EFFECT OF THE NATURAL ADDITIVES ON THE PRODUCTIVE PERFORMANCE OF LACTATING GOATS.

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SUMMARY

The purpose of this study was to evaluate the effects of diets supplemented with the medicinal herbs (black cumin and chamomile) on the digestion coefficients, blood parameters and milk production of goats. Fifteen lactating *Zaraibi* goats were assigned randomly to three equal groups (five animals each). The first group (G1) was fed un-supplemented basal diet. The second and third groups [(G2) & (G3)] were fed the basal diet supplemented with black cumin and chamomile as 100 and150 mg/kg body weight (BW), respectively. The basal diet consisted of berseem hay (BH) and concentrate feed mixture (CFM) representing 50 and 50 % of the total ration (on dry matter basis). The experimental period extended from one week post partum until the fourth month of lactation. The obtained results illustrated that black cumin and chamomile addition (G2 & G3) significantly ($P \leq 0.05$) improved the digestibility of nutrients and the nutritive value compared with control diet (G1). Significant ($P \leq 0.05$) increases have been observed in the milk production up to 13.52 & 23.08% and in milk fat yield up to 19.50 & 28.04% for black cumin and chamomile goats, respectively compared with the control goats. Furthermore, goats in groups (G2) & (G3) had significant increases ($P \leq 0.05$) in plasma glucose, while, had significant ($P \leq 0.05$) decreases in urea-nitrogen compared with goats in G1. The study concluded that chamomile had the significant superiority ($P \leq 0.05$) in improving milk as yield and milk contents. .

***Keywords**: Zaraibi goats, medicinal herbs, digestibility, milk yield, milk composition.*

INTRODUCTION

Feed additives have been added in order to stimulate the appetite, provide the animal with a certain nutrient, and improve the biological processes such as: ruminal fermentation, metabolism, productivity, and re-productivity of the animal. Feed additives must be safe not only for animal but also for human.

Recently, medicinal herbs such as: fenugreek, caraway, garden cress,..etc., have been used as feed additives and have shown good effects on the animal production (*Abo El-Nor, et al.,*2007, *Aboul-Fotouh, et al.,*2000,*El-Saadany, et al.,* 2001 and *Kholif* and *Abd El-Gawad,* 2001).

Some of these herbs are *Nigella sativa* (black cumin, or habbet el-barakah) and *Matricaria chamomille* (chamomile, or baboning). The words pre and post "or" in the brackets refer to English and Arabic names, respectively (*Boulos*, 1983). In studies with mono-gastric animals, black cumin and chamomile had beneficial effects, whereas, black cumin increased, a) the number of secretary epithelial cells of the mammary gland, b) the activity of anti-pathogenic, while chamomile acts as an a) anti-microbial, b) anti-inflammatory. Actually, these beneficial effects are attributed to the bioactive compounds of these herbs (*Boulos,* 1983; *Mahmoud*, 1993 and *El-Komy*, 1996).

With regard to use black cumin and chamomile in ruminants diets, many studies have shown that both herbs had good effects on the animal performance either as meat or milk production (*El-Hosseiny, et al.,* 2000; *El-Allamy, et al.*, 2001; *Abd-El Ghani*, 2003; *Shehata et al.*, 2004; *El-Bordeny et al.,* 2008 and *Saleh et al.*, 2009

The aim of the present work was to evaluate the effects of some medicinal plants (black cumin and chamomile) as feed additives in the rations of lactating *Zaraibi* goats on the digestion efficiency, blood parameters and milk production.

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, Giza, Egypt.*

Feeding and management

Fifteen homo-parity *Zaraibi* goats weighing about 35±0.87 kg, after one week of parturition were assigned randomly to three groups of five animals each.

All animals received the basal diet. Black cumin and chamomile were added to the basal diet as 100 mg and 150 mg / kg of the body weight (BW) for goats in the groups (G2) and (G3), respectively. Un-supplemented diet was offered to animals in the group G1. The basal diet consisted of concentrate feed mixture (CFM) and berseem hay (BH) at the ratio of 1:1 on DM basis. CFM and BH were offered twice a day at approximately 07:00 a.m. & 02:00 p.m. and 09:00 a.m. & 04:00 p.m., respectively. Feed additives were top- dressed on CFM immediately prior to morning feeding. The nutrients requirements were calculated according to NRC (1981). Goats had unlimited access to water. All animals were remained on the experiment until the end of the fourth lactation month. The chemical composition of feed ingredients and the control diet is shown in Table (1). This analysis was done according to *A.O.A.C.* (1995).

Table (1): Chemical composition of diet ingredients and the control diet

Item	DM	on DM basis (%)					
		OM	CF	CP	EE	NFE	Ash
CFM*	93.49	83.44	12.42	14.25	03.28	53.49	16.56
Berseem hay	88.32	88.37	26.64	12.85	01.36	47.52	11.63
Control diet	90.86	85.90	19.53	13.55	02.32	50.50	14.10

**CFM: commercial concentrate feed mixture*

Milk sampling

The goats were individually milked twice a day. Milk weights were measured and biweekly sampled from each goat. Composite samples (morning & evening) were frozen until analysis. Milk fat, protein, and total solids (TS) were determined by the method of *Ling* (1963). Lactose and ash were analyzed according to *Barnett* and *Abd El-Tawab* (1957) and *A.O.A.C.* (1995), respectively. Solids not fat (SNF) was calculated by difference. Four percent fat corrected milk (4%FCM) was calculated using the equation:

$$FCM = \text{milk (g)} \times (0.3925) + 0.1510 \times \text{fat (\%)}$$ (*Gaines* and *Davidson*, 1923)

Digestibility coefficients

The apparent digestibility of the DM, OM, CP, CF, EE and NFE, was determined by the method of the grab sample in which acid insoluble ash (AIA) was used as an internal marker according to *Van Keulen* and *Young* (1977). Total digestible nutrients (TDN) and digestible crude protein (DCP) were calculated.

Blood samples

Blood samples were collected once every month before feeding from the jugular vein in anti-coagulated tubes .Blood plasma was separated by centrifugation and stored frozen until chemical analysis for glucose (*Trinder*, 1969); total protein (*Armstrong* and *Carr*, 1964); albumin (*Doumas et al.*, 1971); globulin was calculated by difference; urea-N (*Patton* and *Crouch*, 1977) and glutamic-oxaloacetate- transaminase (GOT) and glutamic-pyruvate-transaminase (GPT) by the method of *Reitman* and *Frankel* (1957).

Statistical analysis

The statistical analysis system *(SAS*, 1999) analyzed the data by using the general linear model (GLM) procedure of completely random design. Differences among groups were determined by the Duncan's new multiple rank test (Duncan, 1955). The following model was used:

$$Y_{iK} = \mu + G_i + E_{ki}$$

Where : $Y\,ik$ = the observation ; μ = the mean ; Gi = the effect of the experimental groups (i =G 1,G 2 and G3) and $E\,ik$ = the residual error.

RESULTS AND DISSCUSION

Digestibility and nutritive value

A summary of the mean apparent digestion coefficients is shown in Table (2). Apparent digestibilities of DM, OM, CP, EE, and NFE were higher (P≤0.05) for black cumin and chamomile goats than for control goats. The digestion coefficients of CF were significantly lower for control goats (51.37%) than for goats in groups G1 & G2 (57.79 & 59.65%, respectively). Data of Table (2) indicated that TDN were 60.11; 64.87 and 66.22 %, as DCP percentages were 7.52 , 8.43 and 9.57% for the groups G1 ; G2 and G3, respectively (P≤ 0.05) .

Table(2): Effect of feeding the natural additives to lactating Zaraibi goats on nutrients digestibility and nutritive value on DM basis

Item	The experimental diets			±SE
	Control diet (G1)	Black cumin[1] (G2)	Chamomile[2] (G3)	
Digestibility % :				
DM	60.31[b]	64.87[a]	65.92[a]	0.91
OM	64.23[b]	68.93[a]	70.57[a]	2.83
CP	62.76[b]	65.81[a]	68.19[a]	4.11
CF	51.37[b]	57.79[a]	59.65[a]	3.13
EE	65.17[b]	69.21[a]	70.92[a]	3.12
NFE	70.09[b]	74.35[a]	75.98[a]	2.71
Nutritive value % :				
TDN	60.11[b]	64.87[a]	66.22[a]	1.75
DCP	7.52[b]	8.43[a]	9.57[a]	0.95

[a,b] Means in the same rows with different superscripts differed significantly at (p< 0.05)
[1] 100 mg/kg of BW
[2] 150 mg/kg of BW

It is of interest to report that apparent digestion coefficients and nutritive value terms were numerically higher for chamomile group than for black cumin group, however, the difference between two groups did not significantly differ (P≥0.05). These findings could reflect that the medicinal herbs (black cumin and chamomile) stimulated the digestion efficiency either as microbial or chemical digestion all over the digestive tract. The present results are in line with those reported by Abd El-Ghani, (2003); Mohamed *et al.*, (2003);Ali *et al.*, (2005); El-Ashry *et al.*, (2006) and El-Bordeny *et al.*, (2008) who evaluated the effect of diets containing chamomile or black cumin on the digestion efficiency of sheep in Egypt .

Dry matter intake, milk yield and milk composition

With regard to DM intake, it is notable to report that there were no evident palatability problems with additives. No significant differences (P ≥0.05) in intake were observed among control, black cumin, and chamomile goats. The DM intakes were 1172, 1295, and 1287 g/h/d for the groups G1, G2 and G3, respectively (Table, 3)

Concerning milk yield data, Table (3) showed that lactating goats fed black cumin and chamomile had marked increases (P ≤ 0.05) in milk yield up to 13.52 and 23.08% and in 4 % FCM up to 16.8 and 30.6 %, respectively compared with control goats. Chamomile effect was higher (P ≤ 0.05) than that of black cumin.

Data in Table (3) illustrated that feeding black cumin and chamomile to Zaraibi goats did not affect (P≥0.05) any of the milk contents, with one exception where both the feed additives significantly

increased (P≤0.05) lactose contents in milk of goats (4.92 and 4.99 % for G2 and G3, respectively) compared with control goat (G1) (4.41%).

Table (3): Effect of feeding the natural additives to lactating Zaraibi goats on feed intake, milk yield, milk composition, and feed conversion.

Item	The experimental diets			
	Control diet (G1)	Black cumin[1] (G2)	Chamomile[2] (G3)	±SE
DM intake (g/h/d)	1172	1295	1287	6.92
Milk constituents%:				
Fat	3.21	3.38	3.57	0.11
Protein	2.90	2.93	2.98	0.08
Lactose	4.41[b]	4.92[a]	4.99[a]	0.12
T S	11.22	11.23	11.54	0.18
SNF	8.01	7.85	7.97	7.97
Ash	0.70	0.71	0.71	0.01
Yield (g/h/d):				
Milk	1105.3[c]	1254.7[b]	1360.4[a]	44.2
4%FCM	974.3[c]	1138.0[b]	1272.6[a]	28.4
Fat	35.48[b]	42.41[a]	45.43[a]	3.10
Protein	32.05[c]	36.76[b]	37.92[a]	0.30
Lactose	48.74[b]	61.73[a]	63.51[a]	1.20
Feed conversion : Kg DMI /Kg milk	1.06	1.03	0.94	

[a,b,c] *Means in the same rows with different superscripts differed significantly at (p< 0.05)*

[1] 100 mg/kg of BW

[2]150 mg/kg of BW

Clearly, remarkable increases (P≤0.05) were noticed in the yield of milk fat (42.41 and 45.43 g/h/d), protein (36.76 and 37.92 g/h/d) and lactose (61.73 and 63.51 g/h/d) for diets supplemented with black cumin and chamomile (G2 and G3, respectively) compared with the un-supplemented diet (G1) in which yields of these compounds were 35.48, 32.05 and 48.74 g/h/d., respectively. Milk fat yield (P≤ 0.05) increased in groups G2 and G3 by 19.50 and 28.04 %, respectively compared with that in G1.

These findings can be illustrated on the basis that the different bioactive substances present in black cumin and chamomile stimulated milk production. Significant effects of feed additives on digested CF, TDN and plasma glucose (Table 2 & 4) may emphasize this explanation. Accordingly black cumin and chamomile may possibly be considered as glucogenic substances.

Table (4): Effect of feeding the natural additives to lactating Zaraibi goats on blood plasma parameters

Item	The experimental diets			
	Control diet (G1)	Black cumin[1] (G2)	Chamomile[2] (G3)	±SE
Glucose (mg/dl)	64.21[b]	68.17[a]	70.43[a]	2.09
Total protein (g/dl)	7.16	7.45	7.73	0.51
Albumin (A) (g/dl)	3.62	3.86	3.97	0.27
Globulin (G) (g/dl)	3.54	3.59	3.76	0.35
A/G ratio	1.02	1.07	1.05	0.02
Urea- N (mg/dl)	18.19[a]	14.71[b]	12.36[b]	0.54
GOT (unit/L)	24.18[a]	21.02[b]	18.22[c]	1.37
GPT (unit/L)	13.33[a]	11.25[b]	09.57[c]	0.65

[a,b,c] *Means in the same rows with different superscripts differed significantly at (p<0.05)*

[1] *100 mg/kg of BW*

[2]*150 mg/kg of BW*

The present results agree with those obtained by El-Saadany, *et al.*, (1996); Allam, *et al.*, (1999); El-Allamy *et al.*, (2001) ; Shehata, *et al.*, (2004) and Saleh and Saleh (2005) who used diets supplemented

with black cumin and chamomile for the lactating buffaloes, ewes, and goats. They have found increases in milk yield and contents in response to feeding black cumin or chamomile

Feed conversion

Data in Table (3) indicated that feed conversions were 1.06, 1.03, and 0.94 kg DMI/kg produced milk for the un-supplemented diet (G1) and those supplemented with black cumin and chamomile (G2 and G3), respectively. Feeding chamomile resulted in a slight, but not significant ($P \geq 0.05$), improvement (9%) in feed conversion.

Plasma parameters

Concerning blood metabolites, data in Table (4) clearly showed that feeding black cumin and chamomile diets to goats resulted in a significant increase ($P \leq 0.05$) of plasma glucose compared with the control goats This could be attributed to the significant ($P \leq 0.05$) effects of black cumin and chamomile on the CF digestion (Table, 2).

Results of blood glucose are in accordance with those obtained by El-Ashry, *et al.*, (2006) and Abo El-Nor, *et al.*, (2007), who found significant increases in blood glucose of calving and lactating buffaloes fed the diets supplemented with medicinal herbs.

With regard to nitrogen metabolites, it could be noticed that black cumin and chamomile had slight, but not significant, increases in total proteins, albumin, globulin, or the ratio between the later items (Table 4). However, both additives significantly ($P \leq 0.05$) decreased the urea-N, GOT and GPT concentrations in the plasma. Despite of this marked decrease, these concentrations were not out of the normal range suggested by Kaneko (1989) for the healthy animals. The present results of plasma items studied here are in line with those obtained by Zeid, (1998); El-Allamy, *et al.*, (2001); and Shehata, *et al.*, (2004).

CONCLUSION

From the foregoing results, it could be concluded that black cumin (as 100 mg/kg BW) and chamomile (as 150 mg /kg BW) added to *Zaraibi* goats diets ($P \leq 0.05$) improved the milk production and milk fat yield. Their beneficial effects resulted from the proper effects of the black cumin and chamomile as good stimulators for the digestion and milk secretion. The chamomile effect had the significant ($P \leq 0.05$) superiority.

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تأثير الإضافات الطبيعية على الأداء الإنتاجى للماعز الحلاب

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الهدف الرئسى لهذا البحث هو دراسة تأثير الاضافات الطبيعية (حبة البركة وزهرة البابونج) الى علائق الماعز الزرايبى الحلاب على معاملات الهضم والقيمة الغذائية والمأكول من المادة الجافة و انتاج و مكونات اللبن و مكونات الدم. ولهذا الغرض قسمت خمسة عشر عنزة بعد الولادة باسبوع الى ثلاث مجاميع متساوية :

غذيت المجموعة الأولى على عليقة الكنترول (G1) التى تتكون من علف مركز ودريس برسيم بنسبة 1:1 على أساس المادة الجافة وغذيت المجموعة الثانية (G2) والثالثة (G3) على عليقة الكنترول مضاف إليها 100 و 150 ملليجرام من الأعشاب الطبية / كم وزن حى من حبة البركة (المجموعة الثانية) و زهرة البابونج (المجموعة الثالثة) على التوالى واستمرت التجربة حتى الشهر الرابع من الولادة. و قد اثبتت النتائج أن:

1- إضافة هذين العشبين إلى المجاميع التجريبية (G2 & G3) ادى الى تحسن معنوى فى كل من معاملات هضم مكونات المادة الغذائية والقيمة الغذائية للعليقة بالمقارنة بمجموعة الكنترول (G1).

2- أدت إضافة حبة البركة و البابونج الى زيادة انتاج اللبن بنسبة 13,52 و23,08 % والى زيادة كمية دهن اللبن بنسبة 19,5 و 28,04 % على التوالى.

3- كما ادت هاتان الاضافتان الى زيادة معنوية فى جلوكوز الدم والى نقص معنوى فى نيتروجين يوريا الدم .

وتشير نتائج البحث الى ان اضافة كل من حبة البركة وزهرة البابونج الى علائق العنزات الحلابة لها تأثير ايجابى يؤدى الى زيادة انتاج ومكونات اللبن وزيادة معاملات الهضم والقيمة الغذائية للعليقة الا ان زهرة البابونج كان تأثيرها افضل فى ذلك وليس لها اى تأثير سلبى على مكونات الدم او صحة الحيوانات الحلابة لذا ينصح باستخدامه كإضافة غذائية بمعدل 150 ملليجم/كجم وزن حى للعنزات الحلابة.