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Effect of Some Medicinal Plants Seeds in the Rations on the Productive Performance of Lactating Buffaloes

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Abstract: Fifteen lactating buffaloes aged 4-6 years, 4 weeks before calving were divided into five feeding treatments, 3 animals each. Medicinal plant seeds were added to basic diet at levels of 200 g fenugreek seeds (T_1), 50 g caraway (T_2), 50 g black seeds (T_3) and 100 g lepidium sativum (T_4) were fed for 12 weeks of lactation. Dry matter intake was slightly ($p>0.05$) increased in T_1 than the other groups. Feeding herbs significantly ($p<0.05$) increased nutrient digestibility (DM, OM, CF and NFE) and significantly ($p<0.01$) increased digestibility co-efficient of CP and EE compared with control. Milk yield and 4% FCM were significantly ($p<0.05$) increased in treated animals than those of control being 6.08 (control), 7.56 (T_1), 6.43 (T_2), 6.95 (T_3) and 7.35 (T_4) for milk yield and 7.96 (control), 9.84 (T_1), 8.5 (T_2), 9.1 (T_3) and 8.97 (T_4) for FCM yield, respectively. Daily fat, SNF, lactose and protein yield were significantly ($p<0.05$) increased with treated groups than control group. Milk composition was not affected by medicinal plants additives except that lactose content significantly ($p<0.05$) increased with treated animals than those of control being 4.5, 5.05, 4.84, 4.94 and 4.97 respectively. However, fat content was slightly ($p>0.05$) decreased with treated groups being 6.27, 6.11, 6.09, 6.19 and 5.54 for control, T_1, T_2, T_3 and T_4, respectively. The calculated efficiencies of milk yield/DMI and 4% FCM/DMI were improved ($p<0.05$) in treatment (T_2) compared with other groups. Fenugreek seeds (FG) treatments showed non significant lower values of cholesterol and total lipids, however, FG significantly ($p<0.05$) increased blood glucose, TP, Albumin and creatinine compared with other groups. Values of blood plasma for globulin, urea, Alk-p-ase and GOT were not significantly affected by added of medicinal plants.

Key words: Medicinal plants, lactating buffaloes, nutrients digestibility, blood plasma, milk yield and composition

INTRODUCTION

Buffaloes are considered the principle milk yielding animal in Egypt. They produced about 60 and 40% of the total milk yield and meat production in Egypt, respectively (Agriculture Economy Research Institute, 2003). Average milk yield ranged between 1404 and 1836 kg/head /lactation season (305 day) as well as, average fat content was about 7% and productive life of lactating buffaloes was estimated to be at 5 lactation season (Nigm, 1996).

Feed additives are important materials that can improve feed efficiency and performance of lactating buffaloes. Moreover, there are evidence indicating that these products could be considered as pollution for human and threaten there health on the long-run (Salem and El-Mahdy, 2001). On the

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other hand, attempts to use the natural materials as alternative growth promoters such as medicinal plants are widely accepted. Such medicinal plants include *Nigella sativa, Trigonella foenum* and *Lepidium sativium* have some properties as antiseptic, antibacterial activities against microorganism treatment, of gastro-intestinal complaints and tonic (Mericli, 1990). Moreover, Hanafy and Hatem (1991) reported that *Nigella sativa* seeds extracts inhibited gram-positive and gram-negative bacteria. In addition, Kholif and Abd El-Gawad (2001) and Abo El-Nor *et al*. (2004) reported that Nigella sativa, *Lepidium sativium* and *Carum carvi* seeds might be useful as a galactogogue for lactating buffaloes.

Also, some studies indicated that such plants seeds had favourable effects on nutrient digestibility, live weight and feed efficiency with cows (Youssef *et al*., 1998; Aboul-Fotouh *et al*., 1999; Saadany *et al*., 2001; Mohamed and El-Saidy, 2004).

In addition, some studies indicated that the medicinal plants improved rumen activity and nutrient digestibility (El-Saadany *et al*., 1996; Allam *et al*., 1999; Aboul-Fotouh *et al*., 1999).

The objective of this study was to evaluate effects of some medicinal plants as feed additives in the rations of lactating buffaloes on the yield and composition of their milk.

MATERIALS AND METHODS

This study was conducted at the experimental farm station of milk replacer research centre, Faculty of Agriculture, Ain shams University and National Research Centre, Dairy Science Department, Dokki. Cairo, Egypt.

Animals Management and Feeding Regime

Fifteen lactating buffaloes (at the third and fourth seasons of lactation), 4 weeks before calving were divided into five equal groups. The animals were randomly assigned among five experimental treatments of three animals each. The overall means of animals' weight were 575, 585, 591, 600 and 603 kg for control, T_1, T_2, T_3 and T_4. The experimental period started from 4 weeks before calving and extended for 12 weeks after parturition.

The extended ratio of concentrates to roughage were 70:30 on DM basis. Control group fed CFM and RS without supplements, whereas animals in the treated groups received T_1 (control + 200 g fenugreek seeds h^{-1} day^{-1}), T_2 (control + 50 g caraway seeds h^{-1} day^{-1}), T_3 (control +50 g *Nigelle sativa* seeds h^{-1} day^{-1}), T_4 (control + 100 g lepidium sativum seeds h^{-1} day^{-1}). The CFM consisting of 25% undecorticated cotton seed meal, 35% wheat bran, 30% yellow corn, 4% rice bran, 3% molasses, 2% limestone and 1% sodium chloride. The chemical composition of ingredients are shown in Table 1. The offered feeds were assessed to cover the requirements for each animal from Starch Equivalent (SE) and Digestible Protein (DP) according to Shehata (1971). Animals were fed individually. Concentrates were offered once daily at 8:00 am supplemented with medicinal plant seeds. Roughage was offered twice daily in equal parts at 9:00 am and 16:00 pm water was always available to the animals all the day.

Table 1: Chemical Composition of Concentrate Feed Mixture (CFM), Rice Straw (RS) and the experimental medicinal plants (on DM basis)

	Diet ingredients					
Item	CFM	RS	FG	CC	NS	LS
Dry matter	92.7	91.0	96.65	93.800	95.78	94.77
Organic matter	90.9	85.8	96.14	9.082	95.86	94.00
Ash	9.1	14.2	3.86	9.180	4.14	6.00
Crude protein	14.1	3.4	22.01	18.320	18.65	23.92
Ether extract	4.2	1.2	11.50	22.240	42.10	32.51
Crude fiber	15.1	35.1	7.78	24.330	17.60	15.60
Nitrogen free extract	57.5	46.1	54.85	25.930	17.51	21.97

FG = Fenugreek, CC = *Carum carvi*, NS = *Nigella sativa*, LS = *Lepidium sativium*

Analysis of Feed Samples

Samples of ingredients and rations were analyzed for DM, ash, Crude Fiber (CF) and Ether Extract (EE) according to the methods of AOAC (1995). Nitrogen Free Extract (NFE) was calculated by difference.

Sampling and Analysis of Milk

Animals were machine milked twice daily at 7:00 am and 3:00 pm. Milk were recorded daily for each animal during 12 weeks of experimental period. Sampling of milk were collected once every two weeks immediately after each milking milk samples were taken for acidity determination. Milk samples were also analyzed for fat, Total Solids (TS), Total Protein (TP) and ash (Ling, 1963). Lactose (Barnett and Abd El-Tawab, 1957). Solids Not Fat (SNF) was calculated by difference.

Sampling and Analysis of Blood Plasma

Blood samples were taken from all animals at the same day of milk sampling at 4 h after morning feeding. Blood was directly collected every 2 weeks from the jugular vein in glass tubes containing EDTA and centrifuged at 4000 rpm for 20 min. Blood plasma was then separated into a clean dried glass vial and stored frozen at -18°C until chemical analysis. Plasma total protein was determined as described by Armstrong and Carr (1964) while, albumin (Doumas *et al*., 1971), Urea (Patton and Crouch, 1977), glucose (Siest *et al*., 1981) and Plasma Glutamic-Oxaloacetate-Transaminase (GOT) and Glutamic-Pyrovate-Transaminase (GPT) (Reitman and Frankel, 1957), Globulin and albumin/globulin ratio were calculated, Creatinine (Husdan, 1968), total lipids (Postma and Stores, 1968), cholesterol (Kostner *et al*., 1979), Alkaline phosphatase (Bessey *et al*., 1946).

Statistical Analysis

The statistical analysis system (SAS, 1998) was used for least square of variance for repeated measures of milk yield, milk composition, milk acidity, parameters and data of blood plasma analysis. The following model was applied:

$$Y_{ijk} = \mu + T_i + e_{ik} + W_j + (TW)_{ij} + e_{ijk}$$

Where:

Y_{ijk} = An observation on the Kth animal in the Jth week given the ith treatment.
μ = An effect common to all animals. In this model the constant μ is assumed to represent the population mean
T_i = An effect common to all animals given ith treatment
e_{ik} = Error 1 which is Kth animal within ith treatment
W_j = An effect common to all animals in the Jth week
$(TW)_{ij}$ = An effect particular to ith treatment and Jth week of lactation period
e_{ijk} = Is a randomized error of all the unidentified factors that may affect the dependent variables and are not included in the model.

On the other hand, the data for digestibility trials was subjected to statistical analysis by a simple one-way classification analysis. The following model was applied:

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

Where :

μ = Grand mean of treatment population, which is a constant for all observations.
T_i = Effect of treatment population (I = 1th to 5 th)
e_{ijk} = Experimental error

Duncan's multiple range-test (1955), was used for testing the significant differences between means (if any).

RESULTS AND DISCUSSION

The Effect of Treatments on Feed Intake and Nutrients Digestability

Dry Matter Intake (DMI) for animals fed T_1 and T_4 were slightly ($p<0.05$) higher than those recorded for control, T_2 and T_3 as shown in Table 2. The same observation was noticed in DMI/$kg^{0.75}$. However, Abo El-Nor (1999) concluded that dry matter intake was insignificantly decreased in treated groups being 14.23, 13.93 and 13.96 kg h^{-1} day^{-1} when he fed lactating buffaloes on zero, 100 and 200 g fenugreek seeds h^{-1} day^{-1}. These results may be attributed to the effect of fenugreek and lepidium sativum seeds on hypothalamus to stimulate hungriness center in the brain and increase the desire for eating (Petit *et al*., 1993).

The present value (Table 2) showed that co-efficients of digestibility of NFE and DM were significantly increased in T_1 than control, Whereas there no significant differences between the other treatments and control. Morever, OM and CF co-efficient significantly increased for T_1, T_3 and T_4 while there were no significant differences between T_2 and control. All treatments significantly increased ($p<0.01$) CP and EE digestibility compared with control. The improvement in digestibility co-efficiets of T_1 could be illustrated on the basis that these seeds contain saponins which stimulate anaerobic fermentation of organic matter that improve efficiency of utilization of nutrients. In addition it increased bacterial number in the rumen of lactating cows (Valdez *et al*., 1986; Ali *et al*., 2005).

The Effect of Treatments on Milk Yield and Composition

Milk Yield

During the first 12 weeks of lactation period the milk yield had a higher significant ($p<0.01$) effect. The overall milk yield means of weeks (Fig. 1) significantly increased gradually with time progress to reach its maximum at the 6th week then decreased ($p<0.01$) gradually until the 12th week (the end of the experiment). The overall daily milk means for control, T_1, T_2, T_3 and T_4 were 6.08, 7.56, 6.43, 6.95

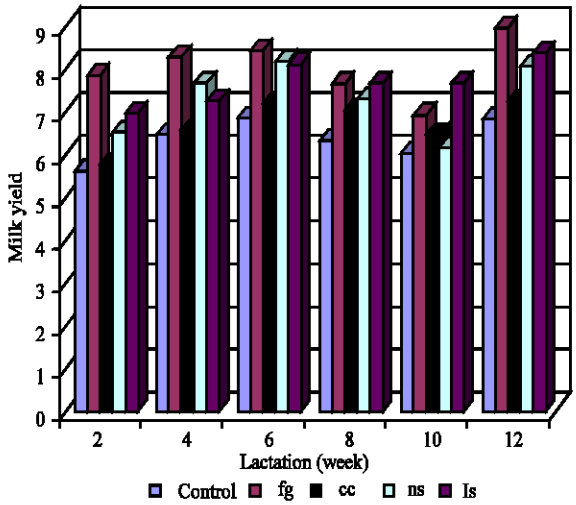

Fig. 1: Effect of treatment on average milk yield of buffaloes (fg = Fenugreek, cc = Carawey, ns = Balck seed, Is = Cress

and 7.35 kg h^{-1} day^{-1}, respectively. The relative improvement in milk production by medicinal plant seeds supplementation might be due to higher value of nutrients digestibility (Table 2). Moreover, the higher milk production for fenugreek group (T_1) could be illustrated on the basis that fenugreek seeds may contain some active components stimulating the hypothalamus or directly to pituitary gland leading to release of prolactin (Basha *et al*., 1987). While, the improvement in milk production in T_3 could be illustrated on the basis that *Nigella sativa* increased secretary epithelial cell number and mammary weight in treated animals (El-Komey, 1996). Also, the galactopoietics effect of *Nigella sativa* may be due to its Estrogenic activity which was noticed by Agrawal *et al*. (1990). Also the improvement in milk production for Lepidium sativium group (T_4) could be attributed to increase efficiency of nutrients utilization (Tiwari *et al*., 1993). Table 3 show the effect of supplementing rations with different medicinal plant seeds on 4% Fat-Corrected Milk (FCM) yield of lactating buffaloes during the first 12 weeks of lactation period. It could be noticed

Table 2: Effect of treatments on mean* values of LBW, DMI and nutrients digestibility

		Treatment				
Item	Control	T_1	T_2	T_3	T_4	SE±
No. of animal	3	3	3	3	3	
LBW (kg)	580	591	601	609	610	6.13
DMI (kg h^{-1} day^{-1})	12.36	13.12	12.7	12.52	13	0.14
CFM	7.36	8.12	7.7	7.52	8	0.15
Rice straw	5	5	5	5	5	
DMI/$W^{0.75}$	104.6	109.5	104.6	102.1	105.4	0.28
Nutrients digestibility						
DM	60.51^{b}	68.51^{a}	63.29^{ab}	65.68^{ab}	66.32^{ab}	2.21
OM	62.4^{c}	70.69^{a}	65.19^{bc}	68.86^{ab}	69.16^{ab}	1.46
CP	63.54^{B}	74^{A}	69.77^{A}	71.6^{A}	73.74^{A}	1.56
CF	53.07^{c}	62.98^{a}	55.11^{bc}	60^{ab}	62.5^{a}	2.06
EE	70.06^{B}	76.11^{A}	72.71^{A}	75.54^{A}	75.66^{A}	1.21
NFE	71.05^{b}	77.83^{a}	71.33^{b}	75.00^{ab}	75.1^{ab}	1.47*

*Each value is a mean of 3 animals; means with different subscripts in the same raw are differ significantly ($p<0.05$, a,b and c) or ($p<0.01$ A and B)

Table 3: Effect of treatments on milk yield and composition

		Treatments				
Item	Control	T_1	T_2	T_3	T_4	SE±
Milk yield (kg h^{-1} day^{-1})	6.08^{b}	7.56^{a}	6.43^{ab}	6.95^{ab}	7.35^{a}	0.39
Fat corrected milk	7.96^{b}	9.84^{a}	8.50^{ab}	9.10^{ab}	8.97^{ab}	0.49
Yield (g)						
Milk fat yield	381.65^{b}	457.17^{a}	389.79^{ab}	424.51^{ab}	405.06^{ab}	23.75
Total solids yield	926.33^{b}	1184.57^{a}	1012.9^{ab}	1071.9^{ab}	1128.77^{a}	57.57
Solids not fat	558.34^{b}	729.13^{a}	621.21^{ab}	648.68^{a}	722.96^{a}	37.36
Total protein	219.64^{b}	296.81^{a}	255.65^{ab}	260.07^{ab}	282.03^{a}	16.26
Lactose	279.48^{b}	382.65^{a}	313.19^{ab}	344.08^{a}	366.21^{a}	21.67
Ash	48.24	55.98	47.18	53.35	49.27	4.37
Feed efficiency						
DMI/kg h^{-1} day^{-1}	12.36	13.12	12.7	12.52	13.00	
DMI/milk	2.03^{a}	1.74^{b}	1.98^{a}	1.80^{b}	1.45^{c}	0.001
Milk/DMI	0.49^{b}	0.58^{a}	0.51^{b}	0.56^{a}	0.57^{a}	0.004
FCM/DMI	0.64^{c}	0.75^{a}	0.67^{b}	0.73^{a}	0.69^{b}	0.002
Composition (%)						
Fat	6.27	6.11	6.09	6.19	5.54	0.2
TS	15.2	15.69	15.72	15.5	15.36	0.2
SNF	9.18^{b}	9.58^{a}	9.62^{a}	9.31^{b}	9.82^{a}	0.1
TP	3.62	3.93	3.95	3.77	3.93	0.14
Lactose	4.57^{b}	5.05^{a}	4.84^{a}	4.94^{a}	4.97^{a}	0.08
Ash	0.79	0.75	0.74	0.77	0.68	0.04
Acidity	0.177	0.177	0.174	0.176	0.185	0.004

Means with different subscripts in the same raw are differ significantly ($p<0.05$, a, b and c)

Table 4: Effect of treatments on overall means of some blood parameters

		Treatment				
Item	Control	T_1	T_2	T_3	T_4	SE±
Total protein	7.19^{ab}	6.99^{b}	7.29^{ab}	7.10^{ab}	7.60^{a}	0.163
Albumin	3.87^{ab}	3.55^{b}	3.86^{ab}	3.69^{ab}	3.99^{a}	0.124
Globulin	3.33	3.44	3.45	3.38	3.63	0.142
A/G ratio	1.22	1.01	1.13	1.10	1.10	0.080
Urea	39.15	40.41	38.58	42.00	38.44	2.140
Creatinine	1.07^{ab}	1.17^{ab}	1.41^{ab}	1.31^{a}	0.91^{b}	0.150
GOT	32.55	34.72	32.47	27.86	34.19	4.130
GPT	12.47^{B}	11.11^{A}	17.87^{A}	16.21^{A}	15.69^{A}	0.740
Alkaline phosphates	36.47	36.89	37.69	38.84	37.62	0.890
Glucose	61.45^{b}	68.81^{a}	66.21^{a}	66.93^{a}	67.14^{a}	1.480
Total lipids	263.00	251.89	261.40	261.33	261.49	3.170
Cholesterol	142.75	124.77	138.40	141.65	136.33	7.560

Means with different subscripts in the same raw are differ significantly ($p<0.05$, a, b and c) or ($p<0.01$ A and B)

that, the overall 4% FCM yield means significantly increased. The present results are in accordance with those of Allam *et al.* (1999) and Abo El-nor (1999) who reported that 4% FCM yield was higher ($p<0.01$) when lactating buffaloes were fed on zero, 100 and 200 g fenugreek seeds/head/day.

Milk Composition

Milk Solids Not Fat (SNF) content was higher ($p<0.05$) in T_4, T_2 and T_1 than T_3 and control (Table 3). Also milk lactose content was higher ($p<0.05$) in T_1, T_4, T_3 and T_2 than control. While, milk fat, total solids, total protein and ash content did not differ significantly between treatments. As on impact of the increased milk yield, daily TS, SNF, TP and lactose yields were significantly higher in T_1 and T_4 than T_3 and T_2 than control. However milk fat yield was higher ($p<0.05$) in T_1 than T_3, T_4 and T_2 compared with control.

The efficiencies in milk production calculated as DMI/kg milk yield, milk yield/DMi and 4% FCM yield/DMI were improved ($p<0.05$) in treatment T_2 (Fenugreek seeds) as compared with the other group.

Blood Plasma Metabolites

Data in Table 4 showed no significant differences ($p<0.05$) among different treatments on some blood parameters (globulin,albumin/globulin ratio, urea, GOT, alkaline phosphates, total lipids and cholesterol). Other parameters (total protein, albumin, creatinine, GPT and glucose) were increased significantly ($p<0.05$) in different groups. The increase in total protein may be due to nourishing effect and improved digestion effect for *Lepidium sativium* seeds (Boulous, 1983). While the increase in albumin are in good agreement with those reperted by (Allam *et al*., 1999; Ali *et al*., 2005; El-Ashry *et al*., 2006). However the result of creatinine are in good agreement with Nazar (1994) who found that creatinine was higher ($p>0.05$) by using fenugreek seeds and lower ($p>0.05$) by using *Lepidium sativium* seeds. Also, the increase of GPT may be illustrated on the basis that milk production of treated animals enhanced liver metabolism which lead to increase of GPT activity (Larson, 1985). Whatever, increase of glucose can be illustrated on the basis that used medicinal plant seeds as mentioned previously increased apparent digestibility of nutrients. this result are agreement with those reported by Nazar (1994) and El-Ashry *et al*. (2006) who found that the mean values of blood glucose were higher in treated animals with medicinal herbs than control.

CONCLUSIONS

From the results obtained, it could be concluded that supplementing lactating buffalo's diets with medicinal plants is recommended as a new step in the field of animal production for improving productive performance of lactating buffalo, regarding milk yield and composition and feed efficiency.

Additionally, these results revealed to negative effects on general health of the treated animals. Therefore, medicinal plant seeds can be successfully used in lactating buffaloes rations as feed additives.

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