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Impact of Physical Form of Linseed on Digestibility, Rumen Fermentation and Milk Yield of Dairy Cow

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ABSTRACT

This work aimed to investigate the effect of supplementing different forms of linseed (meal , whole linseed and oil) to lactating cow's ration on milk yield and milk composition .Sixteen multifarious Friesian cows 15±2.26kg milk /d, and averaging 460±15.26 kg/body weight, were divided into four experimental feeding groups (4 each) for 180 days. All group animals were received concentrate feed mixture containing zero, linseed meal, whole linseed and oil linseed in ration A, B, C and D, respectively. All experimental rations were almost equals in energy and protein. Results indicated that supplementation of linseed meal recorded the highest FCM (13.60 kg/h./d.). There were no significant differences in milk composition among groups. Supplementation linseed oil (D) reduced the apparent digestibility of CF compared with control. The different form of oil seed did not influence ruminal pH but it caused significant ($P<0.05$) increased in ruminal ammonia concentrations for (C) and (D) groups compared with control. While, the concentration of volatile fatty acids was significantly ($P<0.05$) differ for cows fed (B) and (D) except those fed rations (C) compared with control . From the previous results, it could be concluded that using linseeds, especially meal, in lactating cow’s rations increased milk yield decreased feed cost and give more profit per Kg milk without adverse effects on cow’s health or performance.
Keywords: Oilseeds, rumen fermentation, digestibility, lactating cow.

INTRODUCTION

linseed (*Linum usitatissiumum*) also known as linseed, is thought to be one of the world’s oldest cultivated crops. The by-product remaining after oil extraction from linseed is a source of protein which used in livestock feeds, especially in the rations of ruminant animals. The seed and oil were also used in the past in livestock production for its medicinal properties, in particular for its functions as a laxative as well as for improving skin and hair quality.

Recently, it showed a renewed interest in using linseed and linseed oil in animal rations to alter the fatty acid composition of meat products and, therefore, provide functional health benefits for the consumer.

Over a few past decades interest in ruminant animal rations with various fat sources has increased Hess *et al*., (2008)Initially, the primary aim of fat addition to the ruminant’s ration was to provide concentrated energy.Presently, the increase interest in fat utilization in ruminant nutrition is mainly a possibility to modify fatty acid composition of animal origin food products ,milk and meat,(Jan *et.al.,*2013). Traditional varieties forms of linseed,were used in dairy cows feeding are characterized by highly content of total fatty acids (over 50%) specially, linolenic acid C18:3(53% of total FA)(Chow, 1992)P18/6 and others healthy fatty acid profile. These fatty acids promotes increased n-3 fatty acids and conjugated linoleic acid (CLA) content in milk (Chilliard*et.al,*. 2007).

Feeding dairy cows a ration contained whole flax seeds(linseed), flax oil or rolled extruded linseed (meal) has beneficial effects on the fatty acids profile of cow’s milk whereas, there was an increase in alpha-linolenic acid (ALA, conjugated linoleic acid (CLA) and the proportion of stearic acid relative to other saturated fatty acids, and there was decrease in the omega-6/omega-3 ratio and the overall saturated fat content. These enhancements give consumers value-added foods with good sensory qualities and a healthier fat profile (Diane and Essi, 2008).Also, fat supplementation in the ruminant rations may have negative impact on rumen fermentation process, (Jenkins 1993). This impact depends on the amount of the inserted additive (Hess *et al.* 2008), its form, e.g. crude or processed (extruded, micronized) oilseeds (Gonthier*et al.* 2004and Doreau*et al.* 2009) and diet composition,mainly high roughage vs. high concentrate diets (Hess *et al*. 2008).

The aim of this study was to determine the effect of different physical forms of linseed fat on rumen parameter ,nutrients digestibility, milk yield and milk composition, beside its effect on rumen parameters.

MATERIALS AND METHODS

This experiment was carried out at El-Karada Experimental Station of Animal Production Research Institute belonging to Agriculture Research Center during summer season 2014-2015.

The aim of this study to use different sources of energy in concentrate feed mixtures for lactating cows. About ten percentage of energy source of concentrate feed mixture coming from Linseed meal , linseed and linseed oil were used as source of energy.

The composition of concentrate feed mixtures used in this experiment are shown in table (1)

Sixteen friesian cows average 460±15.26 kg/body weight, were chosen and divided into four similar experimental feeding groups (4 in each). Animals in all of the experimental groups were housed under open loose system barns. The groups of animals were randomly assigned to receive four experimental ration containing concentrate feed mixtures which included zero% , 9% linseed meal , 6% whole linseed and 3% linseed oil as a source of energy . Energy coming from the previous materials were represent about 10% from total energy of concentrate feed mixtures . All animals received concentrate feed mixture plus roughage with rate of 50:50 according NRC (2001). The roughages were berseem hay and straw with rate of 1:2 concentrate feed mixtures were offered to animals at 8.00 a.m and 3:00 p.m followed by berseem hay while rice straw was available all day. All experimental rations were isonitrogenous and isoenergetic. The feeding trial lested 180 days. During experimental trials , milk yield were determined and its composition were estimated.

Table 1. Ingredient of concentrate feed mixtures (CFM)containing different sources of energy.

	CFM of Experimental rations			
Item	A	B	C	D
Crushed corn	40	38	35	25
Soybean meal	6.5	3	4	4
Wheat brain	24	22	20	24
Sunflower meal	23	21.5	26.5	33
Linseed meal	0	9	0	0
Whole linseed	0	0	6	0
Linseed oil	0	0	0	3
molasses	3	3	5	7.5
Na-cl salt	1	1	1	1
Limestone	2	2	2	2
Minerals mix.	0.5	0.5	0.5	0.5

A: control. B: CFM Containing linseed meal.C: CFM Containing linseed. D: CFM Containing linseed oil.

Digestibility trial and rumen parameters:-

During the feeding trial , feces samples were collected for three successive days via bag technique from each animal to determine total tract apparent nutrient digestibility using acid insoluble ash (AIA) technique as internal marker according to Van- Keulen and young (1977)

Table 2. Chemical composition of concentrate feed mixtures containing linseed as whole seed , meal or oil as sources of energy , barseem hay and rice straw.

	Chemical composition DM basis (%)						
Items	DM(%)	CP	CF	EE	NFE	ASH	OM(%)
Barseem hay	88.93	12.17	29.07	2.7z4	42.45	13.57	86.43
Rice straw	92.11	4.05	39.89	1.50	41.61	12.95	87.05
linseed	93.04	18.29	42.16	27.30	8.55	3.70	96.30
linseed meal	91.51	28.90	7.57	8.52	44.35	10.66	89.34
*Concentrate feed mixtures							
A	88.02	16.11	9.87	3.04	64.02	6.96	93.04
B	88.02	16.75	9.69	3.25	63.28	7.03	92.97
C	88.00	16.42	10.34	4.76	61.28	7.20	92.80
D	88.10	16.85	11.75	4.93	61.64	4.83	95.17

*** Concentrate feed mixtures of ration B, C and D containing linseed meal , whole linseed and linseed oil as a source of omega three , respectively**

Also, ruminal fluid samples were collected at the end of the experiment using stomach tube before feeding then at 3 and 6 hrs. After feeding. Samples of rumen liquor , for each animal, were filtered through four layers of cheesecloth, and then ruminal pH was immediately recorded using digital pH meter then, samples were stored at -20 C for latter analyses.

Analytical procedures:

Representative samples of feed ingredients and feces were analyzed for DM, CP, EE, CF and ash according to A.O.A.C. (1995). Ruminal ammonia nitrogen (NH3-N) concentration was determined according to Conway (1957). Ruminal total volatile fatty acids (TVFA's) concentration were determined according to Warner (1964). Milk analysis was determined using milko scan (model 130 series – type 10900 FOSS electric – Denmark)

Statistical analysis

Data collected for lactation, digestibility trials and milk were subjected to statistical analysis as one-way analysis of variance using SAS (1999) according to the following model:

$Y_{ij} = \mu + T_i + e_{ij}$ where:

Y_{ij}= the observation

μ = Over all mean

T_i = Effect of treatment

e_{ij} = Experimental error

While, data of rumen parameters were statistically analyzed as two-way analysis of variance according the following model:

$Y_{ijk} = \mu + S_i + T_j + (ST)_{ij} + e_{ijk}$. Where:

Y_{ijk} = the observation.

μ = overall means.

S_i = effect of time of sampling.

T_j = effect treatment.

$(ST)_{ij}$=effect of interaction between time of sampling and treatment.

e_{ijk} = Experimental error Duncan's multiple range test (Duncan, 1955) was used to separate means when the dietary treatment effect was significant ($P < 0.05$).

RESULTS AND DISCUSSION

Data presented in table (2) showed the chemical composition of different concentrate feed mixtures of experimental rations beside berseem hay and rice straw. It could be noticed that the chemical composition of both berseem hay and rice straw were agree with those reported by Etman *et.al.,* (2014). Different concentrate feed mixtures have nearly the same composition. Also, it could be noticed that , however different component of each CFM, but all of them having the same chemical composition as shown in table (2). The CP content ranged between 16.11 to 16.85% while EE ranged from 3.04 to 4.93. It could be shown that CFM of ration D containing some higher CP, EE, CF than the others, getting somewhat higher OM content . Generally CFM containing linseed had the highest EE content as shown in Table (2). There results were agreement with the finding of Mirzaei*et.al*., (2009).

Data presented in table (3) showed the daily feed intakes from all ingredient feeds and total DM intakes beside calculated composition of experimental rations , digestibility coefficients and nutritive values of different experimental rations.

It could be noticed that the average daily feed intakes (Kg DM / head) were nearly equal in different experimental groups.

The same pervious phenomenon were showed with calculated composition of experimental rations. The CP contents reached 13.03 , 13.50 , 13.67 and 13.40% for rations A, B , C, and D, respectively while CF contents were 22.15 , 21.68 , 21.28 and 21.00% for respective rations, as shown in table (3).

On the other hand , the digestibility coefficients of all nutrients are shown in table (3), DM digestibility of ration C (contain whole linseed) showed somewhat higher digestibility (68.23%) with no significant difference . The difference in CP digestibility were significant, showing higher (p<0.05) with ration B. But differences in CP digestibility between ration A and both of C and D were not significant . The EE digestibility showed the same significant with ration A, B and C with ration D recorded the lowest significant. Data also showed that the difference in CF digestibility between ration B and C were not significant. The lowest CF digestibility obtained with ration D.

The NFE digestibility showed the highest value with ration B (75.31) compared with the others. In this respect the ration D (containing linseed oil) appeared the highest OM digestibility (70.24%).

Generally, ration B, C and D containing linseed meal, whole linseed and linseed oil, respectively had higher digestibility of all nutrients compared with the control ration (A).

It could be noticed that ration B and C containing linseed meal or whole linseed had the higher (p<0.05) significant in all nutrient digestibility.

The nutritive values expressed as TDN recorded 61.49, 67,32 , 66,53 and 63.41% for rations A , B , C and D , respectively versus 8.79 , 9.56 , 9.39 and 9.10 % as DCP for respective rations. The tested rations (ration B, C and D) containing different sources of linseed pictures appeared significantly(p<0.05) higher in TDN and DCP as shown in table (3).

Data in Table (3) showed that there was no significant (P<0.05) differences among groups in DMD, being 66.80 ,66.87, 68.23 and 66.90%, for A, B, C and D respectively. These results are in agreement with findings of Gonthier*, et al.,(*2004) that supplementation raw or extruded flaxseed to dairy cow's ration by 12.5% (of DM) had no effect on ruminal digestion of DM .The OMD was significantly (P<0.05) increased by 2.4% when cows fed ration D compared with those fed R1, while there was insignificant (P<0.05) difference in OMD among A, B and C. These results were in agreement with findings of Gonthier*et al.* (2004) that diets with flaxseed improved post ruminal OM and total-tract OM digestibility (expressed as a percent of passage to duodenumand percent of intake, respectively) compared with control diet containing no flaxseed. Also, Schroeder*et al.*,(2014) found greater total-tract OM digestibility when feeding different forms of flaxseed to Holstein steers compared with all physical forms of flaxseed .The digestion coefficient of CF was significantly (P<0.05) decreased with feeding ration D compared with ration A being 62.05% and 64.74% , respectively .The decrease in CF digestibility may be due to the negative effect of oils on rumen microbes especially cellulatic bacteria. These results were agreement with findings of Schroeder *et al.,(*2014). Data in the same table showed that there was significant difference (P<0.05) in the digestibility of CP digestibility among groups. Crud protein digestibility's were greater (P < 0.05) for cows fed the flaxseed meal diets than for those fed the control diet. The data were in agreement with the findings of Orias*et al.* (2002) who reported higher small intestine protein digestibility for steers fed soybean-supplemented diets than for steers fed a control diet.

Table 3.The average daily feed intake , calculated composition and digestibility coefficient and nutritive values of different experimental rations.

Items	Experimental rations A	B	C	D
Av. feed intake (kg DM/h)				
concentrate feed mixture	6.492	6.750	6.665	6.628
Barseem hay	2.164	2.250	2.220	2.209
Rice straw	4.327	4.501	4.447	4.419
Total DM intake	12.983	13.501	13.332	13.256
Calculated composition of experimental rations				
DM	90.66	89.62	89.83	89.92
CP	13.03	13.50	13.67	13.40
EE	2.65	3.40	4.01	4.37
CF	22.15	21.68	21.28	21.00
NFE	47.14	49.30	48.92	48.79
Digestibility coefficients of experimental rations				
DM	66.80	66.87	68.23	66.90
OM	68.57^{b}	69.69^{ab}	69.88^{ab}	70.24^{a}
CP	67.44^{b}	70.84^{a}	68.67^{ab}	67.93^{b}
EE	79.30^{a}	77.79^{a}	77.84^{a}	74.01^{b}
CF	64.74^{b}	67.72^{a}	66.56^{a}	62.05^{c}
NFE	47.14	49.30	48.92	48.79
Nutritive values, %				
TDN	61.49^{d}	67.32^{a}	66.53^{b}	63.41^{c}
DCP	8.79^{c}	9.56^{a}	9.39^{ab}	9.10^{b}

a,b and c: Means of different superscripts letter in the same raw are significant (P<0.05) different

There was insignificant difference (P<0.05) in the digestibility of EE among rations A, B and C while, ration D appeared significantly (P<0.05) decreased in digestibility of EE % by 6.67% compared with control one. This increase in EE digestibility in ration B and C may be due to that seeds and meal make a kind of protection for its content of oils and this make oil escape from rumen micro organisms and bypass to intestine and degraded by lipase enzymes(Brask*et al.*,2013).

Data in the same table showed that there was a significant (P<0.05) increase in digestibility of NFE when cows fed ration B or C compared with those fed ration A . This increase may be due that adding linseed meal or oilseeds inhibited the cellulatic bacteria in the rumen meanwhile, the ruminal microorganisms more depended on the soluble carbohydrates as energy source (Hristov *et al.,*2009).

On the other hand data indicates that there was a significant (P<0.05) improvement in the nutritive values expressed as TDN or DCP for ration B , C or D compared with ration A . This improvement may be due to the highest digestion coefficient of nutrients in these groups.

Daily milk yield and its composition :

Data presented in table (4) revealed that the actual milk yields were 12.06 , 15.40 , 13.01 and 12.76 Kg with animals fed rations A , B , C and D , respectively . The corresponding values as FCM yield were 10.61, 13.60 , 11.25 and 11.38 Kg for rations, respectivly.

Table 4. Average daily actual and fat corrected milk (FCM) yields and its compositions.

Items	A	B	C	D
Av.Milk yield (Kg/head/day)				
Av. Actual Milk yield	12.06^c	15.40^a	13.01^b	12.76^b
Av. 4% FCM yield	10.61^b	13.60^a	11.25^b	11.38^b
Av. Milk composition and its yield				
Fat%	3.21	3.22	3.10	3.28
Fat yield(gm/cow/day)	387	496	403	419
Protein%	2.67	2.64	2.68	2.60
Protein yield(gm/cow/day)	322	407	349	332
Lactose%	4.71	4.72	4.87	4.74
Lactose yield(gm/cow/day)	568	727	634	605
Total solids%	11.30	11.27	11.22	11.28
Total solids yield (gm /cow/ day)	1363	1736	1459	1439
Solids not fat%	8.09	8.05	8.12	8.00
solids not fat yield(gm /cow/ day)	976	1240	1056	1020

a,b and c: Means of different superscripts letter in the same raw are significant (P<0.05) different

The results showed that the milk yield either actual or corrected milk appeared to significant (P<0.05) higher than the others as shown in table (4) Increasing milk yield and FCM yield with animals fed ration B might be due to increase energy content of this ration. The results were agreement with the finding of Depeters and Cant(1992) and Chilliard*et al.,* (2001). They reported that increasing in milk yield might be attributed to feed animals as fat supplemented ration at mid or even late lactation period, while feed animals on rations supplemented high amount oil caused a drop in feed intake and therefore milk yield as recorded by Chilliard*et al.,*(2001)and Rego*et al.,* (2003). They reported also negative effects on digestibility and rumen fermentation.

On the other hand, all component of milk composition showed no significant difference among different experimental rations. Fat , protein, Ts , SNF and lactose percentages and their yields were no significant affected by different experimental rations. However somewhat higher in fat percentage was recorded with animals fed ration D (containing linseed oil) while animals fed ration A tended to higher of protein and TS percentages .

The results were in agreement with those reported by AbuGhazaleh *et.al.,*(2007), Bu *et.al.,*(2007) and Chilliard *et.al.,*(2001)

Feed utilization efficiency:

Data presented in table (5) revealed the average daily feed intake , milk yield either actual or FCM and feed utilization efficiency.

The results showed that animals fed ration B containing linseed meal appeared to the best efficiency , recorded 0.877 Kg DM / Kg milk yield. When feed utilization efficiency expressed as Kg TDN or DCP per Kg milk yield , it was the most also efficient , being 0.592 and 0.084 Kg, respectively .

Also, feed utilization efficiency with animals fed ration B recorded 0.993 , 0.668 and 0.095 Kg DM , TDN and DCP per Kg 4% FCM , respectively.

Table 5. Average daily feed unit intake, actual and fat corrected milk (FCM) yields and feed utilization efficiency .

	Experimental rations			
Items	**A**	**B**	**C**	**D**
No. animals	4	4	4	4
Av. Live body weight (Kg)	457	463	473	444
Experimental period (day)	180	180	180	180
Av.Milk yield (Kg /head /day)	12.06	15.40	13.01	12.76
Av. 4% FCM yield (Kg /head/ day)	10.61^b	13.60^a	11.25^b	11.38^b
Daily feed unit intake (Kg)				
DM	12.983	13.501	13.332	13.256
TDN	7.983	9.089	8.870	8.406
DCP	1.141	1.291	1.252	1.206
Feed utilization efficiency as				
Kg DM/ Kg milk yield	1.077	0.877	1.025	1.039
Kg TDN/ Kg milk yield	0.662	0.592	0.682	0.659
Kg DCP/ Kg milk yield	0.095	0.084	0.096	0.095
Kg DM/ Kg FCM yield	1.224	0.994	1.185	1.165
Kg TDN/ Kg FCM yield	0.752	0.668	0.788	0.709
Kg DCP/ Kg FCM yield	0.108	0.095	0.111	0.106

a,b and c: Means of different superscripts letter in the same raw are significant (P<0.05) different

It could be noticed that the most feed efficiency expressed as Kg DM / Kg milk yield was shown with animals fed ration B followed by those fed ration C , D and A .While feed efficiency expressed as Kg TDN /Kg milk yield were the best with animals fed ration B followed by those fed ration D.

The same pervious trend was observed with feed efficiency when expressed as DM , TDN and DCP / Kg 4% FCM yield, showing the ration B was the best efficiency followed by ration D . Generally experimental rations containing different pictures of linseed as a source of energy appeared to the best feed utilization efficiency it might be due to increasing nutritive values of those rations such as TDN and DCP % and also the animals fed these rations gave greater amounts of milk yield. These results were agreement with those reported by sabbah*et.al.,*(2012)

Data presented in Table (6) showed that the highest feed cost per head per day was recorded with group fed ration B (29.336 LE) versus the lowest feed cost for ration A (28.44 LE). At the same time , groups fed ration B gave the highest milk yield with the highest cost of milk yield (61.600 LE) while groups fed ration A gave the lowest milk yield with the lowest cost of milk yield (48.240 LE). So the animals fed ration B (containing linseed meal) showed the lowest feed cost to get one Kg both actual or 4% FCM yield .According , animals of this group appeared to have the highest economical efficiency and gross margin above feed cost, being 2.100 and 1.998 respectively. The profit for Kg actual milk or 4% FCM yield showed the highest profit , recording 2.095 and 2.372 LE , respectively. Moreover, increasing in profit for Kg milk either actual or 4%FCM yield was significantly (p<0.05) higher than those of the others.

Generally animals fed ration fed ration B (containing linseed meal) had the highest milk yield , giving the highest net revenue with more net profit per both actual Kg milk and fat corrected milk yield.

Also, using linseed meal as source of energy in rations such as whole linseed or linseed oil did not significantly affected in feed cost or gross margin above feed cost and net revenue.

Table 6. Average daily fed intake as feed , milk yield, feed cost and economical efficiency with different experimental rations.

Items	Experimental ration			
	A	B	C	D
Av. Daily feed intake as fed (Kg/head/day)				
Concentrate feed mixture	7.285	7.651	7.574	7.523
Berseem hay	2.433	2.530	2.496	2.484
Wheat straw	4.698	4.887	4.828	4.498
Av.Milk yield (Kg/head/day)				
Av. Actual Milk yield	12.06	15.40	13.01	12.76
Av. 4% FCM yield	10.61^{b}	13.60^{a}	11.25^{b}	11.38^{b}
Feed cost and economical efficiency				
Cost of feed intake (LE/ h)	28.440	29.336	28.990	29.022
Cost of milk yield(LE/ h)	48.240	61.600	52.040	51.040
Av. Daily feed cost/ Kg milk yield	2.358	1.905	2.228	2.274
Av. Daily feed cost/ 4% FCM yield	2.680	2.157	2.577	2.550
Av. Net revenue (LE/ h)	19.800	32.264	23.050	22.018
Economical efficiency	1.696	2.100	1.795	1.759
Gross margin above feed cost (LE)	0.696	1.998	0.795	0.759
Improvement in Economical efficiency	-	23.82	5.84	3.71
Profit / Kg milk yield	1.642^{b}	2.095^{a}	1.772^{b}	1.726^{b}
Profit / Kg 4% yield	1.866^{b}	2.372^{a}	2.049^{b}	1.935^{b}

a,b and c: Means of different superscripts letter in the same raw are significant (P<0.05) different

***Based on the assumption that price of one ton of berseem hay , rice straw, concentrate feed mixture of ration A , B, C and D was 1600, 700 , 2918 , 2858 , 2854 and 2911 LE, respectively and the price of one Kg of milk yield in selling was 4.00 LE**

Rumen parameters

Rumen parameters such as pH , NH3-N and VFA's, concentration during different periods are presented in Table (7).

It could be showed that the overall means of rumen of pH values were 5.79 , 5.73 , 5.74 and 5.77 of rumen of animals fed ration A , B , C and D, respectively.

PH value tended to increase with sampling time at 3hr and decreased at 6 hr except for such of group fed ration A.

Data in table (5) showed that there was no significant (P<0.05) differences in the mean of ruminal pH among the experimental feeding groups .This may be due to the relatively low inclusion levels of flaxseed in the diet (10% of diet DM). These results are agreement with findings of Schroeder *et al.,* (2014).

The results obtained in Table (7) showed that the animals fed ration C (containing whole linseed) had the highest significant ammonia- nitrogen (NH3-N)concentration (19.07) compared with the others. However, differences in NH3-Nbetween animals fed ration A and B were not significant.

Data in the same table indicated that there was a significant (P<0.05) increase of the mean of ruminal ammonia concentration in the rumen of cows fed C or D compared with those fed A, while, feeding cow ration B significantly (P<0.05) decreased ruminal ammonia concentration compared with A. These results were agreement with the findings of Ueda *et al.,* (2003) who observed the greater ruminal ammonia concentration in LO-supplemented dairy cows when compared with control cows. Other studies, reported a decrease in ammonia concentration in sheep supplemented with different levels of LO (Ikwuegbu and Sutton, 1982and Broudiscou *et al.,* 1994).

Table7.Effect of feeding the experimental rations and rumen sampling time on some of rumen parameters of dairy cows.

Item	Sampling time, h.	The Experimental rations			
		A	B	C	D
pH	0	5.80	5.69	5.70	5.68
	3	5.64^{bc}	5.76^{abc}	5.90^{ab}	5.86^{abc}
	6	5.93^{a}	5.74^{abc}	5.62^{c}	5.79^{abc}
	Mean	5.79	5.73	5.74	5.77
NH3-N mg/100 ml R.L.	0	14.37^{d}	14.95^{de}	19.24^{a}	10.46^{bc}
	3	14.64^{de}	14.09^{e}	18.67^{a}	15.65^{c}
	6	14.82^{de}	13.37^{e}	19.31^{a}	16.12^{b}
	Mean	14.61^{c}	14.14^{d}	19.07^{a}	16.08^{b}
VFA's, meq/100 ml R.L.	0	6.86^{bcd}	6.25^{bcd}	8.87^{ab}	6.44^{d}
	3	9.88^{a}	7.40^{bcd}	8.23^{bc}	6.96^{bcd}
	6	7.80^{bcd}	7.62^{bcd}	7.36^{bcd}	6.37^{bc}
	Mean	8.18^{a}	7.09^{b}	8.15^{a}	6.59^{b}

a,b and c: Means of different superscripts letter in the same raw are significant (P<0.05) different

Data in Table (7) revealed that the VFA's, concentration showed somewhat higher with animals fed ration A and C compared with those fed ration B and D.

It could be found that the differences in VFA's, concentration between ration A and C and between ration B and D were not significant

There was no significant (P<0.05) difference of the mean of ruminal VFA concentration among cows fed ration A and C, while, it was significant (P<0.05) decrease for B and D by13.32% and 19.43, respectively compared with control, this depression may be due to the addition of fat partially replaces the nonstructural carbohydrates in the feed and so reduces the fermentable carbohydrate available for VFA production, which results in a decrease in the total VFA concentration in the rumen. This result agreed with the finding of (Chichlowski *et al.,* 2005). These results were agreement with those reported by Brask *et.al.,*(2013), Broudiscou *et.al.,*(1994) and Mirzaei *et.al.,*(2009)

Data revealed that animals fed linseed as source of energy as different picture did not affected on some ruminal parameter.

Generally, Using linseed as source of energy with different picture tended to increase TDN and DCP. Using linseed meal in ration formulation of dairy cows increased milk yield, improved milk component , decreased feed cost and gave the most feed efficiency with the most highest profit per Kg milk yield.

REFRANCE

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تأثيرالشكل الفيزيائي للكتان على معاملات الهضم وتخمرات الكرش و الأداءالإنتاجى للأبقار الحلابة

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تهدف هذة الدراسة الى دراسة تأثير أضافة أشكال مختلفة من الكتان (كسب او بذرة او زيت) الى علائق الابقار الحلابة كمصدر للطاقة وتأثيرها على معاملات الهضم وتخمرات الكرش والانتاج و التركيب الكيماوى للبن . تم اختيارستة عشر بقرة خليط فريزيان حلابة فى الموسم الرابع عند ٨٠ يوم من موسم الحليب ومتوسط إنتاج اللبن ١٥ كيلو جرام وبمتوسط وزن ٤٦٠ كجم قسمت الى اربعة مجموعات متماثلة (اربعة حيوانات فى كل مجموعة) تم تغذية جميع الحيوانات على علف مركز و مواد خشنة بنسبة ١:١ وكانت المواد الخشنة عبارة عن قش ارز ودريس برسيم بنسبة ٢:١ وكان العلف المركز للحيوانات يحتوى على اشكال مختلفة من الكتان كمصدر للطاقة والتى تمثل ١٠% من طاقة العلف المركز وكانت المجموعة الاولى هى الكنترول والتى تتغذى على علف مركز بدون اضافات و المجموعة الثانية تم اضافة كسب الكتان الي العلف و المجموعة الثالثة تم اضافة بذرة الكتان للعلف و المجموعة الرابعة تم اضافة زيت الكتان للعلف لتصبح جميع العلائق متساوية فى الطاقة والبروتين وأوضحت النتائج ان استخدام كسب الكتان ادى الى تحسن فى القيمة الغائية للعلائق التجريبية مثل TDNو DCP كما حقق اعلى انتاج فى انتاجية اللبن (13,6 كجم لبن / للراس / اليوم) مع المجموعة التى غذيت على كسب الكتان . لم تظهر اختلافات معنوية فى تركيب الكيماوى للبن وأدت اضافة الزيت الى انخفاض معامل هضم الالياف مقارنة بالكنترول . كل اشكال الاضافة لم تسبب فى حدوث اختلاف معنوى فى درجة حموضة الكرش فى حين ادى الاختلاف الى زيادة معنوية فى تركيز الامونيا بالنسبة للمجموعة الثالثة والرابعة مقارنة بالكنترول وظهرت ايضا اختلافات معنوية فى تركيز الاحماض الدهنية الطيارة بالنسبة للمجموعات الثانية والرابعة ما عدا المجموعة الثالثة مقارنة بالكنترول .من ناحية اخرى اظهرت المجموعة التى تغذت على العلف المركز المحتوى على كسب الكتان افضل كفاءة غذائية مع اقل تكلفة اقتصادية وتحقيق اعلى ربحية لكل كيلو جرام لبن

اوضحت الدراسة ان استخدام الكتان وخصوصا الكسب فى علائق الأبقار الحلابة ادى الى زيادة انتاج اللبن بدون اى تاثير سلبي على صحة الحيوانات او كفاءتها الإنتاجية