

EFFECT OF TAFLA SUPPLEMENTATION ON FEED UTILIZATION, SOME RUMEN PARAMETERS AND NUTRIENT DIGESTIBILITY OF LACTATING COWS.

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SUMMARY

The objective of this study was to evaluate the effect of tafla supplementation on feed intake, nutrients digestibility and rumen parameters of lactating cows. Total of 18 Friesian cows (between 2-4 lactations) at late gestation period (30 days prepartum) were used in this study. Cows were divided into 3 similar groups, (n=6). The 1 group was control (G1), while cows in the G2 and G3 groups were supplemented with 100 and 200 (g/d/h) tafla from 30 days prepartum into 90 days postpartum, respectively. The obtained results showed that, feed intake of CFM and rice straw significantly increase ($P \leq 0.05$) by tafla supplementation. Whereas, the average of berseem feed intake did not differ significantly ($P \leq 0.05$). There were significantly ($P \leq 0.05$) increased in digestibility coefficients of CP and CF in G3 than those in both G1 and G2. While no significant effects for experimental treatments on digestibility coefficients of DM, OM, EE and NFE. There was no significant effect of dietary tafla supplementation on total digestible nutrients while, it was significantly ($P \leq 0.05$) on digestible crude protein, being the higher in G3 and G2 than in G1. Ruminal parameters including pH value and protozoa count in ruminal liquor (RL) of Friesian cows fed different experimental rations at pre and post 2h of feeding did not affected by treatment groups. No significant effect of tafla treatments on rumen liquor NH₃-N (mg/100ml), TVFA's (meq/100ml) concentrations. In general, the present results indicated clear improve in rumen function. In conclusion, treatment of lactating cows 30 days prepartum into 150 days postpartum with tafla supplementation at 200 (g/d/h) recommended to improve feed intake and rumen activity which led to improve lactating cows performanc.

Keywords: cow, tafla, feed intake, rumen parameters and nutrient digestibility.

INTRODUCTION

In Egypt, Friesian cattle are of great agricultural constituents it is considered the main source for meat and milk production. Tafla is one of the more common feed additives which widely used by commercial dairies in ruminant diets to increase productive and reproductive performances of Friesian cows. Tafla is naturally obtained from some Egyptian mines as a member of clay family which used to improve ruminants performance (Abd EL-Baki *et al.*, 2001 and Salem *et al.* 2001).

Bentonites as natural clay that comes from volcanic ash used widely in ruminants diets because it can act as gut protectants, it had partiality to binding with aflatoxins in the digestive tract which led to reduce it is absorption into animal organs (Phillips *et al.*, 2002). Also, bentonites reduced the adverse effect of aflatoxins on efficiency and liver function without defects in mineral metabolism (Marroquin-Cardona *et al.*, 1999). Clay play an important role in animals health, it helps in dispose of cadmium and radiocaesium, virus infection, and parasites that cannot reproduce with clay presence (Grosicki, 2008 and Bellou *et al.*, 2014). Also, clays are extremely used in dairy cattle diets to reduce the transfer of mycotoxins in milk (Bosi *et al.*, 2002).

Positive effects of tafla were reported on steers growth performance (Cho *et al.*, 2001) and daily gain of growing lambs (Salem *et al.*, 2001) and on milk production in buffalo (Saleh *et al.*, 1999) and Friesian

cows (Mikolaichik and Morozova, 2009). Studies indicated clear improvement in milk composition in ruminant fed diet supplemented with different levels of clay mineral (Garcia Lopez *et al.*, 1988).

In ruminant fed diets containing high level of grain, feed utilization could be high efficiencies with supplementation of sodium bentonite (Sweeney *et al.*, 1980 and Leng, 1986). Dietary supplementation of tafla was found to affect nutrients digestibility (El-Tahan *et al.*, 2005), dry matter intake (Ibrahim, 2012), ruminal parameters (Forouzani *et al.*, 2004), hematological parameters (Nowar *et al.*, 1993) and some blood biochemicals (Mohsen and Tawfik 2002). The haematological and biochemical parameters of rats fed aflatoxin-contaminated diet were improved with the addition of clay, therefore, liver and kidneys histological picture were get better (Abdel-Wahhab *et al.*, 2002).

The objective of this study was to assess the effect of supplementing different levels of tafla as natural clay to dairy cow diet on digestibility coefficient of nutritive values and some rumen parameters.

MATERIALS AND METHODS

The present study was carried out at the Department of Animal Production, Faculty of Agriculture, Tanta University and Animal production Research Institute, Ministry of Agriculture during the late gestation period (30 days prepartum) of dairy cows in to 3 months postpartum.

This study was conducted to evaluate the effect of feeding two supplementation levels of tafla on Friesian cows during late gestation on digestibility and rumen activity.

Animals:

A total of 18 Friesian cows (2-4 lactations) at late gestation period (30 days prepartum) were used in this study. Animals were divided randomly into three groups, 6 animals in each.

Treatment groups and feeding system:

Cows in the 1st group were fed according to NRC (1988) requirements for dairy cows diet was containing of concentrate feed mixture (CFM), berseem (*Trifolium alexandrinum*) (2nd cut) and rice straw (RS) as a control group (G1). Cows in the 2nd (G2) and 3rd (G3) groups were fed the control ration with tafla clay supplementation 100 and 200 (g/d/h), respectively.

The contents of CFM were 65% uncorticated cotton seed cake, 9% wheat bran, 20% rice polish, 3% molasses, 2% limestone and 1% NaCl. Different feedstuffs chemical composition (on dry matter basis, %) was presented in Table (1). Feeding period lasted from approximately 30 days prepartum to 90 days postpartum.

Table (1): Chemical composition of different feedstuffs used in feeding experimental cows

Item	DM %	Chemical analysis on DM basis (%)					
		OM	CP	CF	EE	NFE	ASH
CFM	90.63	90.35	17.04	9.21	3.01	61.09	9.65
Rice straw (RS)	92.14	82.71	4.29	34.13	0.93	43.36	17.29
Berseem forage (BF)	13.62	86.03	17.54	24.12	2.29	42.08	13.97
Tafla clay	92.91	7.03	-	7.03	-	-	92.97

DM: Dry matter, OM: Organic matter, CP: Crude protein, CF: Crude fiber EE: Ether extract, NFE: Nitrogen free extract, CFM: Concentrate feed mixture

Digestibility trails:

Digestibility trails were conducted at 60 days postpartum using three cows from each group. Acid Insoluble Ash (AIA) method was used for nutrients digestion coefficients based on use the silica as indigenous marker (Van Keulen and Young, 1977) according to the following formula:

$$\text{Digestion coefficient (\%)} = 100 - \left[\frac{\% \text{ indicator in feed}}{\% \text{ indicator in feces}} \times \frac{\% \text{ nutrient in feces}}{\% \text{ nutrient in feed}} \right] \times 100$$

Feces were collected from cow's rectum during 3 consecutive days in the morning before feeding and at evening. After the end of the collection period, representative samples were taken from feces of each cow and dried for 48 hours at 60°C. Samples of feces were grinded to pass through a 0.5 mm screen and kept until chemical analysis in close tightly plastic containers.

Samples of CFM, BF, RS and feces were taken and prepared for the chemical analysis for crude protein (CP), crude fiber (CF), ether extract (EE) and ash according to the methods of A.O.A.C. (1995).

Rumen parameters:

After 120 days postpartum, rumen liquor (RL) samples were collected individually from three animals in each group for three consecutive days, just before morning feeding and 2 hours post feeding, by using stomach tube, about 200 ml of RL were collected from each animal and strained through four layers of cheese cloth and acidity was immediately determined by the pH meter (Apera® Instruments AI209 PH20) after preparing RL.

According to micro diffusion method (Conway and O'Malley, 1942), the concentration of ammonia-N in RL was determined, while total concentration of volatile fatty acids (TVFA's) were determine by distillation according to Abou-Akkada and El-Shazly (1964). The protozoal cells count in RL was performed by microscopic examination according to Collins and Lyne (1985).

Statistical analysis:

Data were statistically analyzed using analysis program version 15 of SPSS (2010). The significant differences for group or sampling time were performed by multiple range test (Duncan, 1955). The model used was as following:-

$$Y_{ij} = \mu + G_i + E_{ij}$$

Where:- Y_{ij} = Observations, μ = General mean, G_i = Treatment effect and E_{ij} = Error

RESULTS AND DISCUSSION

Feed intake and feeding value:

Means and standard errors of feeding value of cows in different treatment groups are presented in Table (2).

Results showed that feed intake of CFM significantly increase ($P \leq 0.05$) in G3 compared to G1 by the percentage of 30%. Also, there was significant increase in rice straw intake in G3 compared with G1 by 39.2% and in G2 by 30.5%, in the same order. Whereas, the average of berseem feed intake did not differ significantly ($P \leq 0.05$). It is worth to noting that, the increase in cows feed intake was reflect the effect of tafla supplementation on improve animal nutritive value appetite. In this respect, Forouzani *et al.* (2004) showed feeding lambs on diet supplemented with clay elements led to significantly increased in daily dry matter intake. Also, El-Tahan *et al.* (2005) fed growing calves on diet supplemented with tafla they showed that tafla addition improved dry matter intake. Recently, Ghaemnia *et al.* (2010) and Ibrahim (2012) indicated significant increase in dry matter intake in lambs fed rations supplemented with clay element. While, Yazdani *et al.* (2009) in crossbred steers and Norouzian *et al.* (2010) on lambs, found no effect for clay elements on daily dry matter intake. In dairy cows fed diet supplemented with natural clay elements, Moate *et al.* (1985) and Johnson *et al.* (1988) indicated significant decreased in feed intake.

Results showed that the effect of dietary tafla supplementation (Table 2) on total digestible nutrients (TDN %) was not significant, while, the effect of tafla treatment was significantly ($P \leq 0.05$) on digestible crud protein (DCP %) in G3 than those in G1 or G2. However, the differences between G2 and G3 were not significant. On the other hand, there were insignificant differences of nutritive values as total

digestible nutrients (TDN %). It was higher in cows of G3 and G2 than those in G1, respectively (Table 2).

The significant improvement in nutritive values as DCP was associated with increasing the digestibility coefficients of CP. The observed improvement in TDN was related to the increase in digestion of OM, EE and CF was insignificant.

In accordance with the present results, Salem *et al.* (2001) and Hassan (2009) showed that no significant differences were observed in the nutritive value as TDN. While Salem *et al.* (2001) indicated a significant increase in DCP.

In general, the nutritive values improvement as TDN and DCP reflect the beneficial effects of dietary supplementation with 200 g tafla/h/d on digestibility coefficients of most nutrients as compared with the control diet.

Digestibility coefficients and nutrient values:

The nutrients digestibility coefficients of different rations are presented in Table (2). Data reflected that digestion coefficient of CP and CF were affected significantly by tafla treatment.

Table (2): Means and standard errors of daily feed intake, nutrients digestibility and nutritive values (%) of cows as affected by different experimental treatments:-

Feed intake (kg/h/d)	Experimental group		
	G1	G2	G3
CFM	5.00±0.29 ^b	5.33±0.33 ^b	6.50±0.28 ^a
Berseem 2 nd cut	17.33±1.45	18.33±1.20	19.67±0.33
Rice straw	3.83±0.44 ^b	5.00±0.29 ^{ab}	5.33±0.33 ^a
Nutrients digestibility:			
DM	63.78±4.31	69.41±0.94	72.05±1.00
OM	67.98±3.76	70.79±0.49	72.76±1.38
CP	61.08±3.74 ^b	68.82±0.92 ^{ab}	72.85±1.56 ^a
EE	61.74±4.66	65.48±1.07	67.84±1.46
CF	52.56±4.29 ^b	62.97±1.93 ^{ab}	65.04±2.62 ^a
NFE	68.61±4.46	71.29±0.46	75.32±1.10
Nutrient values:			
TDN	58.08±3.93	63.14±0.81	65.79±0.90
DCP	7.81±0.48 ^b	8.85±0.12 ^{ab}	9.34±0.20 ^a

- G1= Control, G2= Control+100 (g/h/d) with tafla clay supplementation, G3= control+ 200 (g/h/d) with tafla clay supplementation

- Means with different superscripts (a, b) within the same row are differ significantly at (P≤0.05).

in ruminal NH₃-N concentration post-feeding lamb on diet supplemented with zeolitea. The results in table (2) showed significantly (P≤0.05) increased in digestibility coefficients of CP and CF in G3 than those in both G1 and G2 (72.85 vs. 61.08 and 68.82% for CP and 65.04 vs. 52.56 and 62.97% for CF). While the differences in digestion coefficient of CP and CF was not significant between G1 and G2 and G2 versus G3 group. The results presented in Table (2), showed that digestibility of DM, OM, EE and NFE significantly (P≤0.05) for cows fed tafla supplemented rations than those in control diet.

In agreement with the present results, Salem *et al.* (2001) found that diets supplemented with 4 or 8% bentonite had higher (P≤0.05) digestibility value of CP and CF than those fed un-supplemented diets. Also, Mikolaichik and Morozova (2009) found marked improvement in digestibility coefficients crude protein of dairy cows supplemented with bentonite. Whereas, Grabherr *et al.* (2009) fed dairy cows on

diet supplemented with 10 and 20 g zeolite /kg of dry matter they indicated significant reduced in ruminal dry matter.

On the other hand, Cole *et al.* (2007) reported that supplementing diets of beef steers with zeolite did not affect CP digestibility. Also, Aguilera-Soto *et al.* (2009) indicated that adding sodium bentonite to Holstein cow diets had no effect on digestibility of different nutrients among experimental treatments.

Rumen parameters:

Values of some ruminal parameters as means including pH value, NH₃-N concentration, TVFA's and protozoa count in ruminal liquor (RL) of Friesian cows fed different experimental rations at pre and post 2h of feeding are presented in Table (3).

Current experiment showed that overall mean affected by treatments at different sampling time, being the highest value (P≤0.05) in control group (6.11) and the lowest at G3 (5.81). While, the effect of sampling time on overall mean of pH value was significant (P≤0.05), being lower at 2 hours post-feeding (5.72) than pre-feeding value (6.16). The effect of interaction of treatment groups with sampling time was insignificant which reflect the lower pH values in tafla group (G2 and G3) than those of control (G1). In good agreement with the present results, similar trend was found by Ahmed (1999) who reported significant decrease in ruminal pH of lactating goats fed on diet supplemented with 3% tafla. On the other hand, Grabherr *et al.* (2009) reported that the ruminal pH value not affected by adding zeolite to dairy cows.

Table (3): Means and standard errors of cows rumen liquor parameters as affected by different experimental treatments

Sampling time	Experimental group			Overall mean
	G1	G2	G3	
pH – value				
0	6.28±0.11	6.08±0.11	6.14±0.09	6.16±0.06 ^a
2	5.95±0.12	5.71±0.23	5.49±0.10	5.72±0.09 ^b
Overall mean	6.12±0.10 ^a	5.90±0.27 ^{ab}	5.82±0.16 ^b	5.94±0.08
NH ₃ -N (mg/100ml)				
0	18.38±1.07	17.73±0.98	17.16±1.00	17.76±0.54 ^b
2	22.57±0.99	21.90±0.33	22.21±0.38	22.23±0.33 ^a
Overall mean	20.48±1.14	19.82±1.04	19.69±1.23	19.99±0.62
TVFA's (meq/100ml)				
0	5.90±1.00	6.18±1.45	6.03±0.84	6.04±0.57 ^b
2	9.77±1.48	10.37±1.96	11.15±1.75	10.43±0.89 ^a
Overall mean	7.84±1.18	8.28±1.44	8.59±1.43	8.24±0.74
Protozoal count (x 10 ³ /mm ³)				
	238.67±23.75 ^c	319.33±22.30 ^b	389.67±6.36 ^a	315.89±23.82

- G1= Control, G2= Control+100 (g/h/d) with tafla clay supplementation, G3= control+ 200 (g/h/d) with tafla clay supplementation

- Means with different superscripts (a, b, c) within the same row or column are differ significantly at (P≤0.05).

Data in the present study of ruminal pH, being around the normal range (5.5-7.0) which were identified value as critical maintaining the ruminal fiber digestion (Hungate, 1966; Garrett, 2000 and Bravo and Wall, 2016). Also, clays showed marked alkalizing capacity and have ability for H+ exchange at different pH ranges (Yong *et al.*, 1990).

The obtained results indicated that no significant effect for dietary treatment was noticed for ammonia and total volatile fatty acids concentrations in rumen liquor. While, sampling times had significant effect on NH₃-N concentration at (P≤0.05), being higher post-feeding compared to pre-feeding (22.23 vs. 17.76 mg/100ml). There were insignificant effect for interaction between treatment groups and sampling time on NH₃-N concentration, being high post-feeding compared with pre-feeding. Similar trend was found in dairy cows, Dschaak *et al.* (2010) indicated that no significant effect was found in ruminal NH₃-N concentration by adding zeolite to diet. Also, Aguilera-Soto *et al.* (2009) demonstrated that ammonia

concentration in rumen fluid did not differ ($P \leq 0.05$) among dietary treatments with or without 1% sodium bentonite. On the other hand, Forouzani *et al.* (2004) indicated significant increase

Data of TVFAs concentration had no significant effect by tafla treatments being low in control group (7.83 meq/100ml). However, it was affected significantly ($P \leq 0.05$) by sampling time, being high post-feeding (10.43 meq/100ml) compared with pre-feeding (6.04 meq/100ml). The interaction effect between treatment groups and sampling time did not affect significantly. In this respect, Bosi *et al.* (2002) found significant reduction in VFA concentration of dairy cattle rumen liquor when it fed on diet with 200 g clinoptilolite addition. Also, Dschaak *et al.* (2010) indicated that, no significant effect for zeolite supplementation on $\text{NH}_3\text{-N}$ concentration in ruminal liquor of dairy cows. On the other hand, Ibrahim (2012) found that the ruminal total volatile fatty acids significantly increased in rams feed diet with tafla addition. Also, Ahmed (1999) showed significant increase in ruminal total volatile fatty acids when goats fed diet with 3% tafla supplementation.

Data showed that there is a significant ($P \leq 0.05$) effect for treatment groups on protozoal count. It was significantly ($P \leq 0.05$) increased in G3 by 163.3% and by 133.8% in G2 as compared to G1. Also, the differences between G2 and G3 were significant ($P \leq 0.05$) being high in G3 (389.67 cell/mm³) compared to G2 (319.33 cell/mm³). These results are in harmony with the findings of several authors, who found that the supplementation of diet with clay had a significant effect on increasing protozoal count in rumen liquor (Nistiar *et al.*, 2000, Krause and Oetzel, 2005 and Weimer *et al.*, 2010). In this respect, Ibrahim (2012) indicated that the inclusion of clay elements in ruminant diet had beneficent effect on rumen microorganisms by release the ions in rumen liquor gradually which led to increase it populations.

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تأثير إضافة الطفلة على الاستفادة من الغذاء وبعض قياسات الكرش وهضم المكونات الغذائية للأبقار الحلابة.

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الهدف من هذه الدراسة هو تقييم إضافة الطفلة على الاستفادة من الغذاء وبعض خصائص الكرش وهضم المكونات الغذائية في الأبقار الحلابة. في هذه الدراسة تم استخدام إجمالي 18 بقرة حلابة (2-4 موسم حليب) في الفترة الأخيرة من الحمل (30 يوم قبل الولادة). تم تقسيم الأبقار إلى 3 مجموعات متماثلة (6 أبقار/مجموعة). كانت المجموعة الأولى هي الضابطة (G1) بينما الأبقار في المجموعتين 2 و 3 تم إضافة 100 و 200 جم (طفلة/رأس/يوم) لها على التوالي من 30 يوم قبل الولادة حتى 90 يوم بعد الولادة. وأظهرت النتائج التي تم الحصول عليها زيادة المأكول من مخلوط العلف المركز وقش الأرز معنوياً بإضافة الطفلة. بينما لم يتأثر المأكول من البرسيم معنوياً. كان هناك زيادة معنوية في معاملات هضم البروتين والألياف في المجموعة الثالثة عن المجموعتان الأولى والثانية بينما لم يكن هناك فروق معنوية للعلائق المختبرة على معاملات هضم المادة الجافة والعضوية والمستخلص الاثيري والكريبوهيدرات الذائبة ولم يكن هناك فروق معنوية لإضافة الطفلة إلى العليقة على مجموع المركبات الغذائية الكلية المهضومة بينما كان هناك تأثير معنوي على البروتين الخام المهضوم وخاصة في العليقة الثالثة عن العليقة الضابطة. كما أظهرت قياسات الكرش والتي تشمل رقم الحموضة والعد الميكروبي في سائل الكرش لأبقار الفريزيان أثراً معنوياً بالمعاملة التجريبية قبل وبعد 2 ساعة من التغذية. لم يكن هناك تأثير معنوي للمعاملة بالطفلة على تركيزات الأمونيا والأحماض الدهنية الطيارة لسائل الكرش. بصفة عامة كان هناك تحسن في وظائف الكرش بواسطة المعاملة. والخلاصة من هذه الدراسة أن إضافة الطفلة بمعدل 200 جم/رأس/يوم في الفترة من 30 يوم قبل الولادة حتى 90 يوم بعد الولادة يحسن من المأكول ومعاملات الهضم ووظائف الكرش للأبقار الحلابة.