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EFFECT OF ADDING YEAST CULTURE OR SODIUM BICARBONATE TO FRIESIAN COWS DIET CONTAINING FODDER BEET ROOT SILAGE ON FEED QUALITY, MILK PRODUCTION, FEED CONVERSION AND BODY WEIGHT CHANGE

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SUMMARY

Twenty one multiparous lactating Friesian cows were used to study the effect of adding yeast culture or sodium bicarbonate to daily diet of fodder beet root silage (FBRS) on nutrient digestibility, nutritive value, milk production, feed intake, efficiency of feed conversion and live body weight change. Three days after calving the cows were assigned into three similar groups (7 cows each).

Daily ration was composed of concentrate feed mixture (CFM),wheat straw(WS), and fodder beet root silage (FBRS) representing 30% of daily total TDN requirements given to group 1 (G1 as control). Rations of second (G2) and third (G3) groups were supplemented with 15.0 gm/day/ head yeast culture or 150.0 gm/day/head sodium bicarbonate, respectively.

Results indicated that cows received yeast culture in their daily diet had higher ($P<0.05$) milk production ,fat , protein and total solids. Digestion coefficients, feeding values, feed conversion (TDN/Kg FCM) and body weight change during the first 12 weeks post-calving were also better ($P<0.05$) compared to control group.

Cows in G3 produced higher milk ($P<0.05$), meanwhile, there was insignificant increase in fat, protein, lactose and total solids. Treatment of $NaHCO_3$ had neither effect on nutrient digestibility , nutritive values, feed conversion nor body weight change than control group.

Keywords: Dairy cows, yeast, sodium bicarbonate, digestibility, milk, body weight

INTRODUCTION

During hot months of summer there is a clear drop in productive and physiological performance of Friesian dairy cows. Many factors affect this phenomenon, of which feeding quality is considered as one of these factors. Fodder beet root has been recommended as good source of energy (Kanbe *et al.*, 1986 and Schwarz *et al.*, 1992). It could be ensiled to produce a good quality silage to feed dairy cattle during summer months (Shalaby *et al.*, 1989),otherwise it will be contaminated with funji which produce many types of mycotoxin if it is stored fresh (Abdelhamid, 1983). Lactic acid as a strong acid produced during silage making, causes a reduction in rumen pH of dairy cows (El-Gaafarawy *et al.*, 2000). The Egyptian farmers have no way to measure the degree of silage acidity and they have no way also to control lactic acid production. Therfore, the farmer either uses a restricted amount of this type of feeding or he tries to find another way to face this problem. Many studies had been carried out to control rumen acidity by using some types of buffers as feed additives to improve rumen pH(West *et al.*,, 1982, Cole *et al.*,1992 , El-Ashry *et al.*, 1996 and El-Gaafarawy *et al.*, 2000). Yeast culture is used to reduce rumen acidity throughout stimulation of lactic acid utilizing bacteria, *Selenomas rumintium*, (Nisbet and Martin,1991). Higher ruminal pH of cows fed yeast has been suggested as being an important property of yeast in ruminants (Yoon and Stern, 1996) while sodium bicarbonate, is also used to counter balance rumen acidity (Bioslair *et al.*, 1986). Similarly, EL-Bedawy *et al.* (1989) reported that the addition of sodium bicarbonate to daily ration of lactating cows had a beneficial effect on rumen pH.

The objective of this study is to improve performance of dairy Friesian cows during summer season, when fed daily ration containing fodder beet root silage, this is throughout the addition of yeast culture or sodium bicarbonate to their food.

MATERIALS AND METHODS

Twenty one multiparous lactating Friesian cows were assigned randomly into three similar groups according to their live body weight, parity and preceeding lactation, The experiment was carried at Sakha Animal Production Research Station, Animal Production Research Institute, Agriculture Research Center. Experiment was started three days after calving, at July 1998, and was extended for five months postpartum to be ended at November. All cows in this experiment were fed a daily ration (DR) composed of concentrate feed mixture (CFM), wheat straw (WS) and fodder beet root silage (FBRS) which represented 30% of the total energy requirements/ day/head . The intended ratio of roughage: concentrate was 40:60.

All cows were fed individually according to NRC , 1988 allowances. Experimental treatments were: Group1 (G1), cows were fed the previous mentioned daily ration (DR) without any buffer supplementation (control), Group2 (G2), cows were fed DR plus 15 gm./cow/day yeast culture (*Saccharomyces cervisia*, 5*109 c.f.u. Sc, Strain 1026/gm.), according to Yousef *et al.*(1996) , Group 3 (G3), cows were fed DR plus 150 gm/cow/day sodium bicarbonate ($NaHCO_3$) as recommended by Orrego *et al.*(1993). Yeast or NaHCO3 were added to fodder beet root silage just before feeding.

To evaluate the experimental treatments, nine mature Friesian bulls were used equally in three digestibility trials to determine digestion coefficients and feeding values, trials were started at September, 1989,each trial included two weeks preliminary period followed by one week collection period. Bulls were fed according to NRC, 1988 allowances. Daily feed intake and feces collection were recorded twice a day.. Composite samples were taken for chemical analysis according to A.O.A.C.(1986). Weekly milk recording and composite samples were taken to determine fat, protein, lactose and total solids using Milko-Scan Analyzer device Fat corrected milk (FCM) was estimated according to the formula published by Gains, (1923): 4% FCM=0.4 milk yield + 15 fat. Weekly recording of live body weight (L.B.W.) was carried out to estimate postpartum body weight change (Kg.). Feed efficiency was also calculated according to Gabra *et al.*;, (1992) as follows:

Kg DM Intake/ Kg4%FCM, Kg. Kg TDN Intake/ Kg4%FCM, Kg

All cows were under similar conditions, they were fed CFM twice a day , at 8 h and 15 h , silage at 11.0 h, while wheat straw was offered at 17 h. Cows were machine milked twice a day at 7.0 h and 16 h. All cows were kept under semi shaded yard and water was offered freely along the day. The data were statistically analyzed according to General Linear Model (GLM) and the differences among treatments were determined by Duncaens multiple rang test (SAS,1992) .

RESULTS AND DISCUSSION

Effect of treatments on digestibility and nutritive values

Chemical composition of daily rations are presented in table (1), while digestion coefficients of different nutrients in experimental treatments are shown in table (2).

It was observed that added yeast culture to daily diet of FBRS (G2) increased significantly ($p<0.05$), digestibility's of OM, CP, CF, and NFE compared with the control (G1) and G3, exept CP. Addition of NaHCO3 to daily diet of FBRS (G3) improved , but not significantly, the digestibility coefficients of all feed nutrients except crud protein when compared with control (G1), Wholt *et al.* (1998) and More *et al.* (1992), came to similar results when they added 10 grams of yeast or 1% Sodium sesquicarbonate to daily ration of lactating cows based on corn silage . These improvements in digestibility's of most nutrients may be due to that the addition of yeast to daily diet of cows tended to increase the number of total anaerobic bacteria (Stahl, *et al.*, 1988), or may be due to the ability of yeast to release essential enzymes during digestion which have a positive effect on digestibility (Newbold, *et al.*,,1996). Nutritive values (TDN and DCP) in G2 group was significantly higher ($p<0.05$) than those obtained for the control(G1) and G3. These results were in a harmony with those found by Wohlt *et al.*(1991). and More *et al.* (1992).

Table 1. Chemical composition of daily ration (DM%)

Items	DM	Composition of DM					
		OM	CP	EE	CF	NFE	Ash
Concentrate feed mixture	92.6	90.2	16.1	3.2	10.4	60.5	9.8
Wheat straw	93.7	82.6	1.1	1.5	39.2	40.8	17.4
Fodder beet root silage	26.8	87.5	11.3	1.4	13.7	61.1	12.5
Yeast culture	92.8	95.8	55.3	1.5	3.7	35.7	4.2
Experimental ration (calculated)							
G1, G2 and G3	73.0	88.6	13.1	2.5	14.3	58.7	11.4

Table 2. Digestion coefficients and feeding values (%) of consumed experimental rations

Item	Experimental treatments		
	G1	G2	G3
Digestion coefficients (%)			
Organic matter	68.9ᵃ	73.3ᵇ	70.8ᵃ
Crude protein	65.6ᵃ	71.8ᵇ	68.1ᵇ
Ether extract	74.9ᵃ	74.1ᵇ	75.0ᵃ
Crude fiber	68.1ᵃ	72.9ᵇ	70.7ᵃ
Nitrogen free extract	66.1ᵃ	70.4ᵇ	66.9ᵃ
Nutritive value (DM basis)			
TDN	61.4ᵃ	65.1ᵇ	62.5ᵃ
DCP	8.5ᵃ	9.4ᵇ	8.9ᵃ
Nutritive ratio	7.2	7.2	7.0
Nutritive value (as fed)			
TDN	44.8ᵃ	47.5ᵇ	45.6ᵃ
DCP	6.2ᵃ	6.7ᵇ	6.4ᵃ

Averages having different superscripts per each row are different ($P<0.05$).

Effect of treatments on milk production and composition

Averages of actual total milk production, FCM and different milk components production were calculated and recorded in table (3). It is observed that total actual milk production and FCM production of cows fed FBRS supplemented with Yeast culture (G2) was significantly ($P<0.01$) higher than the corresponding production in G1 by about 7.6% and 12.8%, respectively. However, there is an increase in actual milk production and FCM in cows fed FBRS supplemented with $NaHCO_3$ (G3) by about 6.4% and 7.7% but this increasing was not significant when compared with the control group. Fat, protein, lactose and total solids produced from cows in G2 were significantly ($P<0.05$), higher by about 16.4%, 25.0%,13.0% and 16.2%, respectively, than the corresponding types of production in G1.

Addition of $NaHCO_3$ to daily diet of FBRS (G3) gave a slight increase in fat, protein, lactose and total solids production than what obtained in control by about 18.5%, 14.3%, 9.5% and 9.5%, respectively, but these differences were not significant.These results were similar to these estimated by Williams *et al.* (1991) and Karalazos *et al.*. (1992), where they stated that the addition of yeast culture to daily diet containing maize silage improved significantly milk and fat production. Similarly, Wohlt *et al.* (1998), observed higher milk and fat yields in response to the supplemental yeast culture to daily diet based on corn silage during early lactation.. Meanwhile Erdman and Sharma, (1989), concluded that fed daily ration contained 40% corn silage supplemented with 0.75% sodium bicarbonate (DM basis) had no superiority in milk production and composition when compared with those fed the same daily ration without buffer supplementation. However, Orrego *et al* ,1993 and Szulc and Janeczko, 1992 stated that cows given a daily diet of silage supplemented with $NaHCO_3$ had a higher milk yield and fat content.

Table 3. Effect of experimental treatments on milk production, composition, dry matter intake, feed conversion and body weight change

Items	G1	G2	G3
Milk production (kg)			
Actual	1588.3ᵃ±110.7	1708.2ᵇ ± 95	1690.9ᵇ ± 102.5
FCM	1521.7ᵃ ± 107.1	1715ᵇ ± 105.2	1639.4ᵃ ± 97.1
Milk components yield (kg)			
Fat	59.1ᵃ ± 2.6	68.8ᵇ ± 3.9	64.2ᵃ ± 3.3
Protein	50.3ᵃ ± 3	62.8ᵇ ± 2.4	57.5ᵃᵇ ± 2.9
Lactose	74.1ᵃ±4.8	83.7ᵇ±3.1	81.2ᵃᵇ±5.7
Total solids	187.3ᵃ±2.2	217.6ᵇ±5.3	205.3ᵃᵇ±4.7
DMI / day /head (kg)	12.96 ± 1.2	12.00 ± 1.9	12.2 ± 0.9
Feed conversion (intake /yield):			
Kg DMI / kg FCM	1.28 ± 0.08	1.04 ± 0.03	1.10 ± 0.01
Kg TDN / kg FCM	0.790ᵃ ± 0.01	0.680ᵇ ± 0.01	0.700ᵃᵇ ± 0.02
Live body weight (Kg)			
Initial life body weight	450	430	441
Final live body weight	452	448	445
Body weight change (kg)	+ 2	+18	+4

Averages having different superscripts per each raw are different ($p<0.05$).

The authors suggested that the superiority of yeast over $NaHCO_3$ for improving milk production in this study may be due to that yeast culture have more than one role in counter balance the rumen media. First, the yeast has superiority in protecting the anaerobic rumen bacteria from damage throughout O2 utilization, second, yeast provides malic and other dicarboxylic acids which stimulates growth of some rumen bacteria (Newbold *et al.*, 1996), third, is to stimulate growth of lactic acid utilizing bacteria (Nisbet and Martin, 1991). .Meanwhile NaHCo3 have only to balance the acidity of rumen media (Biosolair *et al.*, 1986).

Effect of treatments on DMI and feed conversion

Due to the difference between the calculated and actual feeding, dry matter intake was obtained, the results in table 3 indicated that supplementation of daily ration with yeast culture (G2) or sodium bicarbonate (G3) failed to elevate DMI for cows during postpartum period. Erdman and Sharma, (1989)and Wohlt *et al.* (1998), came to corresponding results, they stated that each of Yeast culture and NaHCO3 had no effect on DMI in animals fed ration contained 40% maize silage . The above results obtained in this study indicated that although that addition of each of yeast culture or sodium bicarbonate to daily ration success to raise milk yield, they failed to raise DMI, Teh *et al.* (1987) published the similar findings, they stated that the effect of adding yeast to daily rations with or without addition $NaHCo_3$ on lactating goats increased milk production without an increase in DM intake. Results in table (3) shows that cows supplemented with 15 gm of yeast culture added to their daily diet of FBRS (G2) had significant ($P<0.05$) lower TDN/ Kg FCM and DCP/ Kg FCM than cows in G1. Feed efficiency in G2 was about 86.0% of the conversion efficiency of G1, measured as TDN/Kg FCM and about 90.0% when measured as DCP/Kg FCM. Addition of NaHCO3 to daily diet of FBRS (G3) gave a similar trend, but the treatment failed to give a significant difference compared with group1. These were nearly similar to that obtained by Drennan and Moloney (1993), on the other hand Erdman and Sharma,(1989) found that feed conversion efficiency, represents as FCM/DMI did not differ by adding each of yeast culture or sodium bicarbonate to daily diet based corn silage.

Effect of treatments on live body weight change

Table (3) indicates a positive superiority in live body weight change(18.0 Kg.) during only 12 weeks postpartum for cows receiving yeast culture in their daily diet of FBRS (G2) compared with cows that received either $NaHCo_3$ (G3) or did not receive any supplementation (control). This result is in harmony with what reported by Marther *et al.* (1960) which indicated that nutritional regeim is a primary factor influencing weight change, mean while Erdman and Sharma, (1989) observed that live body weight was not affected by each of yeast culture or $NoHCo_3$ supplementation to total mixed ration consisting of 40% corn silage in cows of similar producing ability, Broster *et al.*(1989) indicated that Friesian cows fed high digestible energy diet after calving had a smaller live body weight loss in early lactation. Figure (1) shows an opposite trend for each of weekly live body weight and milk production (Kg), it was observed that the addition of each yeast or $NaHCO_3$ to cow daily diet of FBRS push the peak of production slightly towards week 6 compared with cows which did not receive any buffer (G1).Cows in both G1 and G3 reached their peak earlier at about fifth week. This means that treatments improved milk persistency in G2. It was observed also in figure 1 that the difference between maximum milk yield and minimum live body weight (Kg) was greater in G2 compared to each of G1 and G3,this may be due to that yeast culture have ability to transfer a greater proportion of dietary energy into milk production (Harrison *et al*, 1989).

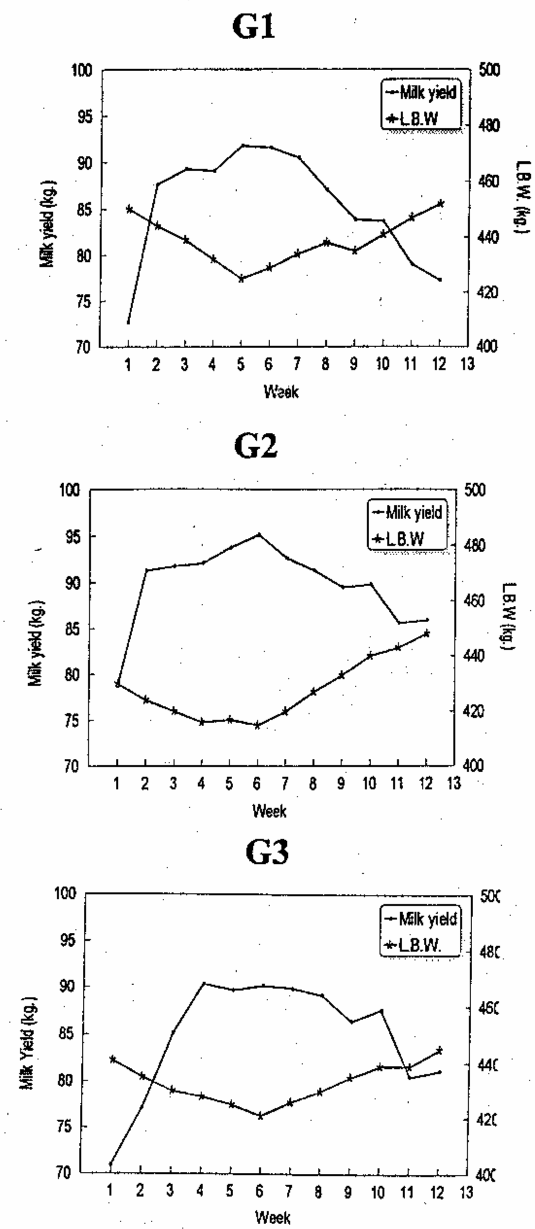

Figure 1: Relation between weekly milk yield an body weight change (kg)

It could be concluded from the results obtained in this study that yeast culture has a pronounced beneficial effect than sodium bicarbonate as an additives to daily ration based fodder beet root silage this may be attributed to the pronounced improvement in each rumen media or metabolic blood profile in friesian cows (El-Gaafarawy, *et al.* 2000).

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