

EFFECT OF FEEDING *MORINGA OLIEFERA* STEMS ON PRODUCTIVE PERFORMANCE OF LACTATING FRIESIAN COWS

Ghada S. El-Esawy¹; W.A. Riad¹; M.F.E. Ali² and H.M.A. Gaafar¹

¹*Animal Production Research Institute, Agriculture Research Center, Dokki, Giza, Egypt.*

²*Animal Production Department, Faculty of Agriculture, Kafr El-Sheikh University, Egypt.*

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SUMMARY

This study was carried out to investigate the effect of partial replacement of berseem hay by *Moringa oleifera* stems. Fifteen of lactating Friesian cows with average live body weight of 500 kg and 2-4 seasons of lactation after the peak milk yield were divided into three groups (5 each) assigned randomly to three experimental rations. Control ration (R1) consisted of 40% concentrate feed mixture (CFM) + 20% corn silage (CS) + 20% rice straw (RS) + 20% barseem hay (BH). While the other rations contained 10 and 20% *Moringa oleifera* stems (MS) instead of 50 and 100% of BH in R2 and R3, respectively. Results revealed that the contents of CP, CF and ash tended to increase, however the contents of DM, OM, EE and NFE tended to decrease with increasing the level of *Moringa oleifera* stems in the rations. Ration 2 recorded significantly ($P < 0.05$) the highest digestibility coefficients of DM, OM and CP and R3 the highest EE digestibility and DCP value. Average daily feed intake and rumen fermentation activity were nearly similar for the different groups. Total protein, albumin and globulin concentrations increased significantly ($P < 0.05$), however urea-N and creatinine concentrations in plasma decreased significantly ($P < 0.05$) with increasing the level of *Moringa* stems in the rations. Average daily yield of actual milk and 4% FCM as well as the percentages of fat, protein, total solids and solids not fat in milk increased insignificantly ($P < 0.05$) with increasing the level of *Moringa* stems in the rations. *Moringa Stems* led to significant decrease ($P < 0.05$) in the amounts of DM and TDN per 1 kg 4% FCM. Also, *Moringa* stems reduced the average daily feed cost and feed cost per one kg 4% FCM, but increased the price of 4% FCM yield and subsequently economic efficiency.

Keywords: *Moringa oleifera* stems, lactating Friesian cows, digestibility, milk yield and composition, feed and economic efficiency.

INTRODUCTION

In Egypt, there is a great developing gap between demand and available resources of animal milk and protein. Currently, great attention has been given to *Moringa* forage by many Egyptian animal nutritionists to overcome the green fodder shortage particularly during summer season. *Moringa* leaves had good quality protein rich of essential amino acids which can enhance dietary N utilization and improve animal productivity as well as *Moringa* forage is rich in most nutrients (Mendieta-Araica *et al.*, 2013 and Nouman *et al.*, 2013). *Moringa* leaves have been reported to be a valuable source of both macro and micro nutrients, being a significant source of beta-carotene, vitamin C, protein, calcium, iron, and potassium (Anwar *et al.*, 2007; Pullakhandam and Failla, 2007; Siddhuraju and Becker, 2003 and Thurber *et al.*, 2009).

Moringa oleifera Lam (synonym: *Moringa oleifera* pterygosperma, Gaertner), is commonly referred to as 'drumstick tree' describing the shape of its pod or 'horseradish tree' describing the taste of the roots (Makkar and Becker, 1996). The leaves could be harvested twice a month and have diverse uses among the local people. Leaves are used as a cabbage, to treat malaria, hypertension, stomach disorders, to expel retained placenta, to treat asthma and diabetes and has antitrypanosomal activity (Mekonnen *et al.*, 1999). It can also be used as a protein meal (crude protein approx. 60%) in livestock diet. The leaves of this tree are also edible and are highly nutritious. It used as livestock feed; *Moringa oleifera* leaves (crude protein approx. 25%). Leafs are free from anti-nutritive factors (e.g. phenols, tannins, saponins,

etc.) and high in iron (up to 582 mg/kg DM), in beta-carotene (up to 400 mg/kg DM) and in vitamin C (up to 9.2 g/kg DM). Lately, this plant has received a lot of attention. *Moringa oleifera* foliage has been found to increase animal productivity (Foidl *et al.* 2001). *Moringa oleifera* stems are suitable for feeding sheep and can be used to replace a part of CH or CFM without any adverse effect on the performance of Rahmani lambs (Mahmoud, 2013).

Many researchers are attention of using *Moringa oleifera* leaves as animal feed but it's still highly expensive in our country and we can used plant stems in ruminants diets and study the potentiality of its as animal feed. So, the objective of this study was to evaluate the effect of feeding of *Moringa oleifera* stems to lactating Friesian cows on intake, digestibility, rumen and blood parameters, milk yield and composition, feed conversion ratio and economic efficiency.

MATERIALS AND METHODS

The present work was carried out at Sakha Animal Production Research Station, belonging to Animal Production Research Institute (APRI), Agricultural Research Center, Ministry of Agriculture in Co-operation with Department of Animal Production, Faculty of Agriculture, Kafr El-Sheikh University, Egypt.

Experimental animals and rations:

Fifteen of lactating Friesian cows with average live body weight of 500 kg and 2-4 seasons of lactation after the peak milk yield were divided into three groups (5 each) assigned randomly to three experimental rations. Control ration (R1) consisted of 40% concentrate feed mixture (CFM) + 20% corn silage (CS) + 20% rice straw (RS) + 20% berseem hay (BH), While the other rations contained 10 and 20% *Moringa oliefera* stems (MS) instead of 50 and 100% of BH in R2 and R3, respectively.

Management procedure:

Animals were fed to cover them recommend requirements according to NRC (2001) feeding allowances for dairy cows and adjusted every week based on the average body weight of animals and milk production. Concentrate feed mixture were offered twice daily at 8 a.m. and 4 p.m. Corn silage, berseem hay and *Moringa oliefera* stems were offered daily at 9 a.m., while rice straw was offered ad-libitumat 11 a.m. Fresh water was available continuously.

Digestibility trial:

Digestibility trail were conducted during the feeding period using 3 cows from each group to determine the digestibility and nutritive values of the experimental rations. Each digestibility trial consisted of 15 days as preliminary period followed by 7 days as collection period. Acid insoluble ash was used as a natural marker (Van keulen and Young, 1997). Feces samples were taken from the rectum of each cow twice daily with 12 hrs interval during the collection period. Samples of feedstuffs were taken at the beginning, middle and end of the period. Chemical analysis of samples of CFM, corn silage, berseem hay, rice straw and *Moringa oliefera* stems as well as feces samples were carried out according to the methods of AOAC (1990). Nutrient digestibility was calculated from the equation stated by Schneider and Flat (1975) as follows:

$$\text{DM digestibility \%} = 100 - \left(\frac{\text{AIA \% in feed}}{\text{AIA \% in feces}} \times 100 \right)$$

$$\text{Nutrient digestibility \%} = 100 - \left(100 \times \left(\frac{\text{AIA \% in feed}}{\text{AIA \% in feces}} \times \frac{\text{Nutrient \% in feces}}{\text{Nutrient \% in feed}} \right) \right)$$

Where AIA is acid insoluble ash.

Milk yield and composition:

Cows were mechanically milked and daily milk yield was recorded individually and corrected for 4% fat corrected milk (FCM) using the formula of Gains (1928) as follows: 4% FCM = 0.4 * milk yield (kg) + 15 * fat yield (kg)

Milk samples from consecutive evening and morning milking were taken every week during the experimental period and mixed in proportion to milk yield. Composite milk samples were analyzed for fat, protein, lactose, solids not fat (SNF) and total solids (TS) using Milkoscan, model 133 B. Ash was determined by the difference.

Rumen liquor samples:

Rumen liquor samples were taken from cows at 3 hr. after the morning feeding using stomach tube with draw pulse power of the automatic milking machine. Every sample was strained through four layers of cheese cloth and rumen pH was determined immediately after straining the samples using Orian 680 digital PH meter. Ammonia nitrogen (NH₃-N) was determined using saturated solution of magnesium oxide distillation according to the method of AOAC (1990). Total volatile fatty acids (TVFA's) was determined by the steam distillation method described by (Warner, 1964).

Blood samples:

Blood samples were taken from the jugular vein of cows at 3 hrs after the morning feeding in centrifuge tubes containing anticoagulant (EDTA). Then centrifuged for 15 minutes at 4000 rotations per minute to obtain plasma and kept in deep freezer until analysis. Blood plasma protein, albumin, globulin (by difference), urea nitrogen, AST and ALT were determined calorimetrically using commercial diagnostic kits (test- Combination-Pasteur lap).

Feed conversion:

The feed conversion was expressed as the amounts of DM, TDN and DCP required for producing 1kg 4%FCM.

Economic efficiency:

Economic parameters expressed as average daily feed cost, feed cost per one kg 4% FCM and price of 4% FCM yield were calculated. Also, economic efficiency as the ratio between the price of 4% FCM yield and average daily feed cost was calculated.

Statistical analysis:

The data were statistically analyzed using general linear model procedure adopted by IBM SPSS Statistics 22 (2014) for user's guide with one-way ANOVA. Also, Duncan test within program of SPSS was done to determine the degree of significance among the means.

RESULTS AND DISCUSSIONS

Chemical composition:

The proximate composition of feedstuffs and experimental rations are presented in Table (1). Obtained results indicated that the contents of CP, CF and ash were higher, however the contents of DM, OM, EE and NFE were lower in *Moringa oleifera* stems compared with berseem hay. So, the contents of CP, CF and ash tended to increase, however the contents of DM, OM, EE and NFE tended to decrease with increasing the level of *Moringa oleifera* stems and decreasing the level of berseem hay in the rations. Such results were mainly a reflection of the chemical composition and the proportion of the experimental feedstuffs. Similar results obtained by Mahmoud (2013) who found that *Moringa oleifera* stems (MS) contained high protein, ash, CF and low OM, EE and NFE contents compared to clover hay (CH).

Nutrients digestibility and nutritive values:

Nutrients digestibility coefficients and nutritive values for different rations are shown in Table (2). The ration contained 10% *Moringa oleifera* stems (R2) recorded significantly (P<0.05) the highest digestibility coefficients of DM, OM and CP. While, the highest EE digestibility and DCP value detected significantly (P<0.05) with R3 (20% MS). Where, the digestibility coefficients of CF and NFE as well as TDN value were insignificantly different among the three tested rations. The DCP value of R2 and R3 increased by 7.21 and 7.65% compared with R1, respectively. The better digestibility in cows with *Moringa Stems* additive may be a subsequence of antimicrobial and antioxidant effects of *Moringa oleifera* were discussed by some researchers. In general, the higher digestibility values of most nutrients

obtained of all tested rations may be attributed to the effect of feeding such high quality roughages (CS, BH and MS) which provided stimulatory factors to rumen cellulolytic and other bacteria. These factors resulted in some changes in digestive function which led to increasing the availability and utilization of nutrients in the rumen and could have a significant impact on digestion and nutritive values of experimental rations. Jabeen *et al.* (2008) mentioned that the antimicrobial properties of the *Moringa oleifera* seed extracts may be due to lipophilic compounds. These compounds may attach to the cytoplasmic membrane. Talha (2013) also suggested that extracts of *Moringa oleifera* seeds may contain antibiotic metabolites, such as carboxylic acid, 2,4-diacetyl phloroglucinol, and cell wall-degrading enzymes and chitinases. The antioxidant effect of *Moringa oleifera* leaf extract and fruit was explained by Luqman *et al.* (2012), who noticed that it was due to the presence of polyphenols, tannins, anthocyanin, glycosides, and thiocarbamates, which remove free radicals, activate antioxidant enzymes, and inhibit oxidases.

Table (1): Chemical composition of feedstuffs and experimental rations.

Item	DM %	Composition of DM %					
		OM	CP	CF	EE	NFE	Ash
Feedstuffs:							
Concentrate feed mixture	89.88	92.51	16.71	11.32	2.37	62.11	7.49
Berseem hay	91.21	90.10	12.39	28.49	3.10	46.12	9.90
Corn silage	30.12	94.95	9.85	19.91	2.47	62.72	5.05
Rice straw	89.79	83.51	3.62	33.47	1.92	44.50	16.49
<i>Moringa oleifera</i> stems	90.22	88.52	14.50	33.63	2.48	37.91	11.48
Experimental rations:							
R1 (Control)	64.45	90.72	11.86	20.90	2.45	55.51	9.28
R2 (10% MS)	64.40	90.56	12.07	21.42	2.38	54.69	9.44
R3 (20% MS)	64.38	90.40	12.28	21.93	2.32	53.87	9.60

Table (2): Nutrients digestibility coefficients and nutritive values for different rations.

Item	Experimental group			SEM
	R1	R2	R3	
Digestibility coefficients %				
DM	66.65 ^b	70.13 ^a	69.73 ^a	0.61
OM	68.9 ^b	72.46 ^a	72.03 ^{ab}	0.71
CP	77.16 ^b	81.24 ^a	80.18 ^{ab}	0.71
EE	67.48 ^{ab}	66.00 ^b	68.42 ^a	0.54
CF	67.47	66.76	67.22	1.33
NFE	67.34	69.02	67.99	0.79
Nutritive values %				
TDN	64.35	65.38	64.79	0.79
DCP	9.15 ^b	9.81 ^a	9.85 ^a	0.15

a, b: Values in the same row with different superscripts differ significantly (P<0.05).

R1 = Control ration (consisted of 40% concentrate feed mixture (CFM) + 20% corn silage + 20% rice straw + 20% berseem hay),

R2 = Control ration + 10% Moringa oleifera stems + 50% berseem hay,

R3 = Control ration + 20% Moringa oleifera stems + 100% berseem hay.

Feed intake:

Average daily feed intake for the different groups is presented in Table (3). There were no significant differences (P<0.05) in average daily feed intake among the different groups. Total DM intake tended to increase with R2, while TDN, CP and DCP intake tended to increase with R2 and R3. The increases in TDN, CP and DCP intake for R2 and R3 is probably a reflection of increasing quality of the diets with increasing level of *Moringa* which well be probably enhance the utilization and the availability of essential nutrients especially protein, energy and mineral of the dietary organic matter. These results agreed with those obtained by Mahmoud (2013) who indicated that feed intake by lambs was nearly similar with the same ratio of roughage concentrate as well as with the same ratio of clover hay and *moringa* stems.

Table (3): Average daily feed intake (kg/head/day) for different groups.

Item	Experimental group			SEM
	R1	R2	R3	
Concentrate feed mixture*	7.08	7.17	7.07	
Berseem hay	3.49	1.77	-	
Corn silage*	10.56	10.69	10.55	
Rice straw*	3.54	3.59	3.54	
<i>Moringa oliefera</i> stems*	-	1.78	3.52	
Total DM	15.90	16.10	15.89	0.27
TDN	10.23	10.53	10.30	0.15
CP	1.89	1.94	1.95	0.07
DCP	1.45	1.58	1.57	0.04

* as fed.

R1 = Control ration (consisted of 40% concentrate feed mixture (CFM) + 20% corn silage + 20% rice straw + 20% berseem hay),

R2 = Control ration + 10% *Moringa oliefera* stems + 50% berseem hay,

R3 = Control ration + 20% *Moringa oliefera* stems + 100% berseem hay.

Rumen fermentation activity:

Rumen fermentation activity is shown in Table (4). Rumen liquor parameters did not significantly ($P>0.05$) alter with replacing berseem hay by *Moringa* stems. Ruminant pH value and the concentrations of TVFA's and $\text{NH}_3\text{-N}$ were nearly similar for the different groups being 6.24-6.36, 6.33-6.82 meq/100 ml and 24.25-25.01 mg/100 ml, respectively. The means of pH values of sheep fed the different rations were within the normal range as mentioned by Hungate (1996) being 5.5 to 6.85. Mahmoud (2013) indicated that inclusion of MS in tested rations had created similar rumen environment in relation to TVFA's production which showed closer values for all dietary rations either before or after feeding. Ammonia-N concentration was within the normal range described by Church (1976), being 10 to 45 mg/100 ml depending on composition of the ration, time of sampling and method of analysis used.

Table (4): Rumen fermentation activity for different groups.

Item`	Experimental group			SEM
	R1	R2	R3	
pH value	6.36	6.24	6.26	0.17
TVFA's (meq/100 ml)	6.33	6.38	6.82	0.28
$\text{NH}_3\text{-N}$ (mg/100 ml)	24.86	25.01	24.25	1.45

R1 = Control ration (consisted of 40% concentrate feed mixture (CFM) + 20% corn silage + 20% rice straw + 20% berseem hay),

R2 = Control ration + 10% *Moringa oliefera* stems + 50% berseem hay,

R3 = Control ration + 20% *Moringa oliefera* stems + 100% berseem hay.

Blood biochemical:

Results of some blood parameters are shown in Table (5). Total protein, albumin and globulin concentrations in blood plasma increased significantly ($P<0.05$), however urea-N and creatinine concentrations in plasma decreased significantly ($P<0.05$) with increasing the level of *Moringa* stems and decreasing the level of berseem hay. While, liver AST and ALT enzymes activity was nearly similar for the different groups. Plasma total protein was within the normal range being 6-8 g/dl (Kancko, 1989). Blood plasma transaminase enzymes activity (ALT and AST) are the most important indicators of liver cells activity where increasing the concentration of these enzymes indicate the tissue activity are destroyed (Molander *et al.*, 1957). According to Maxwell *et al.* (1990), blood parameters are important in assessing the quality and suitability of feed ingredients in farm animals. Animashahun *et al.* (2006) affirmed that the comparison of blood chemistry profile with nutrient intake might indicate the need for adjustment of certain nutrients upward or downward for different population groups. Evaluation of the

blood profile of animals may give some insight as to the potentials of a dietary treatment to meet the metabolic needs of the animal since according to Church *et al.* (1984), dietary components have measurable effects on blood constituents such that significant changes in their values can be used to draw inference on the nutritive value of feeds offered to the animals.

Table (5): Blood plasma biochemical for different groups.

Item	Experimental group			SEM
	R1	R2	R3	
Total protein (g/dl)	7.10 ^b	7.62 ^{ab}	7.96 ^a	0.28
Albumin (g/dl)	3.68 ^b	4.06 ^{ab}	4.32 ^a	0.17
Globulin (g/dl)	3.42 ^b	3.56 ^{ab}	3.64 ^a	0.24
Urea-N (g/d)	28.44 ^a	25.3 ^{ab}	22.92 ^b	0.83
Creatinine (g/d)	1.36 ^a	1.10 ^{ab}	1.01 ^b	0.066
AST (U/L)	44.42	43.38	42.24	0.53
ALT (U/L)	14.58	13.54	13.08	0.31

a, b: Values in the same row with different superscripts differ significantly (P<0.05).

R1 = Control ration (consisted of 40% concentrate feed mixture (CFM) + 20% corn silage + 20% rice straw + 20% berseem hay),

R2 = Control ration + 10% Moringa oleifera stems + 50% berseem hay,

R3 = Control ration +20% Moringa oleifera stems + 100% berseem hay.

Milk yield:

Results of milk yield are shown in Table (6). Average daily yield of actual milk and 4% FCM increased insignificantly (P<0.05) with *Moringa* stems. Cows fed R3 recorded the highest average daily actual milk and 4% FCM yield followed by R2, where R1 had the lowest yield. Actual milk yield of R2 and R3 increased by 8.88 and 11.34% compared with R1, respectively. The corresponding values for 4% FCM were 10.72 and 16.49%, respectively. These results view that *Moringa oleifera* has a positive effect on the rumen environment, leading to increased rumen microbial output or to the fact that the protein in *Moringa oleifera* also has good rumen bypass characteristics. These results agreed with those obtained by Reyes *et al.* (2006) who reported an increase (P<.0.05) in milk production from 3.1 to 4.9 and 5.1 kg/day when *Moringa oleifera* was supplemented by 2 or 3 kg DM, respectively. Likewise, Sarwatt *et al.* (2004) reported that the milk yield in cross bred cows was increased (P<0.05) due to feeding *Moringa oleifera*. Reyes *et al.* (2006) pointed out that increase in milk yield might be due to increase CP intake. Cows supplemented with *Moringa oleifera* had 13% and 30% higher milk production respectively, than cows fed a basal diet of Hyparrheniaruffa grass or Sorghum vulare straw (Rocha and Mendieta, 1988 and Foidl *et al.*, 2001). Mohamed *et al.* (2014) found that fresh milk and 4% FCM yields were increased (P<0.05) with rations contained either 20 and 40% *Moringa* by 16.00 and 25.40% than those fed 40% berseem ration.

Milk composition:

Milk composition in Table (8) Showed significant (P<0.05) differences in the contents of fat, protein, total solids and solids not fat in milk among the different groups. Which, cows fed R3 recorded significant (P<0.05) the highest fat, protein, total solids and solids not fat contents in milk followed by R2, where R1 had the lowest contents. However, the contents of lactose and ash tended to increase with increasing the level of *Moringa* stems with insignificant differences. The current results obtained are in agreement with those reported by Reyes–Sanchez *et al.* (2006) who described the similar findings that cows supplemented with *Moringa oleifera* had more milk fat and CP than cows fed brachiariabrizantha hay alone or with sorghum silage as a basal diet.

Table (6): Average daily milk yield and composition for different groups.

Item	Lactation period (month)			Mean
	R1	R2	R3	
Average daily milk yield (kg/day):				
Actual milk	14.64 ^b	15.94 ^{ab}	16.30 ^a	0.34
Increase%	0.00 ^c	8.88 ^b	11.34 ^a	1.72
4% FCM	13.34 ^b	14.77 ^{ab}	15.54 ^a	0.38
Increase%	00.00 ^c	10.72 ^b	16.49 ^a	2.42
Milk composition %:				
Fat	3.41 ^b	3.51 ^{ab}	3.69 ^a	0.07
Protein	2.70 ^b	2.82 ^{ab}	2.88 ^a	0.05
Lactose	4.65	4.70	4.81	0.07
TS	11.45 ^b	11.73 ^{ab}	12.09 ^a	0.19
SNF	8.04 ^b	8.22 ^{ab}	8.40 ^a	0.13
Ash	0.69	0.70	0.71	0.01

a, b, c: Values in the same row with different superscripts differ significantly (P<0.05).

R1 = Control ration (consisted of 40% concentrate feed mixture (CFM) + 20% corn silage + 20% rice straw + 20% berseem hay),

R2 = Control ration + 10% Moringa oliefera stems + 50% berseem hay,

R3 = Control ration +20% Moringa oliefera stems + 100% berseem hay.

Feed conversion ratio:

Feed conversion ratio expressed as the amounts of DM, TDN and DCP per 1 kg 4% FCM as affected by *Moringa Stems* level are shown in Table (7). *Moringa Stems* led to significant decrease (P<0.05) in the amounts of DM and TDN per 1 kg 4% FCM, which decreased by 8.40, 7.79 and 14.29, 14.29% for R2 and R3 compared with R1, respectively. However, the amounts of CP and DCP per 1 kg 4% FCM tended to decrease with MS supplementation without significant differences among the different groups. The improvements of feed conversion ratio with *Moringa Stems* may be attributed to the improvements in nutrients digestibility (Table 2), feed intake (Table 3), rumen fermentation activity (Table 4) and milk yield (Table 8). These results are in accordance with those obtained by Mahmoud (2013) who reported that feed efficiency was better for lambs fed ration containing 25% *Moringa oleifera* stems in replace to clover hay and concentrate feed mixture compared to the control ration due to the beneficial effects of *Moringa* providing stimulator factors and essential nutrients specially protein, energy, minerals and vitamins that better utilized by sheep.

Table (7): Feed conversion ratio and economic efficiency for different groups.

Item	Experimental group			SEM
	R1	R2	R3	
Feed conversion ratio:				
DM, kg/kg FCM	1.19 ^a	1.09 ^{ab}	1.02 ^b	0.04
TDN, kg/kg FCM	0.77 ^a	0.71 ^{ab}	0.66 ^b	0.02
CP, kg/kg FCM	0.14	0.13	0.13	0.008
DCP, kg/kg FCM	0.11	0.11	0.10	0.006
Economic efficiency:				
Daily feed cost, LE/day	47.55 ^a	46.58 ^{ab}	44.39 ^b	1.43
Feed cost (LE)/ kg 4% FCM	3.56 ^a	3.15 ^{ab}	2.86 ^b	0.16
Price of 4% FCM yield, LE/day	60.48 ^b	66.47 ^a	69.93 ^a	1.75
Economic efficiency	1.27 ^b	1.43 ^{ab}	1.58 ^a	0.12

a, b: Values in the same row with different superscripts differ significantly (P<0.05).

Prices of one kg were 4.70 LE for concentrate feed mixture, 2.10 LE for berseem hay, 0.50 LE for corn silage, 0.32 LE for rice straw, 1.20 LE for moringa stems and 4.50 LE for 4% fat corrected milk according to prices 2017.

R1 = Control ration (consisted of 40% concentrate feed mixture (CFM) + 20% corn silage + 20% rice straw + 20% berseem hay),

R2 = Control ration + 10% Moringa oliefera stems + 50% berseem hay,

R3 = Control ration +20% Moringa oliefera stems + 100% berseem hay.

Economic efficiency:

Data of economic efficiency presented in Table (7) showed that *Moringa Stems* additive resulted in significant ($P<0.05$) improvements in economic efficiency. Average daily feed cost and feed cost per kg 4% FCM decreased significantly ($P<0.05$), however, the price of 4% FCM yield and economic efficiency increased significantly ($P<0.05$) with *Moringa Stems* additive. Cows fed R3 (20% *Moringa stems*) recorded significantly ($P<0.05$) the best results concerning the economic efficiency followed by those fed R2 compared with those fed the control ration.

CONCLUSION

It could be concluded that introducing *Moringa stems* at the level of 20% in replacing all berseem hay in the ration of lactating cows recorded the best results concerning digestibility, blood plasma parameters, milk yield and composition, feed and economic efficiency.

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تأثير التغذية على سيقان المورينجا على الاداء الإنتاجي للأبقار الحلابية

غادة صلاح العيسوي¹ و واصف عبدالعزيز¹ و عبد الحليم محمد عبد السلام محي الدين¹ و محمد فريد السيد علي² و حامد محمد عبدالمجيد جعفر¹

¹ معهد بحوث الإنتاج الحيواني- مركز البحوث الزراعية- وزارة الزراعة- القاهرة- مصر

² قسم الإنتاج الحيواني كلية الزراعة- جامعة كفر الشيخ – مصر

هذه الدراسة كانت على تأثير استبدال دريس البرسيم بسيقان المورينجا. وتم استخدام 15 بقرة حلابية متوسط الوزن للبقرة 500كجم وقسمت الى ثلاث مجاميع وتم تغذية المجموعة الاولى على عليقة تتكون من 40% علف مركز، 60% علف مالى وقسم العلف المالى الى (20% دريس برسيم+ 20% قش ارز+ 20% سيلاج ذرة) أما فى علائق المجموعتين الثانية والثالثة تم ادخال سيقان المورينجا بمعدل 10، 20% لتحل محل 50، 100% من دريس البرسيم على التوالي

أظهرت النتائج أن محتوى كل من البروتين الخام، الألياف الخام والرماد تميل الى الزيادة، بينما محتوى كل من المادة الجافة، المادة العضوية، المستخلص الاثيرى والمستخلص الخالى من الأزوت تميل الى النقص مع زيادة مستوى سيقان المورينجا فى العلائق سجلت العليقة الثانية أعلى قيم لمعاملات هضم كل من المادة الجافة، المادة العضوية، البروتين الخام، بينما حققت العليقة الثالثة أعلى معامل هضم للمستخلص الاثيرى وكذلك أعلى قيمة للبروتين الخام المهضوم (لا توجد اختلافات معنوية فى كمية الغذاء المأكول ونشاط تخمرات الكرش بين المجموعات المختلفة) زيادة تركيز البروتينات الكلية، الألبومين، الجلوبيولين معنويا فى بلازما الدم، بينما انخفض تركيز بيتروجين الوريا والكرياتينين معنويا مع زيادة مستوى سيقان المورينجا فى العلائق (زيادة انتاج اللبن الفعلى والمعدل 4% دهن وكذلك النسبة المثوية لكل من الدهن والروتين والجوامد الصلبة الكلية والجوامد الصلبة اللادهنية فى اللبن معنويا مع زيادة مستوى سيقان المورينجا فى العلائق) أدت المورينجا الى نقص معنوى فى كميات المادة الجافة والمركبات الكلية المهضومة اللازمة لانتاج 1 كجم لبن معدل 4% دهن

نستخلص من الدراسة السابقة ان تأثير استبدال دريس البرسيم بسيقان المورينجا عند مستوي 20% سجلت افضل نتيجة للهضم ومحتويات الدم وانتاج وتركيب اللبن والكفاءة الاقتصادية للتغذية.