Egyptian J. Nutrition and Feeds (2008) 11 (1):159-170
ISSN 1110 - 6360

EFFECT OF USING NATURAL FEED ADDITIVES ON FEED UTILIZATION AND GROWTH PERFORMANCE OF GROWING FRIESIAN MALE CALVES

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(Received, 2/10/2007, accepted 28/2/2008)

SUMMARY

Twenty four growing Friesian male calves weighing 155 Kg ± 2.5Kg were used in a 288 days feeding trial. Animals were divided randomly into four equal groups (6 calves each) G1, G2, G3, and G4 to study the effect of different yeast cultures supplementation on animal performance, nutrient digestibility, some blood parameters and feed efficiency. Experimental calves were individually fed on rations consisted of concentrate feed mixture, berseem hay and rice straw with or without feed additives. The first group (G1) was fed on the control ration without additives, while, the others groups G2 ,G3 and G4 received the control ration plus 10 g/h/d of Bakery yeast (BY), Dina Ferm (DF) and More yeast (MY) ,respectively. The main results showed that BY, DF, and MY supplementation of the calves rations did not show any affect on nutrients digestibility of DM, OM, CF, and EE. On the other hand, supplementing rations with DF and MY significantly (P<0.01) increased CP digestibility (70.24 % and 70.40 %, respectively) as compared with the control ration (64.00 %).Whereas, NFE digestibility tended to be significantly (P<0.01) increased with BY supplemented ration (76.76 %) compared to the control ration (69.68 %). No significant differences were detected among rations supplemented with BY, DF and MY for both values of CP and NFE digestibilities. TDN values ranged between 62.35 and 67.92 %, the lowest value was recorded with control ration, while the highest value was recorded with BY supplemented ration. There were no significant differences among experimental rations. The DCP values significantly (P<0.01) increased with BY , DF and MY supplemented rations compared with the control ration .Supplementing BY, DF and MY in calve rations showed significantly (P<0.01) lower ruminal pH and ammonia nitrogen at 0, 3 and 6 hrs. compared to control group .TVFA' s concentration at 6 hrs post feeding were significantly (P <0.0 1) decreased in control group compared with groups supplemented with BY, DF and MY. Blood serum of total protein, albumin, ALT and AST significantly (P <0.0 1) increased as a result of consumption of BY, DF and MY supplemented rations compared to control ration. Daily gain (Kg / h) was significantly (P <0.01) increased for supplemented groups compared with the control group. The increasing rates were 12.44, 8.76 and 1.29 % for groups fed BY, DF and MY supplementation, respectively. Moreover, feed conversion as Kg DM , TDN and DCP intake per Kg gain for groups fed supplemented rations with BY , DF and MY had the best values compared to those fed the control ration. Economic efficiency % was higher and feed cost per Kg gain was de reased with supplemented rations compared with the control rations. Generally, adding yeast culture in growing male calve rations is recommended to improve nutrient digestibility, rumen activity, feed conversion and economic efficiency.

Keywords: *Friesian calves, feed additives, digestibility, performance, economic efficiency*

INTRODUCTION

Recently, active live yeast has been successfully examined as satisfactory alternative to antibiotics feed additives due to its antagonistic effect against harmful pathogenic bacteria (Line, *et al* 1998).

Modern animal production requires the use of safe and effective feed additives as rumen manipulators to increase animal productivity . Lateky, the use of antibiotics and growth promoters in animal production has been strongly discouraged in most nations. One of the potential alternatives for antibiotics are microbes which improve the establishment of beneficial gut microflora and reduce the risk of acidosis; increase milk production and weight gain as well as the stimulating cellulolytic and lactate utilizing bacteria; increase fiber digestion and increase flow of microbial protein from rumen (Yoon and Stern, 1995,Ibrahim *et al., 2002*, Mwenya *et al.*, 2005, and Ibrahim *et al.*, 2006).Yeasts are know as rich sources of vitamins , enzymes , nutrients and other important cofactors which make them attractive as a basic nutrient source (vitamins , enzymes and other(EL-Ashry *et al.*, 2001).Yeast cells maintain their metabolic activities under anaerobic conditions and exposure to low pH (Dawson, 1992) so, the objective of this study was to evaluate the effect of different types of yeast supplements in the rations of growing Friesian male calves on feed utilization and growth performance .

MATERIALAS AND METHODS

The present study was carried out at Sakha Animal Production Research Station, Animal Production Research Institute, Agriculture Research Center, Egypt.

Twenty-four growing Friesian male calves with an average body weight of 155±2.50 kg were randomly divided into four similar groups (six for each group) according to live body weight and age. Animals were individually fed the experimental rations to cover the requirements for TDN and protein for growing calves according to NRC (1984) and feed allowance was adjusted biweekly according to their body weight changes. Calves were weighted in the morning before drinking and feeding (fasting 16 hours) at the beginning of the trial and biweekly for each animal till the end of the experimental feeding lasting for an experimental period of 288 days. The concentrate feed mixture (CFM) was offered two times daily at 8a.m and 4 p.m., berseem hay (BH)once daily at 11 a.m ,rice straw (RS) offered *ad-lib*. Fresh water was offered to animals three times daily. The chemical composition of the ingredients and the experimental rations with or without additives are illustrated in Table (1).

Feed consumption and feed conversion were calculated. The first group was assigned as control ration (G1) without additive , while the other three groups received control ration plus l0g /h / d of Bakery yeast , BY of *Saccharomyces cerevisiae* 5×10^9 organisme/gm (G2), 10 g/h/d of Dina

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

Item	DM%	Nutrients % of DM					
		OM	CP	EE	CF	NFE	ASH
Ingredients :							
*CFM	88.11	91.84	16.30	3.17	9.97	62.58	8.16
B H	90.25	88.12	13.16	2.38	29.01	43.57	11.88
RC	91.90	80.92	3.32	1.41	35.74	40.45	19.08
Experimental rations :							
G1	89.56	88.25	12.41	2.56	20.26	53.02	11.75
G2	89.36	88.76	12.86	2.67	19.14	54.09	11.24
G3	89.44	88.47	12.52	2.59	19.77	53.59	11.53
G4	89.30	89.00	13.05	2.73	18.79	54.43	11.00

* Concentrate feed mixture consists of 37 % yellow corn ,30% undecortecated cotton seed, 20% wheat barn ,6.5% rice barn ,3% molasses ,2.5% limestone and 1% common salt.

Table (2): Digestion coefficients and nutritive values of experimental rations (On DM basis)

Item	Control	Baker Yeast	Dina Ferm	More Yeast
	G1	G2	G3	G4
Digestibility coefficients%:				
DM	66.31	71.93	70.87	69.59
OM	67.79	73.78	71.55	71.33
CP	64.00^{b}	67.66^{ab}	70.24^{a}	70.40^{a}
EE	76.34	73.81	77.01	78.57
CF	64.49	69.32	66.06	66.15
NFE	69.68^{b}	76.76^{a}	73.79^{ab}	72.87^{ab}
Nutritive values (%):				
TDN	62.35	67.92	65.88	66.11
DCP	7.94^{c}	8.70^{b}	8.70^{b}	9.19^{a}

a, b and, c: means with different superscripts in the same row are significant different ($p<0.01$).

Farm, DF of *Saccharomyces cerevisiae* 1×10^8 cfu /g , 35% CP, 5%EE, 10%CF,10% moisture, 27.500 units protease, 27.500 units lipase, 2.250 units amylase (G_3) and 1 0 g /h /d of More yeast , MY of *Saccharomyces cerevisiae* 14.8×10^6 cfu/g (G_4) .

At the end of the experimental period (288 days), four digestibility trials were conducted with three Friesian calves, chosen randomly from each group to determine nutrients digestibility coefficients and nutritive values of experimental rations. Acid insoluble ash (AIA) was used as internal marker (Van Keulen and Young 1977). Chemical analyses of samples of CFM, BH, RS and feces were carried out to determine DM, CP, CF, EE and ash according to the methods of A.O.A.C (1995). At the last day of the collection period rumen liquor samples were with draw using stomach tube at 0, 3, and 6hrs. post morning feeding. The samples of rumen liquor were filtered through four layers of cheese cloth and immediately tested for pH values using digital pH meter, ammonia-N concentrations according to Conway (1958) and Total volatile fatty acids (TVFA's) according to Warner (1964). Blood samples were collected from jugular vein and blood serum was separated by centrifugation at 4000 rpm for 20 minutes .Blood serum was tested for total protein, albumin, ALT and AST concentration using commercial Kits.

The data were statistically analyzed using a general linear model procedure (GLM) according to SAS (1995). Duncan multiple rang test Duncan, 1955 was used to determine the significantly differences among treatments.

RESULTS AND DISCUSSION

Nutrients digestibility and Nutritive values:

Data in Table (2) indicate that BY, DF and MY supplementation of calf's rations in the G2, G3 and G4 groups, respectively did not show any effect on digestibility of DM, OM, EE and CF%. These results are agreement with those reported by Harrison *et al.*, (1988) and Angeles *et al* ., (1999).They noticed that adding yeast culture to animal diets did not affect apparent digestibility of DM and fiber .On the other hand , the CP and NFE digestibility tended to increase for animals fed supplemented rations in group G2,G3 and G4 compared with those fed control ration without supplement (G1).These findings could reflect that microbial supplements stimulated the growth and activity of certain ruminal microorganisms (Yoon and Stem, 1996). Supplementing rations with DF and MY showed significantly ($P<0.01$) increased CP digestibility (70.24 % and 70.40 %, respectively) as compared to control ration (64.00 %). NFE digestibly tended to increase significantly ($P< 0.01$) with the BY supplemented ration (76.76 %) compared to the control ration (69.68 %).No significant differences found among BY, DF and MY supplemented rations for both CP and NFE digestibilities .

The nutritive value as TDN % and DCP % in Table (2) showed that TDN

% ranged between 62.35 and 67.92 % ,the lowest value was recorded for G1 (control ration) while , G2, G3, and G4 rations had the higher values. The improvement rates were 8.93, 5.66 and 6.03 % for G2, G3 and G4, respectively compared with G1, control.

The differences were not significant among treatments. These results are in agreement with (Angeles *et al.*, 1999 , Ibrahim *et al.*, 2006).

The DCP values in Table (2) were significantly (P<0.01) increased for supplementation with BY, DE and MY compared to control ration. The lowest value was found in (G1, control) and the highest value in (G4, My). The improvement rates were 9.57 %, 9.57 % and 15.74 % for G2, G3 and G4, respectively compared with G1. Wohlt, *et al.* (1998) found that CP digestibility tended to be improved by cows fed a diet supplemented with yeast culture as also found by EL- waziry *et al.* (2000). On the other hand, Ibarhim *et al.* (2006) found that the yeast culture additive into lamb ration had no significant effect on the nutritive values estimated as TDN and DCP.

Ruminal fermentation:

Ruminal pH, ammonia nitrogen (NH_3-N) and total volatile fatty acids (VFA's) concentration in rumen fluid is presented in Table (3). There are significant difference (P<0.01) between animals fed supplemented rations and control ration in pH values at zero, 3, and 6 hrs. post feeding. Ruminal pH values at 0, 3 and 6 hrs. were significantly (P<0.01) higher in animals fed control ration (G_1) than those fed the supplemented rations with BY, DE and MY. Similar results were obtained by Khattab *et al.* (2003) who found that addition of Yea- Sacc and Lacto- Sacc to lamb rations led to lower ruminal pH at different times after feeding compared with the control ration. However, data of Sohn and Song (1996) and Sharma *et al.* (1998) were in disagreement with these results. They found a significant increase in ruminal pH with yeast supplemented rations. Putman *et al.* (1997) found that the yeast culture additive had no effect on ruminal pH. Ammonia- N-concentration was significantly (P<0.01) higher for animals fed the control ration (G1) compared to those fed supplemented rations at all different collection times. Increasing ammonia nitrogen concentration in the rumen may be attributed to reduction of ammonia nitrogen absorption by rumen epithelium or less is used for microbial synthesis in the rumen.This finding is in accordance with that reported by Vanecta – Koul *et al.* (1998), Fayed (2001) and Ibrahiem *et al.* (2006). Total Volatile fatty acid values at zero time with animal fed MY (G4) was significantly (P<0.01) higher than those fed DF ration (G3) and insignificantly increase with those fed BY ration G2 and control ration G1. At 3 times, after feeding there are no significantly differences between control and other supplemented rations. TVFA's values at 6 hrs. after feeding were significantly (P<0.01) lower for control than those fed DF and MY supplemented rations. Allam *et al.* (1984) founds that TVFA's concentration in rumen is affected by several factors such as DM digestibility, rate of absorption, rumen pH, transportation of the digesta from the rumen to the lower part of the digestive

Table (3): Effect of experimental rations and sampling times on rumen parameters

Item	Sampling times (hrs.)	G1	G2 (BY)	G3 (DF)	G4 (MY)
Rumen pH value	0	6.35^{a}	5.92^{b}	5.99^{b}	5.98^{b}
	3	6.27^{a}	5.94^{b}	6.00^{b}	5.97^{b}
	6	6.22^{a}	5.87^{b}	5.96^{b}	5.91^{b}
Ammonia nitrogen (mg/100ml)	0	21.58^{a}	17.69^{b}	17.57^{b}	18.70^{b}
	3	23.48^{a}	20.48^{c}	20.64^{cb}	21.72^{b}
	6	25.42^{a}	21.91^{b}	21.93^{b}	23.14^{b}
TVFA's(meq/100ml)	0	11.53^{ab}	11.58^{ab}	11.09^{b}	12.24^{a}
	3	13.85	14.04	14.42	14.35
	6	13.50^{c}	14.14^{cb}	14.87^{a}	14.57^{ab}

a, b and, c: means with different superscripts in the same row are significant ($p<0.01$).

Table (4): Some blood constituents of Friesian calves fed the experimental rations

Items	G1	G2	G3	G4
Total protein (g /dl)	7.62^{b}	8.81^{a}	8.31^{a}	8.96^{a}
Albumin (g /dl)	4.36^{c}	4.90^{a}	6.65^{b}	4.99^{a}
Globulin (g /dl)	3.09^{c}	3.64^{a}	3.22^{b}	3.70^{a}
Albumin / Globulin	1.41^{a}	1.35^{b}	1.44^{a}	1.35^{b}
ALT (U / L)	40.28^{d}	47.48^{ab}	46.0^{c}	48.32^{a}
AST (U / L)	24.77^{b}	26.51^{a}	25.74^{ab}	26.98^{a}

a,b, c, d: means with different superscripts in the same row are significant ($p<0.01$).

tract and the microbial population in the rumen and their activities.

Blood parameters:

Data in Table (4) indicate that (By, DF, My) supplemented groups had a significantly ($P<0.01$) higher concentration of total protein, albumin, globulin, ALT and AST than the control group. This indicates that By, DF and MY supplementation of Friesian calves rations had affect in protein synthesis in liver function. These obtained results are in line with those reported by Adel Khalek *et al.* (2000) and El-Ashry *et al.* (2001). The first authors found that albumin concentration was significantly ($p < 0.05$) higher by about 6.5% in calves fed diets supplemented with Lacto-Sacc than those fed control diet. However, Fayed (2001) and Ibrahim *et al.* (2006) found that the serum total protein and albumin did not differ significantly with Yea- Sacc group than compared to the control group for sheep rations.

Growth performance:

Results in Table (5) shows that the DM feed intake (Kg/h/d) was highest for calves fed control ration (G1) without supplement. The lowest DM intake (Kg/h/d) was recorded with calves fed rations with BY, DF and MY supplementation in G2, G3 and G4. TDN and DCP (Kg/h/d) were nearly similar in all groups. But TDN and DCP values in control ration (G1) were slightly higher compared with other supplemented groups. Similar result was found by Fayed (2001) and Ibrahim *et al.* (2006) on sheep they found that the TDN intake in the supplemented group was not higher than that in control. El-Ashry *et al.* (2003) found that TDN and DCP intake (g/Kg BW) were not significant different with lambs fed yeast supplementation compared with the control lambs. The results in Table (5) revealed that the addition of different kind of yeast culture significantly ($P<0.01$) increased daily gain of Friesian calves compared with the control. The increasing rates of gain were 12.44, 8.76 and 11.29 % for animals fed supplemented rations with BY, DF and MY, respectively. The present results are in agreement with Khattab *et al.* (1997), El-Ashry *et al.* (2001), Khalifa *et al.* (2001) reported that yeast culture supplementation with bakery yeast increased average daily gain and the improvement in daily gain may be due to its effect on microbial efficiency and organic matter digestibility.

Feed Efficiency and economic efficiency:

Data in Table (6) shows that there were significant differences ($P <0.01$) between animals fed supplemented ration and those fed control ration without supplement in feed efficiency calculated as gain related to intake of DM, TDN and DCP. Calves fed control ration (G1) obtained the least feed efficiency compared with those fed supplemented rations in G2, G3 and G4. The most efficient one was group G2 which was fed the local beaker's yeast ration. The highest economic efficiency was recorded for calves in G2, G3 and G4 fed supplemented rations compared with those in G1 fed control ration. There are no significant differences between G1 and G3. These results are in agreement with those obtained by Khalifa *et al.* (2001), Ibrahim *et al.* (2002) and (2006). The economic

Table (5): Growth performance of growing Friesian male calves fed the experimental rations.

Item	G1	G2	G3	G4
No of Animals	6	6	6	6
Duration days	288	288	288	288
Initial body weight (Kg)	155	157.5	154.20	157.50
Final body weight (Kg)	405	434.20	425.83	435.83
Total gain (Kg)	250^{b}	276.70^{a}	271.63^{a}	278.33^{a}
Daily gain (Kg / h)	0.868^{b}	0.976^{a}	0.944^{a}	0.966^{a}
Daily DM intake (Kg/h):				
CFM	7.5	7.00	7.25	7.00
Berseen hay	2.5	2.25	2.25	2.25
Rice straw	3.5	2.50	3.00	2.25
Av. Total intake (Kg/ h/ d) :				
DM	12.09	10.50	11.18	10.27
TDN	7.54	7.13	7.37	6.79
DCP	0.960	0.914	0.973	0.944
Feed conversion :				
Kg DM/kg gain	13.93^{a}	10.93^{b}	11.86^{ab}	10.63^{b}
Kg TDN/kg gain	8.69	7.42	7.82	7.03
Kg DCP/kg gain	1.106^{a}	0.951^{b}	1.032^{ab}	0.977^{b}

a, b: means with different superscripts in the same row are significant different ($p<0.01$).

Table (6): Feed efficiency and economic efficiency of calves fed different experimental ration

Item	G1	G2	G3	G4
Feed efficiency:				
Kg gain/Kg DM	0.072^{b}	0.092^{a}	0.084^{a}	0.094^{a}
Kg gain/Kg TDN	0.115^{b}	0.135^{a}	0.128^{ab}	0.142^{a}
Kg gain/Kg DCP	0.904^{b}	1.051^{a}	0.969^{ab}	1.023^{a}
Economic evaluation				
Av. Daily gain Kg	0.868	0.961	0.943	0.966
Daily feed cost(L.E)	9.249	8.54	8.838	8.522
Price of daily gain(L.E.)	10.416	11.532	11.316	11.592
Economic efficiency* %	112.62^{b}	135.04^{a}	128.04^{ab}	136.02^{a}

a, b: means with different superscripts in the same row are significant ($p<0.01$).
* Economic efficiency % = Price of daily gain / price of daily cost × 100

efficiency of the supplemented rations with different kind of yeast culture (BY, DF and MY) showed superiority over control ration and the lowest feed cost was obtained on the supplemented groups.

From the experiment, yeast cultures as feed additive may have a significant effect on performance of growing Friesian calves such effect was enhanced through improving feed utilization by altering the ruminal fermentative activity. It was proved that, nutrients digestibility especially crude protein and feeding values expressed as TDN and DCP in treated calves were greater than that of the control group. Therefore, it can be concluded that the different sources of yeast culture were economically profitable for attaining higher daily weight gain of growing calves and reducing cost of production.

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تأثير استخدام الاضافات الطبيعية على الاستفادة من الغذاء و الاداء الانتاجى لعجول الفريزيان النامية

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معهد بحوث الانتاج الحيوانى-الدقى- الجيزة

استخدم فى هذه الدراسة اربعة وعشرون عجل فريزيان نامى متوسط وزنها 155 كيلو جرام ± 2.5 كيلو جرام لمدة 288 يوم لدراسة تأثير اضافة انواع مختلفة من الخمائر على معاملات الهضم ومعدل النمو ومعدل اداء الكرش وبعض خصائص الدم لعجول الفريزيان النامية .قسمت هذه الحيوانات عشوائيا الى اربع مجموعات بحيث تحتوى كل مجموعة على 6 حيوانات .

وغذيت جميع الحيوانات منفردة على العلف المركز ودريس البرسيم وقش الارز حسب مقررات NRC of (Beef Cattle, 1984) . ولقد غذيت المجموعة الاولى على عليقة الكنترول بدون اضافة (G1) بينما غذيت المجموعات الاخرى كما يلى : G2 (عليقة الكونترول) مضاف اليها 10جرام /للرأس /يوم خميرة الخباز المحلية (BY) و G3 (عليقة الكونترول) مضاف اليها 10جرام /للرأس /يوم دينا فيرم (DF) و G4 (عليقة الكونترول) مضاف اليها 10جرام /للرأس /يوم موريمست (MY) على التوالى .واوضحت النتائج ما يلى :

أن جميع العلائق التى تحتوى على الاضافات الطبيعية (الخمائر) ادت الى تحسين معدلات الهضم ولكن بصورة غير معنوية فى معاملات هضم المادة الجافة والعضوية والالياف الخام والدهن الخام بينما ارتفعت معاملات هضم البروتين معنويا عند مستوى 1% فى العلائق المحتوية على DF (G3) و المحتوية على MY (G4) بينما ارتفعت معاملات هضم الكربوهيدرات الذائبة معنويا عند مستوى 1% مع العليقة المحتوية على BY (G2) فقط عند المقارنة مع عليقة الكنترول (بدون اضافة).

كما تحسنت القيمة الغذائية فى صورة مجموع مركبات كلية مهضومة وبروتين مهضوم فى العلائق المحتوية على BY و DF و MY وكانت الاختلافات معنوية عند مستوى 1% مع البروتين المهضوم بمقارنتها بعليقة الكونترول . وكان مقدار التحسن 8.93 و 5.66 و 6.03 % لمجموع المركبات الكلية المهضومة و 9.57 و 9.57 و 15.74 % للبروتين المهضوم للمجموعات التي تغذت على (BY و DF و MY) فى المجموعات G2 و G3 و G4 على التوالى.

كما انخفضت قيم ال pH وتركيز نتروجين الامونيا فى العلائق المحتوية على الاضافات الغذائية فى جميع الاوقات (صفر – 3 - 6 ساعات من التغذية) معنويا عند مستوى 1% مقارنة بمجموعة الكونترول .بينما ارتفع تركيز الاحماض الكلية الطيارة فى العلائق المحتوية على الاضافات الغذائية معنويا عند مستوى 1% عند الوقت 6 ساعات من التغذية . وكان معدل الزيادة اليومية أعلى معنويا عند 1% فى المجموعات المغذاة على العلائق المحتوية على الاضافات الغذائية وكانت معدلات الزيادة 12.44 و 8.76 و 11.29 % فى G2 و G3 و G4على التوالى مقارنة بمجموعة الكونترول . وكذلك تحسنت الكفاءة التحويلية للغذاء اكل من المادة الجافة والبروتين المهضوم ومجموع المركبات الغذائية الكلية المهضومة للمجموعات المغذاة على العلائق المحتوية على الاضافات الغذائية وكانت الفروق معنوية عند 1% فى الكفاءة التحويلية للغذاء اكل من المادة الجافة والبروتين المهضوم وانخفضت تكاليف الغذاء وارتفعت الكفاءة الاقتصادية مقارنة بالمجموعات المغذاة على عليقة الكونترول .

ومن النتائج المتحصل عليها يوصى باستخدام الاضافات الطبيعية (الخمائر) فى علائق العجول الفريزيان النامية حيث حسنت معدلات الهضم وتخمرات الكرش والكفاءة التحويلية للغذاء وادت الى رفع معدلات النمو اليومية و قللت تكلفة الغذاء ورفعت الكفاءة الاقتصادية مقارنة بمجموعة الكونترول (بدون اضافة).