was to evaluate effects of chamomile flower and black seeds as feed additives on a selection of rumen and blood serum parameters, milk yield and composition, and general health of lactating goats.

MATERIALS AND METHODS

This study was conducted at the Experimental Farm in Shalakan, Faculty of Agriculture, Ain Shams University and Dairy Science Department, National Research Center, Dokki, Cairo, Egypt from October, 2009 to January, 2010.

Animals and Diets:

Fifteen lactating Baladi goats, in early lactation (4-5 years old, 3-4 lactation seasons and weighting on average 27.0 ±0.5 kg) were divided into three experimental groups using complete randomized block design for a 90-day period. The control (C) group received fresh berseem clover (*Trifolium alexandrinum*) (BC), and concentrate feed mixture (CFM) at a 1:1 ratio, on dry matter basis). The two experimental diets used were, control diet plus 5 g/head/d of chamomile flower (T_1), and control diet plus 5 g/head/d of black seeds (T_2). Chamomile flower and black seeds were administered to animals by mixing with one kg CFM for the morning meal. The chemical composition of ingredients is shown in Table (1). The offered feeds were assessed to cover the maintenance and production requirements for each animal (A.R.C., 1983). The CFM for each animal was offered individually once daily at 8.00 am, while fresh berseem clover was offered at 10.00 am. Dry matter intake was measured at 30, 60 and 90 days by weighing the offered diets and refusals from the previous day. Clean water was available ad libitum.

Table (1): Chemical composition (%) of concentrate feed mixture and berseem clover (DM basis).

Item	CFM	berseem clover	Chamomile flower	Black seeds
Dry matter	92.7	88.0	89.0	95.8
Ash	9.1	12.1	5.7	4.1
Organic matter	90.9	87.9	94.3	95.9
Crude protein	14.1	12.8	18.0	18.7
Ether extract	4.2	2.5	4.6	42.1
Crude fiber	15.1	28.2	36.5	17.6
Nitrogen free extract	57.5	44.4	35.2	17.5

CFM: Concentrate feed mixture consisted of 35% yellow corn, 25 % wheat bran, 23% decorticated cotton seed meal, 15% rice bran, 1.5% ground limestone and 0.5% mineral and vitamin mix contained 42 ppm Co, 3500 ppm Cu, 20,000 ppm Fe, 12,000 ppm Mn, 12,000 ppm Zn, 1200 ppm I, 3800 IU/g of vitamin A, 1200 IU/g of vitamin D, and 30 IU/g of vitamin E.

Feed Analysis:

Samples of feed ingredients were analyzed for dry matter, ash, crude protein, crude fiber and ether extract according to methods of A.O.A.C. (1995). Meanwhile, nitrogen-free extract was calculated by difference.

Sampling and Analysis of Rumen Liquor:

Rumen liquor samples were collected from three animals within each group by a stomach tube. Collection was performed 4-hours after feeding of morning concentrates, at 30, 60 and 90 days. The samples were strained through two layers of cheese cloth and then stored in glass bottles (10ml) with 100 µL of toluene and a thin layer of paraffin oil just to cover the surface to stop microbial activity and to prevent volatilization and stored at −18°C till chemical analysis. Ruminal pH was determined using a digital pH-meter, total nitrogen (TN), non-protein-nitrogen (NPN) and NH_3-N were determined according to A.O.A.C. (1995). True protein nitrogen (TPN) was calculated by difference. Total (TVFA's) and fractions of volatile fatty acids were determined by Gas chromatography (Varian 3700; Varian Specialties Ltd, Brockville, Ontario, Canada).

Microbial counts:

Samples of ruminal liquor (500 ml) were mixed thoroughly, and sub-samples of 250 ml were blended anaerobically under oxygen-free CO_2 and strained through 2 layers of cheesecloth. A 3-ml portion of the strained ruminal fluid was preserved using 3 ml of methyl green formalin-saline solution for protozoa enumeration. Protozoa samples were stored at room temperature in the dark until counting. Protozoa were enumerated microscopically in a Levy-Hausser counting chamber (Hausser Scientific, Horsham, PA) (Ogimoto and Imai, 1981). Each sample was counted twice, and when the average of the duplicates differed by more than 10%, the counts were repeated.

Serial 10-fold dilutions of strained ruminal fluid were prepared under 95% CO_2-5% H_2 in an anaerobic chamber and used as inoculum for microbial counts. Total viable counts were enumerated on triplicate layered plates (Kock, 1994) containing ruminal fluid-starch-agar medium (Grubb and Dehority, 1976). Cellulolytic bacteria were counted by the most probable method based on the degradation of a filter paper strip (Mann, 1968).

Sampling and Analysis of Blood Serum:

Blood samples were collected from the jugular vein of each animal at 30, 60 and 90 days after morning feeding. The collected blood samples were centrifuged at 4000 r.p.m./min for 20 minutes to separate the serum. The obtained serum was stored at –18°C till chemical analysis. Blood samples were analyzed for serum total protein (Armstrong and Carr, 1964), albumin (Doumas *et al.,* 1971), urea (Patton and Crouch,1977), glucose (Siest *et al.,*1981), cholesterol (Raltiff and Hall 1973), serum glutamic-oxaloacetate-transaminase (GOT) and glutamic-pyruvate-transaminase (GPT) (Reitman and Frankel, 1957). Globulin was calculated by difference between total protein and albumin.

Sampling and Analysis of Milk:

Individual milk samples were collected every two weeks during the experimental period (90 days). The goats were handily milked twice daily at 8.00 am and 8.00 pm. Milk yield was recorded daily and milk pH was determined using digital pH meter. The sample of each animal represents a mixed sample of constant percentage of the evening and morning yield. Milk samples were analyzed for total solids, fat, protein and lactose using infrared spectrophotometry (Foss 120 Milko-Scan, Foss Electric, Hillerød, Denmark) according to A.O.A.C. (1995) procedures. The ash content of milk was determined after heating in a muffle furnace at 550 °C for 16 h.. Solids not fat content was calculated by difference. Fat corrected milk (4% fat) was calculated by using the following equation according to Gaines (1928):

$$FCM = 0.4 \text{ milk yield (gm)} + 15 \text{ fat yield (gm)}$$

Statistical Analysis:

Data were analyzed using the mixed model procedure of Statistical Analysis System (SAS, 1998) to account for effects of treatment, period and animal within treatment. The treatment was considered a fixed effect; period and animal within treatment were considered random effects. Effects of the factors were declared significant at ($P < 0.05$) unless otherwise noted and trends were discussed at ($P < 0.10$). Duncan's multiple range tests was used to test the significance between means (Duncan, 1955).

RESULTS AND DISCUSSION

Rumen Liquor Parameters:

Effects of the experimental additives on some rumen parameters are shown in Table (2). Ruminal pH values were significantly lower ($P<0.05$) in groups fed chamomile flower and black seeds additives than the control group. All values were above pH 6.0 which indicated a better digestion of cellulolytic materials. These results are agreement with those of Ali *et al.,* (2005), who reported that pH value was insignificantly decreased by chamomile flower addition. Ammonia nitrogen was decreased in groups fed the experimental additives compared with the control group. Similar results were reported by Mohamed *et al.*, (2003), Maged (2004) and Ali *et al.*, (2005) who concluded that ammonia nitrogen concentration was reduced in rumen fluid of sheep fed rations supplemented with chamomile or medicinal additives compared with the control group.

Table (2): Average ruminal parameters of goats fed on rations added with chamomile flower or black seeds.

Item	Control	Chamomile	Black seeds	±SE
pH	6.33^a	6.15^b	6.20^b	0.025
TVFA's (meq/dl)	12.54^b	13.69^a	13.52^a	0.115
Acetate	66.06^a	61.59^b	60.59^b	0.980
Propionate	20.33^b	23.40^a	22.63^a	0.514
Butyrate	13.61^b	15.01^a	16.78^a	0.714
Acetate : propionate ratio	3.25^a	2.63^b	2.68^b	0.102
Total nitrogen (mg/dl)	136.24	138.11	137.89	0.566
Ammonia nitrogen (mg/dl)	30.25^a	27.35^b	28.36^b	0.236
Non protein nitrogen (mg/dl)	65.36^a	61.03^b	60.32^b	0.299
True protein nitrogen (mg/dl)	70.88^b	77.08^a	77.57^a	0.156

a, b means with different superscripts are significant ($P<0.05$) difference.

Lower ammonia nitrogen concentration might be attributed to the action of medicinal additives as buffers or regulators in absorbing and releasing ammonia nitrogen in the rumen. True protein nitrogen was significantly increased with the experimental additives compared to the control (Table 2). These advantages may provide favorable conditions in the rumen for microorganisms activity for best utilization of ruminal ammonia for beneficial conversion into microbial protein. Values of TVFA's were significantly increased in the treated groups which might indicate chamomile action in a stimulating rumen micro flora activity (Zeid, 1998). Molar proportions of individual VFA and the acetate to propionate ratio were significantly affected by medicinal additives which increased the propionate and butyrate proportions and decreased the acetate proportion. Consequently, there was a decrease in the acetate to propionate ratio compared with the control. Ruminal total nitrogen was slightly increased and ruminal true protein nitrogen was significantly increased meanwhile, ruminal non protein nitrogen was significantly decreased in animals fed chamomile and black seeds additives compared with the control animals. These results may be due to the higher uptake of non protein nitrogen to microbial protein syntheses with animals fed chamomile and black seeds additives than with the control animals.

Rumen Bacterial Counts:

Data of the effects of chamomile and black seeds additives on ruminal microbial populations are presented in Table (3). In the present experiment, total viable bacteria, cellulolytic bacteria and protozoa counts were not changed by the addition of chamomile and black seeds. These results are agreement with those of Wallace *et al.*, (2002) who observed no changes in total viable bacteria counts in sheep fed high or low protein diets supplemented with essential oils. In addition, other studies (Benchaar *et al.*, 2003;

Newbold *et al.*, 2004; Benchaar *et al.*, 2006b; Benchaar *et al.*, 2007) reported no effect of essential oil on the number and composition of the ciliate protozoa populations.

Table (3): Ruminal microbial counts of lactating goats fed rations added with chamomile flower or black seeds.

Item	Control	Chamomile	Black seeds	±SE
Number of observations	15	15	15	--
Total viable bacteria, x 10^9/mL	2.44	2.50	2.46	0.055
Cellulolytic bacteria, x 10^7/mL	3.26	3.32	3.28	0.070
Protozoa, x 10^5/mL	4.98	4.76	4.72	0.065

Blood Serum Metabolites:

Data in Table (4) showed no significant differences (P>0.05) among the different treatments on blood serum proteins in-concluding total protein, albumin and globulin. Abo El-Nor *et al.*, (2007) found similar results with black seeds while, Shehata *et al.*, (2004) and Ali *et al.*, (2005) found an increase in serum albumin with added chamomile flower to lactating animals rations. Serum urea nitrogen concentration was increased (P<0.05) with chamomile flower (T_1) compared with the control, while, black seeds showed moderate values. This increase in urea nitrogen may be due to the higher flow of ammonia from rumen to blood in animals fed chamomile and black seeds due to the positive effect on productive performance (Zeid and Ahmed, 2004). Serum glucose was higher in animals fed chamomile flower and black seeds than in the control animals. Shehata *et al.*, (2004) and Abo El-Nor *et al.*, (2007) found a significant increase of serum glucose when chamomile flower and black seeds were added to lactating animals' rations.

Table (4): Blood serum parameters of lactating goats fed rations added with chamomile flower or black seeds.

Item	Control	Chamomile	Black seeds	±SE
Total protein (g/dl)	6.44	6.27	6.66	0.072
Albumin (g/dl)	3.99	4.11	3.97	0..059
Globulin (g/dl)	2.45	2.16	2.69	0.130
Urea (g/dl)	44.54^b	51.32^a	48.0^{ab}	0.319
GOT (U/dl)	40.06^b	29.20^a	30.10^a	0.230
GPT (U/dl)	14.61	14.46	14.97	0.128
Glucose (mg/dl)	63.29^b	70.51^a	71.82^a	0.084
Cholesterol (mg/dl)	99.03	87.21	85.65	0.981

a, b means with different superscripts are significant (P<0.05) difference.

Blood serum glutamic-oxaloacetate-transaminase (GOT) was significantly lower with treated groups than with the control which reflected an improvement of liver function. Meanwhile, glutamic-pyruvate-transaminase (GPT) values were not significantly affected by the treatments. Shehata *et al.*, (2004) observed that chamomile flower addition significantly reduced GOT and GPT compared with control. Cholesterol concentration was slightly decreased with animals fed experimental additives compared with control. Cheikh-Rouhou *et al.*, (2008) observed that oils extracted from black seeds could have many health benefits, especially in lowering LDL-cholesterol and preventing heart disease. These results indicated that chamomile flower and black seeds addition to lactating goats' rations were good affecting on liver activity and animals health

Dry Matter Intake:

Dry matter intake (DMI) was slightly increased with the experimental additives compared with the control (table 5). The increase of feed intake by chamomile and black seeds addition may be due to the improvement of nutrients digestibility which result in the greater milk yield (Abd El-Hamid *et al.*, 1999). When animals are in negative energy balance (early lactation) the additional energy available, due to the essential oil from medicinal supplementation is used to improve performance, reduce body reserve losses (Tedeschi *et al.*, 2003). Goats used in the present experiment had a negative energy balance in early lactation. Similar results were obtained by Shehata *et al.*, (2004) using chamomile flower, and Abo El-Nor *et al.*, (2007) using black seeds in rations of dairy animals, they reported that dry matter intake was not affected by the experimental additives.

Milk Yield and Composition:

Milk yield and 4% fat corrected milk (FCM) were significantly higher with goats fed chamomile flower followed by black seeds and then the control (table 5). It is interesting to note that serum glucose (Table 5) had the same trend as milk yield which was also in agreement with the results of Clark *et al.*, (1977) who claimed a positive correlation between blood glucose and milk yield. As a result of the increased milk yield, daily milk components' yields were significantly increased ($P<0.05$) with animals fed chamomile flower showing highest values followed by black seeds compared with the control animals (Table 5). Aboul-Fotouh *et al.*, (2000), Saleh (2004) and Shehata *et al.*, (2004) found that milk yield and yields of fat, protein and total solids tended to be increased by 8.9% with chamomile supplementation to lactating animal's rations. The relative improvement in milk production of black seeds could be explained on the basis that black seeds increased secretory epithelial cell number and mammary weight in the treated animals (El-Komey, 1996). Also, the galactopoietics effect of black seeds may be due to its estrogenic activity which was noticed by Agrawal *et al.*, (1990). Chamomile act as anti-dysentery, bacteria and worms, which decrease losses of adjusted feed due to parasites and save digested nutrients to improve production (Mericli, 1990). Higher milk yield obtained with animals fed supplemented rations might indicate the stimulation of rumen micro-flora activity through the positive effect of chamomile on animal health and immunity of animals (Allam *et al.*, 1999). Also, chamomile flower increased gastric acid secretion for nutrients digestibility improvement (Khayyal *et al.*, 2006).

Table (5): Average daily milk yield and composition of lactating goats fed rations added with chamomile flower or black seeds.

Item	Control	Chamomile	Black seeds	±SE
No. of animals	5	5	5	--
Live body weight	26.8	26.9	27.35	0.684
Dry matter intake (g/h/d):	935.2	945.6	952.1	1.132
Milk yield (g/d)	859.1[c]	1091[a]	984.4[b]	0.697
4% FCM (g/d)	649.1[c]	813.8[a]	738.6[b]	1.168
Yields (g/d)				
Fat	20.36	25.16	22.98	0.331
Protein	29.04[b]	37.29[a]	35.19[a]	0.263
Lactose	31.79[b]	43.76[a]	36.21[ab]	0.379
SNF	72.51[b]	96.05[a]	79.66[ab]	0.319
Ash	8.26[b]	10.65.[a]	9.13[a]	0.056
Milk composition %				
Fat	2.37	2.30	2.33	0.093
Protein	3.38	3.42	3.57	0.106
Lactose	3.70	4.04	3.68	0.103
TS	10.81	11.10	10.43	0.134
SNF	8.44	8.80	8.09	0.134
Ash	0.961	0.927	0.975	0.048
pH	6.95	6.93	6.96	0.012
Feed efficiency:				
Milk yield/DMI	0.919[b]	1.154[a]	1.034[a]	0.768
FCM yield/DMI	0.694[b]	0.861[a]	0.776[ab]	0.665

a, b, c means with different superscripts are significant ($P<0.05$) difference.

Data of milk composition of the experimental goats are also summarized in Table (5). Milk fat was slightly decreased while milk protein was slightly increased with animals fed chamomile and black seeds additives compared with control animals. The lower milk fat and higher milk protein may be due to the lower ruminal acetate proportion and acetate to propionate ratio in goats which received chamomile and black seeds when compared with the control (Table, 2). Also, the decrease in milk fat may be due to the dilution rate of higher milk yield of supplemented groups.

Milk lactose was slightly higher in T_1 (chamomile flower) than in the other treatments. Milk total solids, solids not fat, ash contents and pH values were not significantly affected by treatments. Similar results were obtained by Saleh (2004), Shehata *et al.,* (2004) and Abo El-Nor *et al.,* (2007) who suggested no significant effect on milk composition by chamomile flower and black seeds addition to rations.

Generally, feed efficiency calculated as milk yield/DMI and 4% FCM/DMI were significantly improved with animals fed chamomile and black seeds compared with the control (Table 5). Shehata *et al.,* (2004) and Abo El-Nor *et al.,* (2007) obtained similar results.

CONCLUSION

Obtained results support the conclusion that addition of chamomile flower to the ration of lactating goats, at the prescribed amount, was more effective in improving performance when compared with black seeds. Adding chamomile flower or black seeds to the ration improved milk production, rumen activity and feed efficiency, with no deleterious effect on general health, when compared with the control treatment. More research is needed to explain the mode of action of chamomile flower as a feed additive on performance of high yield lactating animals.

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تأثير إضافة زهرة البابونج أوحبة البركة إلى العلائق على انتاج اللبن وتركيبة فى الماعز الحلاب

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تم استخدام ١٥ انثى ماعز بلدى حلابة لدراسة تأثير إضافة زهرة البابونج أوحبة البركة على الأداء الإنتاجي للماعز الحلاب. حيث قسمت الحيوانات الي ثلاثة مجموعات باستخدام نظام القطاعات العشوائية الكاملة حيث تغذت الحيوانات على العلائق التالية:

١- المجموعة الأولى (المقارنة): علف مركز ٥٠%+ برسيم أخضر ٥٠%.

٢- المجموعة الثانية: عليقه المقارنة + ٥ جم زهرة البابونج / رأس/يوم.

٣- المجموعة الثالثة: عليقه المقارنة + ٥ جم حبة البركة / رأس/يوم.

وكانت أهم النتائج المتحصل عليها كما يلى:

١- ارتفاع تركيز كل من الأحماض العضوية الطيارة والبروبيونات والبيوترات والبروتين الحقيقى معنويا كما انخفض pH الكرش والأسيتات والأمونيا والنيتروجين الغير بروتينى بإضافة زهرة البابونج أوحبة البركة. بينما لم تؤثر تلك الاضافات على العدد الكلى للبكتريا وأعداد البروتوزوا وأعداد البكتريا المحللة للألياف.

١- ارتفع إنتاج اللبن معنويا (٥%) بإضافة زهرة البابونج أوحبة البركة ونتيجة لذلك ارتفع محصول كل مكونات اللبن مقارنة بالمجموعة المقارنة. بينما لم تؤثر تلك الاضافات معنويا على مكونات اللبن. كما ارتفع معدل الاستفادة من الغذاء معنويا (٥%) بإضافة زهرة البابونج وحبة البركة مقارنة بالمجموعة المقارنة.

٢- ارتفع جلوكوز الدم ويوريا الدم معنويا (٥%) كما انخفض تركيز GOT (الانزيات الناقلة للأحماض الأمينية) بإضافة زهرة البابونج أوحبة البركة لعلائق الماعز الحلاب بينما لم يتأثر تركيز باقى مكونات الدم معنويا بالمعاملات.

ومن هذه النتائج يتضح ان إضافة زهرة البابونج كان أكثر تأثيرا على انتاجية الماعز الحلاب من حبة البركة دون التأثير على صحة الحيوان. ولذلك ينصح بإضافة زهرة البابونج لتحسين انتاجية الحيوانات الحلابة. كما ينصح بإجراء مزيدا من الأبحاث على إضافة زهرة للبابونج للحيوانات عالية الإدرار لدراسة تأثير المادة الفعالة لزهرة البابونج على انتاجية تلك الحيوانات.