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Effect of Extract Crushed Fenugreek Seeds as Feed Additive on some Blood Parameters, Milk Yield and Its Composition of Lactating Egyptian Buffaloes

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ABESTRACT

Milk production & composition and some blood parameters were examined in Egyptian buffaloes as affected by supplemented basal diet by crushed Fenugreek seeds. Sixteen lactating buffaloes aged 5-7 years (at the third and fifth seasons of lactation); 45 days from calving were divided into four dietary treatments, 4 animals per each. Buffaloes were fed individually on basal diet ration [concentrate feed mixture (CFM) and rice straw (RS)] according to developing of body weight and milk production during the whole experimental periods. The crushed Fenugreek seeds were given as feed additives to the basal ration at a level 100, 150 and 200 g/buffalo/ day for 2nd, 3rd and 4th treatments, respectively, while the 1st treatment considered as control.The results indicated that the dry matter intake (DMI) was significantly ($P<0.05$) increased in T_3 and T_3 than other groups. Also, crushed fenugreek seeds significantly($P<0.05$) increased nutrient digestibilities (DM, OM, CP and EE). The total milk yields were 806.4, 896.0, 952.0 and 907.2 Kg, respectively. Also, the overall daily milk yield was 7.2, 8.0, 8.5 and 8.1 Kg/h/d for T_1, T_2, T_3 and T_4, respectively. Lactose percentage significantly ($P<0.05$) increased in treated buffaloes. However, fat percentage was significantly ($P<0.05$) decreased with treated buffaloes. The calculated efficiency of milk yield/DMI was increased ($P<0.05$) in Fenugreek treated buffaloes. The addition of crushed Fenugreek seeds increased ($P<0.05$) the level of blood plasma prolactin and GPT in lactating buffaloes.It could be concluded that adding fenugreek seeds to buffalo's rations at 100, 150 and 200 g /buffalo/day led to raising economic efficiency by about 6.6, 3.95 and 7.89 %, respectively and it could be recommended to improve feed efficiency, milk yield and economic efficiency.

Keywords: Fenugreek seed, Lactating buffaloes, milk yield, Prolactin hormone.

INTRODUCTION

Buffaloes produce about 60 and 40% of milk yield and meat production in Egypt, respectively (Agriculture Economy Research Institute, 2003). The world health organization encourages using medicinal herbs and plants to substitute or minimize the use of chemicals through the global trend to go back to nature. The use of herbal galactogogues is known to have beneficial effect on milk production (Salama *et al.,* 2015).Medicinal herbs are important materials that can improve feed efficiency and performance of lactation buffaloes. Fenugreek (*Trigonellafoenum-graecm L*) is cultivated in Egypt and in various parts of the world. The seeds of this herb have been used in traditional medicine to promote lactation in lactating women (Tiran, 2003). Also, this herb has been shown to influence the lactation performance in ruminants. In goats, feeding on 60 g of fenugreek seeds powder per day increased milk yield without any effects on milk fat percentage (Alamer and Basiouni 2005).In buffaloes,fenugreek seeds feeding increased milk yield but without any effects on milk composition except for a tendency of lower fat content (El-Alamy 2001). Feeding costs of buffaloes represent about 65-70 % of the total current costs. Improving milk production contributes to improve feed efficiency and economic return.

Therefore, thisstudy was designed to examine the effect of crushed fenugreek seeds addition to Egyptian lactating buffalo's diets on feed intake, digestibility, nutrient value, milk yield and composition, as well as some blood parameters.

MATERIALS AND METHODS

This study was carried out at Sids Animal Production Research Station, Beni-Seuf Governorate, Animal Production Institute, Ministry of Agriculture, Egypt.

Experimental Animal and Feeding System:

Sixteen lactating buffaloes (at the third and fifth seasons of lactation), 45 days from calving were divided into four equal groups. The animals were randomly assigned to feeding four experimental rations. The overall mean of buffaloes weight were 559, 554, 551 and 560 Kg for T_1"control", T_2, T_3 and T_4, respectively. The experimental period lasted 16 weeks (starting from 45 days after calving).

Control group (T_1) fed CFM and RS without feed additive (basal diet), whereas, buffaloes in T_2, T_3 and T_4 were fed basal diet supplemented with crushed fenugreek seeds by100, 150 and 200 g/buffalo/day, respectively.

The CFM consisting of 21% undecortecated cotton seed meal, 35% wheat bran, 5% molasses, 35% yellow corn, 2.5% limestone, 1% salt and 0.5% mineral mixture. Animals were fed individually according to requirements of (APRI, 1997) for lactating buffaloes.Feeding allowances were weekly adjusted according to changes in body weight and milk production. All experimental rations were formulated to contain 60 %CFM and 40 % rice straw. Rations were offered twice daily at 8 a.m. and 4 p.m., fresh and clean drinking water was offered three times daily, at 7 a.m., 3 p.m. and 8p.m.

Digestibility trial:

Nutrient digestibility and feeding values were determined by chosen 3 buffaloes randomly from each group, using acid insoluble ash (AIA) technique of Van Keulen and Young (1977). Feeds and feces were sampled and the conventional analytical methods of AOAC (1995) were applied. Also, digestibility coefficient and feeding values of the tested rations were determined. Total digestible nutrients (TDN)

anddigestiblecrude protein (DCP) calculated according to classic formula of McDonald *et al.,* (1995). While digestible energy (DE Mcal/Kg DM) wascalculated according to Nehring and Haenlien (1973).

Sampling and Analysis of Milk:

Buffaloes were hand milked twice daily (7 a.m. and 4 p.m.) during the experimental period (112 days) and milk yields were recorded individually at each milking. Milk Sampleswere collected once every two weeks. Milk samples were analyzed for fat, total solids, total protein and ash (Ling, 1963), Lactose content (Barett and Abd El-Tawab, 1957). Solids not fat (SNF) was calculated by difference.Milk was adjusted as 7 % fat corrected milk (FCM) using the formula given by Raafat and Saleh (1962) as follows: 7 % FCM = 0.265 × milk yield + 10.5 × fat yield.

Blood Plasma Constituents:

Heparinized blood samples were collected from the jugular vein from each of the experimental buffaloes atthe end of feeding trial. Blood samples were centrifuged at 4000 r.p.m for 20 minutes to separateof plasma whichwere stored at -20c° till analysis.

Blood plasma samples were analyzed for prolactin, glutamic oxaloacetic transaminase (GOT) and glutamic pyruvic transaminase (GPT) in the division of radioisotopes application, nuclear research center, Atomic Energy department, Cairo, Egypt.

Economic efficiency:

Economic efficiency was calculated on the basis of daily feed cost andprice of daily milk yield. Prices of feedstuffs and feed additive on dry matter basis were 2.52, 0.45 and 3.50 LE / kg for concentrate feed mixture, rice straw and fenugreek seeds, respectively. While, price of daily milk yield = 5.00 LE / kg.

Statistical Analysis:

The statistical analysis system (SAS, 2001) was used for least square of variance for repeated measures of milk yield, milk composition, feed efficiency parameters and data of blood plasma analysis. The following model was applied:

$$Yij = \mu + Ti + eij$$

Where:

μ = General mean of treatment population.

Ti = Effect of treatment (T_1, T_2, T_3, T_4).

Eij = Experimental error.

The differences between means were detected by Duncan's Multiple Range test (Duncan, 1955).

RESULTS AND DISCUSSION

Chemical composition:

The chemical composition of ingredients and experimental rationsare shown in Table (1).Results showed that adding crushedfenugreek seeds to the experimental rations at rate of 0, 100, 150 and 200 g for control (T_1), T_2, $T_3$and T_4, respectively increased of DM, CP, EE,CFand ashcontents in T_2, $T_3$and T_4compared to control (T_1). While OM andNFEcontents had opposite trend.

Table 1: Chemical composition of ingredients and the experimental rations on DM basis:

Item	DM	OM	CP	EE	CF	NFE	ASH
CFM	92.60	90.80	14.40	4.50	15.40	56.50	9.20
RS	90.60	85.40	3.20	1.10	36.20	44.90	14.60
FG	95.80	95.90	20.60	11.80	8.20	55.30	4.10
Rations:							
R_1	91.80	88.64	9.92	3.14	23.72	51.86	11.36
R_2	92.46	88.61	10.06	3.22	23.78	51.55	11.39
R_3	92.74	88.60	10.12	3.26	23.80	51.42	11.40
R_4	93.16	88.58	10.21	3.31	23.84	51.22	11.42

CFM= Concentrate Feed Mixture, RS= Rice Straw, FG= Fenugreek seeds.

R1, 60% CFM+40% RS; R2, 60% CFM+40% +100 g FG; R3, 60% CFM+40% RS +150g FGandR4, 60% CFM+40% RS +200 g FG.

Feed Intake, Nutrients Digestibilityand feeding values:

Dry mater intake (DMI) for buffaloes fedT_3 rationswas significantly ($P<0.05$) higher than those recorded for T_1, $T_2$and T_4 as shown in Table (2). These results were agreement with those reported by Abo E0l-Nor (1999) and Abo El-Nor *et al.,* (2007) they found that DM intake was increased when lactating buffaloes fed different levels of fenugreek seeds. Tomar *et al.,* (1996) and Nasser *et al.,* (2013) found that the fenugreek seeds stimulates feed intake in dairy cattle, resulting in a significant increase in milk production. Also, Petit *et al.,* (1993) reported isolated steroidal saponin fraction of fenugreek seeds which increase feed intake and motivation to eat in normal rats.

Table 2: Effect of treatments on feed intake, digestibility coefficients and feeding values.

Items	Treatments				±SE
	T_1 "control"	T_2	T_3	T_4	
DMI (Kg/h/d)	13.50^{b}	13.90^{b}	14.74^{a}	13.79^{b}	0.22
CFM (Kg/h/d)	8.50^{b}	8.80^{b}	9.60^{a}	8.60^{b}	0.11
Rice Straw (Kg/h/d)	5.00	5.00	5.00	5.00	
FG seed (g/h/d)	0.00	95.80	144.00	192.00	
Digestibility coefficient, %:					
DM	60.50^{b}	66.00^{a}	68.30^{a}	66.10^{a}	2.10
OM	61.30^{b}	66.10^{a}	70.30^{a}	66.40^{a}	1.50
CP	63.10^{b}	70.80^{a}	74.10^{a}	71.10^{a}	1.60
CF	53.40	54.60	53.00	54.00	8.40
EE	69.30^{b}	75.00^{a}	76.00^{a}	74.20^{a}	1.90
NFE	70.80	70.10	71.00	70.40	9.50
Nutrients value, %:					
TDN	67.28^{b}	69.13^{ab}	70.06^{a}	69.10^{ab}	2.04
DCP	6.37^{c}	7.23^{b}	7.61^{a}	7.37^{b}	0.05
DE	2.86	2.95	3.00	2.95	0.08

$^{a, b}$= means with different superscripts in the same raw are differ significantly ($P<0.05$).

Results in Table (2) showed that digestibility coefficients of DM, OM, CP and EE were significantly ($P<0.05$) increased in supplemented groups than control, these results were agreement with the findings of Abo El-Nor *et al.,* (2007) and Atta Elmnan *et al.,* (2013) they reported that there was an improvement in digestibility coefficients of lactating animals fedfenugreek seeds. The improvement in digestibility could be justified on the basis of that fenugreek seeds contains saponins,

which stimulate an aerobic fermentation of organic matter that improve efficiency of nutrients utilization.

Energy values of total digestible nutrients (TDN)and digestible crude protein (DCP)of the experimental rations in Table (2) had significant increasein fenugreek seeds containing rations (T_2, T_3 and T_4) except in T_2regarding TDN compared to control (T_1), while digestible energy (DE) was not affected by fenugreek seeds addition.

Milk Yield:

The total milk yield for T_1, T_2, T_3 and T_4 were 806.4, 896.0, 952.0 and 907.2 Kg, respectively. Also, the overall daily milk yield was 7.2, 8.0, 8.5 and 8.1 Kg/h/d, respectively (Table 3).FCM yield was improved in T_3 compared with T_1. While there no significant differences betweenT_2, T_3 and T_4, this result might be due to decrease milk fat in treated groups by fenugreek seeds.

Results as showed in Table (3) and Fig. (1). Revealed that total and daily milk yields in the treated groups (T_2, T_3 and T_4)were significantly (P<0.05) higher compared to the control (T_1).These results agreed withthose of (Tomar *et al.,* 1996; Abo El-Nor *et al.,* 2007) they reported that feeding fenugreek increased milk production in buffaloes. The relative improvement in milk yield by crushed fenugreek seeds supplementation might be due to higher value of nutrients digestibility (Table 2). Also, Basha *et al.,* (1987) reported that fenugreek seeds contains some active components which stimulating the pituitary gland leading to release of prolactin hormone (Table 4). Present results indicated that prolactin hormone might be a possible candidate as a mediator of fenugreek action on milk production. The increase inprolactin hormone levels representsa possibleendocrine mechanism for the galactopoietic effect of fenugreek.

Milk Composition:

The results of effectof fenugreek seeds on milkcomposition are shown in Table (3). Milk fat percentage was lower (P<0.05) in treated buffaloes byfenugreek seeds(T_2, T_3 and T_4) than untreated group (T_1). There is an inverse relationship between yield and fat percentage. The lower fat content ofT_2, T_3 and T_4 can be justified by the higher milk yield secured by treated groups compared to control, this result agrees with El-Alamy *et al.* (2001) who found that feedingfenugreek seeds to buffaloes increase milk yield but without any effect on milk composition except for a tendency of lower fat content. Also,Al-Janabi (2012) reported that fenugreek seeds fed goats exhibited significantly (P<0.05) lower milk fat content as compared with control group.

Milk lactose percentage was higher (P<0.05) in buffaloes fed fenugreek seeds than control. The same trend wasobtained by Abo El-Nor *et al.,* (2007) who reported that milk lactose content was higher (P<0.05) in buffaloes fed fenugreek seeds compared to control. However, milk protein; total solids, solid not fat and ash percentages were not affected by supplementing different levelsof fenugreek seeds as shown in Table 3 and Fig. 2). This result agree with Abo El-Nor *et al.,* (2007) who indicated that total solids, total protein and ash content did not differ significantly between buffaloes fedfenugreek seedscompared to control.

Table 3: Milk yield and composition of lactating buffaloes as affected by dietary treatments.

Items	Treatments				±SE
	T_1	T_2	T_3	T_4	
Lactation length (d)	112	112	112	112	
Total milk yield (Kg)	806.40^{b}	896.00^{a}	952.00^{a}	907.20^{a}	18.20
Milk yield (Kg/h/d)	7.20^{b}	8.00^{a}	8.50^{a}	8.10^{a}	0.40
Fat corrected milk (FCM)	6.82^{b}	7.24^{ab}	7.70^{a}	7.25^{ab}	0.41
Milk composition (%):					
Fat	6.50^{a}	6.10^{b}	6.10^{b}	6.00^{b}	0.40
Protein	3.70	3.60	3.70	3.60	0.19
Lactose	4.30^{b}	4.90^{a}	4.80^{a}	4.80^{a}	0.20
Total solids	15.20	15.50	15.40	15.20	0.51
Solid not-fat	8.70	9.40	9.30	9.20	0.90
Ash	0.80	0.77	0.76	0.78	0.05
Feed efficiency:					
DMI / FCM	1.98^{a}	1.92^{b}	1.92^{b}	1.90^{b}	0.03
TDN / FCM	9.86^{a}	9.54^{ab}	9.10^{b}	9.53^{ab}	0.08
DCP / FCM	0.93^{b}	1.00^{a}	0.99^{ab}	1.02^{a}	0.01
DE / FCM	0.42	0.41	0.39	0.41	0.01

$^{a, b}$= means with different superscripts in the same raw are differ significantly (P<0.05).

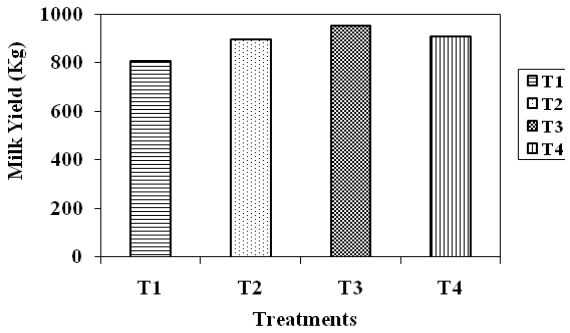

Fig (1) : Total Milk Yield (Kg)

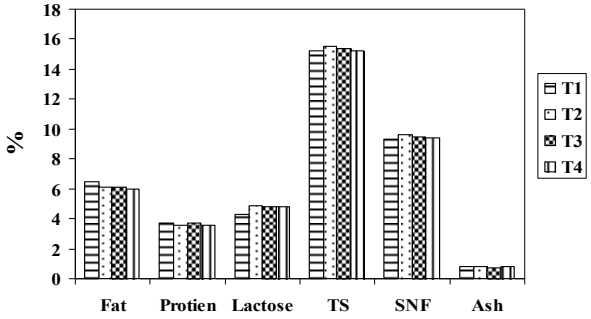

Fig (2): MIlk Composition.

Feed efficiency:

Feed efficiency of DM intake,kg/kg FCMwas improved significantly (P<0.05)when fenugreek seedsincluded at 100, 150 and 200 g in the rations (T_2, T_3 and T_4) compared with (T_1). Also, feed efficiency of TDN was improved in T_3 compared with T_1. While there no significant differences betweenT_2, T_3 and T_4or betweenT_1, $T_2$and T_4. The opposite trend was

obtainedwith feed efficiency of DCP, while, feed efficiency of DE did not significantly differentamong groups.These results are in partially agreement with the findings ofAbo El-Nor *et al.,* (2007) and Nasser *et al.,* (2013) who reported that the efficiencies in milk yield calculated as DMI/Kg milk yield and milk yield / DMI were improved (P<0.05) in treated groups byfenugreek seeds as compared with control group.

Blood plasma constituents:

Data in Table (4) showed no significant differences among different treatments in GOT concentration levels, while GPT and prolactin levels were significantly (P<0.05) higher in treated buffaloes by fenugreek seedscompared to the control group. These results were in agreement with those reported by Abo El-Nor *et al.,* (2007) they found that the level of GPT was increased significantly (P<0.05) in treated buffaloes. 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).

The improvement in milk yield for treated groups could also be due to the positive significant effect of crushed fenugreek seeds supplementation on prolactin hormone concentration levels (Table 4 and Fig. 3). Abo El-Nor (1999) reported that feeding lactating buffaloes with fenugreek seeds as feed additive increased prolactin hormone, which is considered one of the major hormones for milk synthesis and secretion.

Table 4:Effect of treatments on some blood parameters.

Items	Treatments				±SE
	T_1 "control"	T_2	T_3	T_4	
Prolactin (ng/dl)	2.72^b	4.20^a	4.80^a	4.50^a	0.40
GOT (U/L)	29.00	28.20	29.40	28.10	6.10
GPT (U/L)	12.70^b	17.00^a	17.80^a	17.20^a	0.60

[a, b]= means with different superscripts in the same raw are differ significantly (P<0.05).

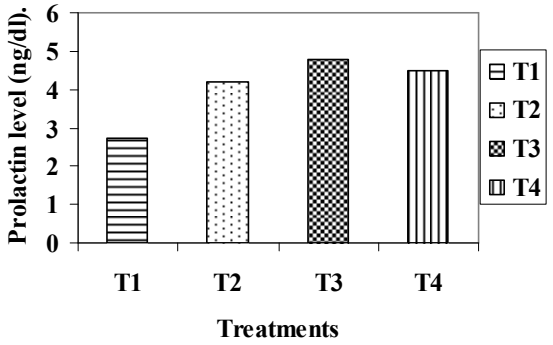

Fig (3) Prolactin level (ng/dl).

Economic efficiency:

Economic efficiency of feeding lactating buffaloes on the experimental rations in Table (5). Indicated that as the ratio between prices of milk yield / daily feed cost (cost of each head of feed intake plus the additional prices of fenugreek seeds) was higher in T_4 and T_2then T_3 (inoculated rations by fenugreek seeds, respectively) compared to the control ration (T_1).

Table (5): Economic efficiency of lactating buffaloes fed the experimental rations.

Items	Treatments				±SE
	T_1	T_2	T_3	T_4	
DMI (Kg/h/d)	13.50^b	14.76^b	14.74^a	13.79^b	0.22
CFM (Kg/h/d)	8.50^b	8.80^b	9.60^a	8.60^b	0.11
Rice Straw (Kg/h/d)	5.00	5.00	5.00	5.00	
FG seed (g/h/d)	0.00	95.80	144.00	192.00	
Daily milk yield	7.20^b	8.00^a	8.50^a	8.10^a	0.40
Feed cost (LE/head/day)	23.67	24.43	26.44	23.92	
Cost of FG (LE/head/day)	0.00	0.33	0.50	0.67	
Daily feed cost (LE/head/day)	23.67	24.76	26.94	24.59	
Price of daily milk yield (LE)	36.00	40.00	42.50	40.5	
*Economic efficiency	1.52	1.62	1.58	1.64	

[a and b] : Means within each row under summer or winter with different superscripts are significantly differ (P<0.05).

Price of one kg (DM basis) of concentrate feed mixture (CFM), rice straw and FG were 2.52, 0.45 and 3.50 LE, respectively. While, milkprice = 5.0 LE/kg.

*** Economic efficiency = price of milk yield / daily feed cost.**

It could be concluded that adding fenugreek seeds to buffalo's rations at 100, 150 and 200 g /buffalo/day led to raising economic efficiency by about 6.60, 3.95 and 7.89 %, respectively and it could be recommended to improve feed efficiency, milk yield and economic efficiency,this effect might be mediated via prolactin hormone stimulation.

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تأثير إضافة مستخلص مجروش بذور الحلبة لعليقة الجاموس المصري الحلاب على إنتاج اللبن وتركيبة وبعض مقاييس الدم

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تم دراسة تأثير إضافة مجروش بذور الحلبة لعلائق الجاموس المصري على إنتاج اللبن وتركيبة وبعض قياسات الدم.إستخدمت في هذه الدراسة ١٦ جاموسة حلابة عمر (٥-٧) سنوات وفي موسمها الإنتاجي (الثالث - الخامس) وعند ٤٥ يوم من الولادة. تم تقسيمها إلى أربع معاملات غذائية ، كل معاملة مكونة من أربع حيوانات متماثلة ، والتغذية فردية: المعاملة الأولى غذيت على العليقة الأساسية فقط (عليقة مركزة + قش الارز) واعتبرت معاملة مقارنة (الكنترول) ، المعاملة الثانية غذيت على العليقة الأساسية مضافاً إليها ١٠٠جم / جاموسة / يوم من مجروش بذور الحلبة ، المعاملة الثالثة غذيت على العليقة الأساسية مضاف أإليها ١٥٠جم / جاموسة / يوم من مجروش بذور الحلبة ، بينما المعاملة الرابعة غذيت على العليقة الاساسية مضاف اليها ٢٠٠جم / جاموسة / يوم من مجروش بذور الحلبة.أشارت النتائج إلى أن الكميات المأكولة من العلف إرتفعت معنوياً عند (مستوى ٥%) في المعاملة الثالثة بالمقارنة بالمعاملات الأخرى. وإن إضافة مجروش بذور الحلبة أدت إلى زيادة معنوية (مستوى ٥%) في معاملات هضم مكونات الغذاء (DM, OM, CP and EE). كمية اللبن المنتج كانت ٨٠٦.٤ ، ٨٩٦ ، ٩٥٢ و ٩٠٧.٢ كجم. أيضاً متوسط انتاج اللبن اليومي كان ٧.٢ ، ٨ ، ٨.٥ و ٨.١ كجم /رأس/ يوم لكل من المعاملة الاولي والثانية والثالثة والرابعة على التوالي، وكذلك النسبة المئوية لسكر اللاكتوز في اللبن كانت مرتفعة معنوياً (مستوى ٥%) في الجاموس المغذى بإضافة مجروش بذور الحلبة. ولكن نسبة الدهن في اللبن إنخفضت معنوياً (مستوى ٥%) في الجاموس المغذى بإضافة مجروش بذور الحلبة. وكانت كفاءة تحويل العليقة المأكولة إلى لبن مرتفعة معنوياً (مستوى ٥%) في الجاموس المغذى بإضافة مجروش بذور الحلبة. واظهرت النتائج أيضا أن إضافة مجروش بذور الحلبة إلى علائق الجاموس الحلاب أدت إلى زيادة معنوية (مستوى ٥%) في مستوى هرمون البرولاكتين وكذلك مستوى الـ GPT في بلازما الدم. يمكن استنتاج أنإضافة بذورالحلبة إلى علائق الجاموس الحلابب معدل ١٠٠ و ١٥٠ و ٢٠٠ جم / رأس / اليوم أدى إلىرفع الكفاءة الاقتصادية بنحو ٦.٦، ٣.٩٥ و ٧.٨٩٪ على لتوالي،ويمكن نوصى به لتحسين كفاء ة الأعلاف،وإنتاج الحليب والكفاءة لاقتصادية.