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EFFECT OF CONCENTRATE ROUGHAGE RATIO AND TAFLA ADDITION ON PRODUCTIVE PERFORMANCE OF LACTATING BUFFALOS

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ABSTRACT

This study was carried out to investigate the effect of feeding different concentrate roughage ratio and tafla clay addition on digestibility, nutritive values, milk and fat yield, milk composition, feed conversion and the economical efficiency of seven lactating buffalos using "Swing over" method to evaluate the following tested rations. Initial control ration (T_1): 100% of nutritional requirements (starch equivalent (SE) and digestible crud protein (DCP)) according to Shehata (1970) from concentrate feed mixture (CFM) plus rice straw (RS) *ad libitum.* Ration 2 (T_2): 50% of nutritional requirements from CFM plus 50% from berseem (Br). (2^{nd} cut) plus RS *ad libitum.* Ration 3 (T_3): 50% of nutritional requirements from CFM plus 50% from Br. (2^{nd} cut) plus RS *ad libitum* plus tafla clay (1g /kg live body weight (LBW)). Finial control ration (T4): as initial control. The main results showed that the daily dry matter intake (DMI) insignificantly increased with control group (T1) compared with those without tafla (T2) and with tafla group (T3).The digestibility of organic matter (OM), crud protein(CP) and crud fiber (CF) insignificantly increased when lactating buffalos fed on T3 compared to those fed on either T1 or T2 . The nutritive values indicated no significant differences among treatments. The differences of feed units intake as total digestive nutrients (TDN) and DCP were not significantly affected by tested rations. The values of the calculated milk yield and fat corrected milk of T3 were insignificantly higher than those of T1 and T2. The milk fat content with (T3) was significantly increased compared to the other rations. The feed conversion as TDN , SE and DCP per kg milk were more efficient utilized ($p<0.05$) with addition of tafla (T3) followed by those fed the 100% CFM (T1) and (T2) group without tafla .Adding tafla clay to ration contained 50% CFM plus 50% berseem reduced the feed cost to produce 1kg FCM and showed better economical feed efficiency.

Keywords: Berseem, tafla, digestibility, nutritive values, milk production, lactating buffalos.

INTRODUCTION

In Egypt, buffalos are the main productive farm animal (3.9 million animals), which gives the national economy around (50-55%) and (30-35%) from the total milk produced and red meat annually in the country, respectively (FAO, 2005).

Berseem (*Trifolium alexandrinum L.*) is the main forage crop fed *ad. libitum* as a common practice in Egypt .Feeding berseem with its narrow caloric /protein ratio usually covers 96% of energy and 177%of protein requirements of animals (Youssef and Saleh, 1978) which considered as unbalanced feed.

Milk production in Egypt did not yet reach acceptable of self sufficiency level because of the limited number of livestock population and the low productivity of local breeds, besides wrong policies where young animals are slaughtered regardless of slaughter legislations. Efforts are made in spite of the limited resources to increase production through the utilization of materials that reduce the passage rate of the digesta into the intestinal canal in order to

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improve efficiency of digestion and consequently improving feed utilization.

Tafla as an aluminaosilicate is a member of clay family naturally obtained from some Egyptian mines. Clays are widely used as feed additives to ruminant diets. The ion exchange capabilities of tafla could possibly influence microbial and animal metabolism through the preferential trapping and release of cations. Minerals ion-binding properties of tafla make this natural alumino-silicate attractive for use dietary supplements to improve digestion in ruminants. Also, tafla clay decreased liquid flow rate, while slightly decreased fractional rate of passage of food particles in digestive tract (Abd El-Baki *et al.,* 2001a).

Tafla is one of the natural clays which is used to improve feed intake, digestibility, daily gain and milk production (Abd El-Baki *et al.,* 1995, 2000, 2001b and Salem *et al.,* 2001).

MATERIALS AND METHODS

This study was carried out at El-Gemmiza Experimental Research Station, Animal Production Research Institute, Agriculture Research Center and the Animal Production Department, Faculty of Agriculture, Zagazig University, to investigate the effect of tafla addition to different rations according to the nutritional requirements of Shehata (1970) from concentrate feed mixture(CFM), berseem (2^{nd} cut) and rice straw on digestibility, nutritive values, milk and fat yield, milk composition, feed conversion and the economical efficiency of the tested rations by lactating buffalos.

Seven lactating buffalos were used in "Swing over" method design as described by Abou-Hussiein (1958), El-Serafi (1968) and Abd El-Baki (1970) as shown in Fig.1.Buffalos were chosen after passing the lactating peak to fed the following experimental rations.

Initial control ration (T_1): 100% of nutritional requirements (SE and DCP) according to Shehata (1970) from CFM plus RS *ad libitum.*

Ration 2 (T_2): 50% of nutritional requirements from CFM plus 50% from Br. (2^{nd} cut) plus RS *ad libitum.*

Ration *3*(T_3): 50% of nutritional requirements from CFM plus 50% from Br. (2^{nd}cut) plus RS *ad libitum* plus tafla clay (1g /kg LBW).

Finial control ration (T4): as initial control. s

Chemical composition of ingredients and the experimental rations are presented in Table (1). Nutrients digestibility were determined by four lactating buffalos using acid insoluble ash (AIA) technique of Van Keulen and young (1977). Animal feces samples were individually collected from rectum twice a daily at 2 and 6 hours after feeding at weeks 5, 10, 15 and 20. Feeds and feces samples were analyzed according to A.O.A.C.(1980).Milk samples were analyzed by Milkoscan apparatus "Model 133D".

A statistical analysis was carried out by SAS User's Guide (SAS, Institute, 2003) according to the following model:

$Yij = \mu + Ti + Eij$ Where:

Yij= an observation, μ = the overall mean,

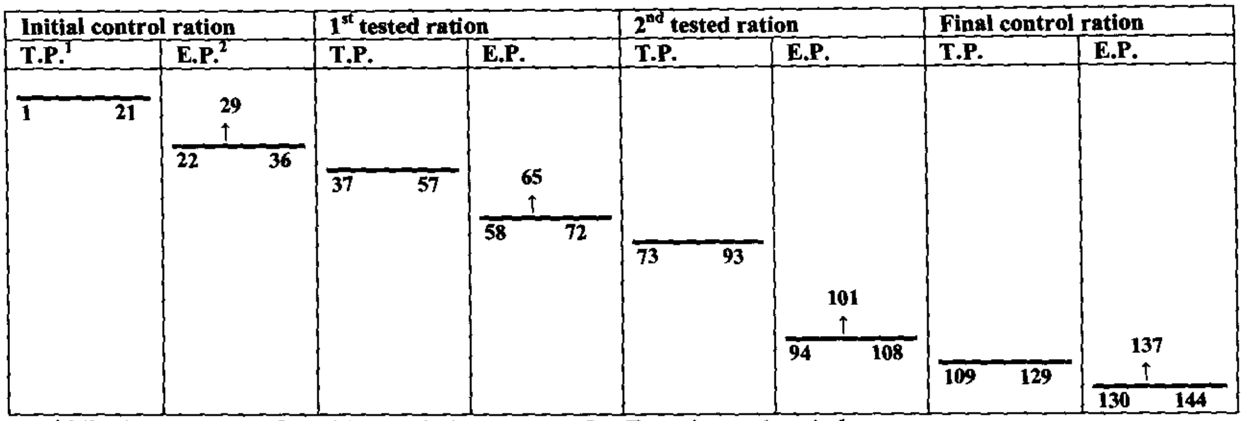
Ti = the fixed effect of the treatment and Eij = random error. Differences among treatment means were separated by Duncan's new multiple-range test (Duncan, 1955).

RESULTS AND DISCUSSION

Digestibility Trials

The digestibility of OM, CP and CF insignificantly increased when lactating buffalos fed T3 compared to those fed T1 or T2 (Table 2). However, the digestibility of EE was significantly ($p<0.05$) increased with control and tafla groups compared with T2. These results are in agreement with those reported by Mohsen and Tawfik (2002); Soliman *et al.* (2003); El- Tahan *et al.* (2005); Hassan (2009) and Dshaak (2010) who observed that digestibility of DM and other nutrients (OM, CP, NDF and ADF) did not affected by the addition of Zeolite.

The nutritive values as TDN and SE showed no significant differences among treatments and the differences were in narrow ranges. . However, the values of DCP were significantly ($p<0.05$) higher when animals fed T3 and T2 than those fed T1 .These results were in agreement with those reported by El-Tahan *et al.* (2005) and Hassan (2009).



↑ Middle days. 1 = Transition period 2 = Experimental period

Fig. 1. Succession of days and periods in the "Swing over" method included two tested rations with lactating buffalos

Table 1. Chemical composition of ingredients and the experimental rations (on DM basis)

Items	Chemical composition %						
	DM	OM	CP	CF	EE	NFE	Ash
Concentrate feed mixture (CFM)	91.12	91.39	17.18	8.33	2.83	63.05	8.61
Rice straw (RS)	90.53	83.35	4.33	31.31	0.80	46.91	16.65
Berseem T2	14.18	85.40	17.29	21.17	2.29	44.65	14.60
Berseem T3	13.14	86.12	17.71	24.50	2.35	41.56	13.88
Tafla	92.94	7.05		7.05			92.95
Calculated chemical composition of consumed rations							
100% CFM+ RS (control) T1	90.84	87.62	11.15	19.12	1.88	55.47	12.38
50% CFM+ 50% Br + RS (T2)	65.19	86.66	12.86	20.41	1.96	51.43	13.34
50% CFM+ 50% Br + RS + Tafla (T3)	65.49	84.56	13.03	20.31	1.99	49.23	15.44

Table 2. Digestion coefficient and nutritive values (%) of the experimental rations

Items	100% CFM	50% CFM	
	T_1	T_2	T_3
DM	77.10±1.84	77.44±0.58	77.28±0.99
OM	79.45±1.63	79.05±0.59	79.87±0.89
CP	77.58±1.91	79.03±1.00	82.12±0.77
CF	65.78±3.64	70.78±1.35	71.86±1.30
EE	81.36 ± 1.46^{a}	75.36 ± 0.65^{b}	84.36 ± 0.76^{a}
NFE	83.64±1.20	82.46±0.58	82.40±0.98
Nutritive value (%)			
TDN	71.06±1.50	70.35±0.58	69.64±0.81
SE	58.93±1.46	57.40±0.69	56.65±0.82
DCP	8.65 ± 0.26^{b}	10.17 ± 0.32^{a}	10.70 ± 0.27^{a}

a,b and c means the same row with different superscripts differ ($P\leq0.05$)

Production Trail

Feed intake

Total DM intake expressed as kg/h/d insignificantly increased with animals which fed 100% CFM (T1) compared with that of groups fed 50% CFM plus 50% Br. without tafla (T2) and with tafla (T3) as shown in Table 3. Also, the values of DMI as g/kg $W^{0.75}$ significantly ($p<0.05$) decreased with T3 compared with values of T1 and T2 .The differences of feed units intake were not significantly affected by the tested rations (table3).While, the feed units intake as SE (g/kg $W^{0.75}$) were significantly ($p<0.05$) increased when buffalos fed control ration (T1) than those fed (T2) and (T3) and also, the differences between (T2) and (T3) were significant. However, feed units intake as TDN (g/ kg $W^{0.75}$) and SE (kg/h/d) were significantly ($p<0.05$) increased with control ration (T1) compared to tafla group (T3). But, the differences between (T1) and (T2) were not significant.

These results agree with Thilsing-Hansen (2002) and Mesgaran (2005) who found that using sodium bentonite as directly buffer in lactating cows (350 g/ cow/ d) decreased feed intake. Abd El- Baki *et al.* (2009) and Hassan (2009) indicated that the addition of 1% bentonite to concentrate feed mixture fed to local crossed male lambs significantly decreased the daily DM intake (kg/h/d). Also, Abd El-Baki *et al.* (2003) who indicated that the feed units intake as TDN, SE and DCP as (kg /h/d) were significantly ($p<0.05$) decreased with the buffalo bull calves which fed 50% CFM plus *ad lib.*treated rice straw with or without tafla than the control group which fed 100% CFM plus *ad lib.* untreated rice straw.

Milk Yield

The average daily actual milk yield (Table 4) with the control (initial) was 10.64 kg. The average calculated daily milk yield in groups T2 and group T3 were 10.77 and 11.32 kg, respectively. The calculated milk yields were increased by 1.22% and 11.32% for the 1st and 2nd tested ration, respectively than the control one. The values of the calculated milk yield of T3 were insignificantly higher than those of T1 and T2 values.

These results are in harmony with those reported by Abd El-Baki *et al.* (2001b) showed that the milk yield and 4% fat corrected milk (FCM) of lactating mixed Friesian cows were significantly higher with rations contained 65% or 75% of nutritional requirement from concentrate feed mixture plus sulphuric acid-urea treated rice straw with tafla than those fed the same rations without tafla or control. Also, Abd El-Baki *et al.* (2009) found that milk yield of lactating buffalos was significantly improved with rations contained 60% of nutritional requirement from concentrate feed mixture plus sulphuric acid – urea treated rice straw with or without tafla (1g/kg LBW) compared to control .

Milk fat yield

The average daily milk fat yield of the initial control, T2 and T3 were 556g, 598g and 620g, respectively (Table 5). The increases of milk fat yield represent 7.55% for T2 and 11.51% for T3 compared with the control value. The fat yield of T3 (50% CFM + tafla) was insignificantly higher than those of T2 and the control (T1). These results took the same trend with those reported by Helal and Abd El-Rahmen (2010) who found that supplementation of bentonite had positive effect ($p<0.05$) on fat milk yield compared with control group. The improvement of fat milk yield may be related to the crude fiber digestibility improvement as a result of the fiber structure differences (berseem vs. straw) and the low passage rate of digesta with tafla addition (Kirilove and Burikhonov, 1993 and Ayyat and Marai, 1997).

Milk constituents

Animals fed ration without tafla (T2) showed significantly ($p<0.05$) higher total solids (T.S) value compared to the control ration value (T1). But, solids non fat (SNF) and lactose content were significantly decreased with T3 compared with 50% CFM without tafla addition (T2).

Fat content of milk significantly increased with T3 group compared with the other groups (Table 6). The results showed that there were no significant differences among all treatments for milk protein and ash content (Table 6). The same trend was reported by Nik-Khah *et al.* (2000); Garcia-Lopez *et al.* (2001); Mesgaran (2005) and Helal and Abd El-Rahman (2010)

Table 4. Effect of the experimental treatments on milk yield of lactating buffalos

Animals No.	Initial of the control (kg/h/d) (T_1)	1st tested ration (T_2)			2nd tested ration (T_3)			Final yield of the control	Daily milk decrease (g)
		Actual yield (kg/h/d)	Calculated yield (kg/h/d)	Difference %	Actual yield (kg/h/d)	Calculated yield (kg/h/d)	Difference %		
	a	b	c	e	B	C	E	F	D
1	13.36	11.83	12.90	-3.44	11.89	14.04	5.09	10.14	29.81
2	13.35	11.52	12.99	-2.70	10.58	13.53	1.35	8.93	40.93
3	12.74	11.45	12.54	-1.57	10.84	13.02	2.20	9.47	30.28
4	10.13	8.5	9.34	-7.80	8.82	10.50	3.65	7.61	23.33
5	11.39	11	11.91	4.57	10.37	12.20	7.11	8.65	25.37
6	5.59	5.7	6.33	13.24	5.47	6.73	20.39	3.7	17.50
7	7.89	8.39	9.36	18.63	7.24	9.17	16.22	4.99	26.85
Average	10.64±1.12	9.77±0.87	10.77±0.95	1.22	9.32±0.86	11.32±1.00	6.39	7.64±0.91	27.78

a and b means the same row with different superscripts differ (P<0.05).
c={b (36*D)} e=(c-a / a × 100) C= {B+ (72*D)} E=(C –a / a × 100) D= {(a-F)/108*1000)}

Table 5. Effect of the experimental treatments on milk fat yield of lactating buffalos

Animals No.	Initial of the control (kg/h/d) (T_1)	1st tested ration (T_2)			2nd tested ration (T_3)			Final yield of the control (kg)	Daily milk decrease (g)
		Actual yield (kg/h/d)	Calculated yield (kg/h/d)	Difference%	Actual yield (kg/h/d)	Calculated yield (kg/h/d)	Difference %		
	a	b	c	e	B	C	E	F	D
1	0.656	0.694	0.690	5.18	0.759	0.751	14.48	0.668	-0.111
2	0.778	0.715	0.784	0.77	0.623	0.760	-2.31	0.572	1.907
3	0.676	0.666	0.688	1.78	0.691	0.734	8.58	0.611	0.602
4	0.523	0.471	0.483	-7.65	0.539	0.563	7.65	0.487	0.333
5	0.597	0.652	0.661	10.72	0.652	0.669	12.06	0.571	0.241
6	0.293	0.352	0.371	26.62	0.356	0.393	34.13	0.237	0.519
7	0.369	0.494	0.511	38.48	0.437	0.472	27.91	0.317	0.481
Average	0.556±0.07	0.578±0.05	0.598+0.06	7.55	0.580±0.05	0.620±0.06	11.51	0.495±0.06	0.565

c={b (36*D)} e=(c-a / a × 100) C= {B+ (72*D)} E=(C –a / a × 100) D= {(a-F)/108*1000)}

Table 6. Effect of the experimental treatments on milk chemical constituents (%) of lactating buffalos

Items	Experimental rations		
	T_1	T_2	T_3
Total solids (T.S)	15.90 ± 0.32^{b}	17.49 ± 0.42^{a}	16.67 ± 0.24^{ab}
Solids non fat (SNF)	10.57 ± 0.10^{ab}	11.74 ± 0.49^{a}	10.21 ± 0.09^{b}
Fat	5.33 ± 0.23^{b}	5.75 ± 0.18^{b}	6.46 ± 0.19^{a}
Protein	4.39±0.07	4.50±0.14	4.20±0.04
Lactose	5.58 ± 0.06^{b}	6.64 ± 0.47^{a}	5.41 ± 0.06^{b}
Ash	0.60±0.00	0.60±0.00	0.60±0.00

a,b and c means the same row with different superscripts differ (P≤0.05).

who found that milk protein and lactose were non significantly affected by rations supplemented with bentonite .while , total solids and fat yield were significantly ($p<0.05$) increased .

Feed conversion and economical efficiency

The results of feed conversion as TDN, SE and DM per kg FCM (Table 7) showed significant ($p<0.05$) differences between the tafla group (T3) and the other groups. However, feed conversion as g DCP per kg FCM was more efficient utilized in tafla ration group (T3) followed by control (T1) and the worst was in (T2) group without tafla clay with no significant differences between all groups. These results are similar with the findings of Mohsen and Tawfik (2002); El- Tahan *et al.* (2005) and Hassan (2009) who showed that feed conversion in terms of DM intake per kg gain was significantly ($p<0.05$) improved by the addition of bentonite to the diet of lambs.

The results of the economical feed efficiency showed that the calculated input and output revealed that the feed cost for the tested groups (T1, T2 and T3) were 2.03, 1.61 and 1.51 L.E/kg FCM, respectively. The corresponding values of return were 31.96, 32.99 and 40.23 L.E /h/d for the tested rations, respectively. From these results, it could be concluded that adding tafla clay to rations contained 50% CFM plus 50% berseem was more effective in decreasing the feed cost to produce 1kg FCM. These results are in harmony with those obtained by Yousef (2001); El-Saadany *et al.* (2003) and El-Tahan *et al.* (2005) who reported that addition of tafla to ration of Friesian calves led to decrease feed cost/kg gain. The same trend was observed by Hassan (2009) and Abd El-Baki *et al.* (2009).

In conclusion, adding tafla clay to rations contained 50% CFM plus 50% berseem could be used economically and successfully to improve digestibility, nutritive values and performance of lactating buffalos.

Table 7. Effect of the experimental treatments on Feed conversion and economical efficiency of lactating buffalos

Items	100% CFM	50% CFM	
	T_1	T_2	T_3
Feed /1 kg FCM			
DM kg/1kg	1.09±0.10 b	0.87±0.08 b	0.61±0.07 a
TDN kg/1kg	0.77±0.07b	0.61±0.06b	0.43±0.05a
SE kg/1kg	0.64±0.06 b	0.50±0.05 b	0.35±0.04 a
DCP g/1kg	99.05±9.86	103.89±9.70	83.09±9.88
Costs of feed intake (pt/h/d)			
Concentrate feed mixture	24.54	14.01	13.94
Rice straw	1.09	0.71	0.49
Berseem	-	6.64	6.43
Tafla	-	-	0.03
Total feed costs (Input)[a]	25.64	21.37	20.89
Average daily production (kg)			
FCM	12.6	13.29	13.83
Gain	0.36	0.06	0.29
Price of weight change[b]	7.20	1.20	5.80
Total feed cost of milk production[a-b]	18.44	20.17	15.09
Feed cost/kg FCM	2.03	1.61	1.51
Price of milk	50.40	53.16	55.32
Total (output)	57.60	54.36	61.12
Economical efficiency	2.25	2.54	2.93
Return/h/d	31.96	32.99	40.23
Return/ 1kg FCM	2.54	2.48	3.63

CFM = 210 L.E./kg   Milk (FCM 4%) =400 L.E ./kg   Body gain = 2000 L.E./kg
R.S=10 L.E ./kg   Berseem =15 L.E ./kg

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تأثير نسبة المركز والمواد الخشنة مع إضافة الطفلة على الأداء الإنتاجي للجاموس الحلاب

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أجريت هذه الدراسة بهدف دراسة تأثير إضافة الطفلة مع البرسيم الأخضر في علائق الجاموس الحلاب على المأكول ومعاملات الهضم وإنتاج اللبن. تم إجراء تجارب إنتاج لبن وهضم باستخدام سبعة جاموسات حلابة بطريقة العودة لذى بدء لتقييم العلائق الغذائية الآتيه: العليقه الأولى (كنترول ابتدائي):١٠٠% من الاحتياجات الغذائية من معادل النشا والبروتين المهضوم طبقاً لمقررات شحاتة ١٩٧٠ من العلف المركز بالإضافة إلى قش الأرز حتى الشبع. العليقه الثانية: ٥٠% من الاحتياجات الغذائية من العلف المركز + ٥٠% من البرسيم بالإضافة إلى قش الأرز حتى الشبع. العليقه الثالثة: ٥٠% من الاحتياجات الغذائية من العلف المركز + ٥٠% من البرسيم بالإضافة إلى قش الأرز حتى الشبع بالإضافة للطفلة(١جم|كجم وزن حي): العليقة الرابعه : عليقه المقارنة مرة أخري (كنترول نهائي). كانت أهم النتائج كالتالي: أظهر الغذاء المأكول ارتفاعاً غير معنوياً لمجموعة الجاموس الحلاب المغذاة على عليقه الكنترول مقارنة بالعليقتين الثانية والثالثة. معاملات هضم المادة العضوية والبروتين الخام والألياف الخام ارتفعت بدرجه غير معنوية مع عليقه الطفلة مقارنة بعليقه الكنترول أو العليقه بدون طفله. أظهرت النتائج عدم وجود فروق معنوية بين العلائق فيما يتعلق بالقيمة الغذائية لتلك العلائق. ارتفع إنتاج اللبن بدرجه غير معنوية للأبقار المغذاة على العليقه المحتوية على الطفلة مقارنة بعليقه الكنترول أو العليقه بدون طفله وأخذت نتائج محصول الدهن نفس الاتجاه. ارتفع محتوى الدهن في اللبن بدرجه معنوية مع العلائق المحتوية على الطفلة مقارنة بعليقه الكنترول أو العليقه بدون طفله. تحسنت كفاءة استخدام وتحويل الغذاء للجاموس الحلاب المغذى على عليقه الطفلة مقارنة بالعلائق الأخرى. أظهرت عليقه الطفلة كفاءة اقتصاديه وعائد أعلى من باقي المجموعات. مما سبق يتضح أن علائق الجاموس الحلاب المحتوية على الطفلة مع البرسيم الأخضر قد حسنت معظم معاملات الهضم كما حسنت من إنتاج اللبن وكذلك دهن اللبن كما حسنت من الكفاءة الاقتصادية والعائد من إنتاج محصول اللبن للجاموس الحلاب.