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Effect of Using Biological Additives on Performance of Animal
(1) Effect of Probiotic Bacteria or Enzymes Supplementation on Productive Performance of Fatting Frisain Steers

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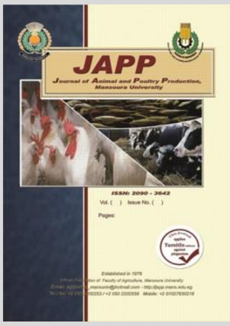

ABSTRACT

Eighteen male crossbred Friesian steers aged 15 months with (ILBW) of 286.91±6.01 kg were collected and divided into three similar groups (six in each). The objective was to study performance of steers using probiotic bacteria or allzyme in ration. Trail lasted about 150d. Each animal was fed individually a basal ration 65% CFM+25% CS+10% alfalfa hay on DM basis (T1,control) or 5g probiotic bacteria/h/d (T2) or 4g allzyme h/d (T3). Animals fed ration supplemented with probiotic bacteria (T2) appeared the highest significant (P<0.05) in DM, OM, CP, CF and EE digestibility. The nutritive values as TDN and DCP were (P<0.05) higher in (T2) and (T3) than control (T1). While Ruminal pH records at 0 and 3 hrs decreased significantly (P<0.05) with (T2) and (T3) compared to (T1). Also, the concentration of NH3-N decreased. However, TVFA's concentration in rumen liquor at 0 and 3 hrs with (T2) and (T3) were higher than (T1). Probiotic bacteria or allzyme led to significant increase (P<0.05) in total protein and globulin with decreasing albumin. The DMI tended to increase with T2 and T3. Whereas, the intake of TDN and DCP increased significantly (P<0.05) in (T2 and T3) than (T1). Feed supplementations showed significant (P<0.05) enhancement in feed conversion. Economic efficiency was high for T2 and T3 compared to T1. It could be summarized that adding probiotic bacteria and allzyme to fattening steers rations led to improve digestibility coefficient, rumen fermentation activity, blood parameters and feed intake, tended to increase DWG, feed efficiency and economic efficiency.

Keywords: Probiotic bacteria, enzymes, crossbred steers, digestion, growth performance, economic efficiency.

INTRODUCTION

The rapidly increase demand for livestock product (dairy products, meat, eggs and aquaculture), largely driven by the massive increase in population, income growth and cultural growth (Thornton, 2010). Probiotics bacteria have been shown to improve the rumen environmental, enhance the quantity (DMI), feed efficiency (FE) and average weight gain (AWG) in ruminants (Elghandour *et al*., 2015). It may be also decrease the activity of undesirable microorganisms, enhancing immunity through bacteterioncin secretion and maintain the situation of microbial system in the digestive canal (Khan *et al*., 2016). Probiotics can reduce the demand of using antibiotics (Callaway *et al*., 2004) found that using probiotic led to raise the average live weight gain in animals by improving the digestibility of feed nutrient, enhancing retention of nitrogen and reducing the losses of basic nutrients. Moreover De Ondarza *et al*. (2010) found that fourteen variable studies on supplemented tested cows with live yeast in ration increase efficiency of feed conversion by 3% (i.e., 1.75 vs. 1.70 for animals fed supplemented feed and group without supplementation, respectively). This improvement in nutritional efficiency is due to the better use of the existing nutrients compounds in diet (Khalid *et al*., 2011). This same found by Robinson (2002) who observed that FCR was improved in the small ruminants with probiotics supplementation. Moreover, Saleem *et al*. (2017) found improvement in the (BW) before slaughtering (+3.16 kg), (ADG) (+25.2 g/lamb), (TG) (+2.11 kg), and FCR (−1.18) of lambs taken feed including Pediococcus *acidilactici* and *Pediococcus pentosaceus* probiotics additives than the no supplemented group during post weaning period. Hillal *et al*. (2011) obtained additional in average daily weight gain by 7.2% when, supplementing growing lambs with diet including bacterial probiotic and yeast (i.e., *S. cerevisiae*, *Lactobacillus*, *Streptococcus*, *Aspergillus*), Similarly, buffalo rearing buffalo calves fed rations with *L. acidophilus* recorded an increase by 31.4% in the average daily weight gain at the 1st month, Mudgal and Baghel (2010). The ruminant nutritionists have started maximizing the efficiency of degradation of feed through gave high attention on modify the rumen carbohydrate and protein metabolism. Cellulases, xylanases, β-glucanases, pectinases, amylases, proteases, phytases and enzymes that analyze toxic substances found in feed like tannins, arise according to the different microbial groups growing in rumen (Kumar *et al*., 2018). Improving the digestibility and quality of fibrous forage by using fibrolytic enzymes (FE) it depends on the ability of these additives to have practical effect on the digestive system. Regarding to that, (Beauchemin *et al*., 2003) explained that bonds ß1-4 linkages that bind cellulose and xylan sugar molecules in the plant tissues are broken by two types of specialized enzymatic groups cellulases and xylanases. Many searches with EFE mention that one of the most effective methods to improve the performance of animal is increase of microbial activities in the rumen. Although there is a relationship between forage degradation and the efficiency of production the relation between enzymatic activity and utilization of forage not been clarified in the rumen system (Eun *et al*., 2007). Moreover, results obtained from research based on using EFE in ruminant digestive systems are different and some are not match (Beauchemin *et al*., 2003; Colombatto *et al*., 2003), lead to difficulty in estimating

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metrics their biological response. Some studies have shown substantial enhancement of feed digestibility and animal performance traits (Cruywagen and Goosen, 2004; Bala *et al*., 2009; Arriola *et al*., 2011), while others recorded negative effects or there are no effect at all (Baloyi, 2008).

The purpose of this experimental was to study the effect of probiotic bacteria and enzymes as feed supplementations on feed intake, digestibility of feed nutrients, activity of rumen fermentation, some blood measurements, body weight gain, feed conversion and economic efficiency of growing and fatting crossbred Friesian steers.

MATERIALS AND METHODS

This work was carried out at Al-Manar Company for feed, Sharkya Government during year 2017.

Experimental animals and rations:

Eighteen male crossbred Friesian steers 15 months old with initial body weight of 286.91±6.01 kg were randomly selected and divided into 3 similar groups (each group included 6 steers). Animals were individually fed a basal ration which contain 65% concentrate feed mixture + 25% corn silage and 10% alfalfa hay on DM basis without supplementation (control) or supplemented with 5 g probiotic bacteria /h/d (T2) or 4 g allzyme per head per day (T3).The commercial probiotic used in this study (Protexin Aquatech, Probiotics International, Somerset, UK) contained spores of two species of Bacillus (*B.subtilis and B. licheniformis*). Probiotic bacteria (enhancer) was *Bacillus subtilis* 3 x 10^8 CFU/g and *Bacillus licheniformis* 1 x 10^9 CFU/g. Allzyme® SSF was solid state fermentation (SSF) multi-enzymatic solution is derived from a select strain of (non-GMO) *Aspergillus niger*, which adds flexibility to the diet by targeting different substrates while enhancing nutrient utilization (AlltechInc Company, USA). Allzyme contains Phytase 300 SPU/g, Protease 700 HUT/g, Cellulase 40 CMCU/g, Xylanase 100 XU/g, Beta Glucanase 200 BGU/g, Amylase 30 FAU/g and Pectinase 4000 AJDU/g.

Management:

Experimental steers were weighed before take water and feeding in the morning for consecutive two days at the starting of the experimental and biweekly thereafter. Animals were individually fed to find their requirements according to the NRC (2000) recommendations allowances for growing steers. Rations were calculated to body weight changes every two weeks. Concentrate feed mixture was given twice daily at 8 a.m. and 4 p.m., while both corn silage and alfalfa hay were given once time daily at 10 a.m. and 2 p.m., respectively. Probiotic bacteria and allzyme were orally added to steers daily before feeding. Steers were offered water to drink three times a day at 7 a.m., and 1p.m. and 7 p.m. Chemical composition of tested ingredients and basal ration are shown in Table (1).

Table 1. Chemical composition of the ingredients and calculated the composition of basal ration (on DM basis).

Items	Chemical composition %						
	DM	OM	CP	CF	EE	NFE	Ash
Proximate analysis							
Concentrate feed mixture (CFM)*	87.27	93.11	16.24	5.36	3.48	68.03	6.89
Corn silage (C.S)	27.18	94.11	8.03	24.67	2.79	58.62	5.89
Alfalfa hay	91.60	89.91	17.71	29.80	3.14	39.26	10.09
Basal ration	57.21	91.92	13.95	16.84	2.59	58.54	8.08

*** concentrate feed mixture consisted of 40% yellow corn, 25% wheat bran, 10% Glutofeed, 10% soybean meal, 7% molasses, 5% corn gluten, limestone and 1% salt**

Digestibility trials:

Three digestion experiments were performed during the feeding trial using three steers from each tested group to evaluate digestible of nutrients and nutritive values of the tested rations. Acid insoluble ash technique was used as a natural marker (Van Keulen and Young, 1997). Feces samples were collected from the rectum of each steer twice daily with 12 hours interval during the collection stage. Tested feedstuffs samples were collected at the beginning, middle and end of sampling stage. Representative samples of feedstuffs and feces were analyzed according to AOAC (2000). Nutrients digestibility coefficients were calculated from the equation stated by Schneider and Flat, (1975).

Rumen liquor samples:

Liquor samples were collected from steer's rumen by stomach tube before providing feed (zero time) and 3 hours after providing. Samples were filtered by using two layers of cheese cloth. Value of pH was measured directly in liquor collected from rumen using Orian 680 digital pH meter. The concentration of total VFA's was evaluated in rumen liquor samples by the steam distillation method (Warner, 1964) using markham micro-distillation unit. The precentage of NH3-N was measured according to the method of AOAC (2000).

Blood samples:

Samples of blood were drawn from the jugular vein of steers using sterile needle into clean dry heparin zed tubes. The samples were collected from blood centrifuged spent at 4000 r.p.m. for 15 minute. Blood serum was tested to determine total protein, albumin, creatinine, AST and ALT by calorimetrically by using commercial diagnostic kits (Test-combination, Pasteur lap.). Globulin concentration was determined by difference.

Feed conversion:

Feed conversion was calculated as the quantity of feed as DM, TDN and DCP consumed by kg / kg live body weight gain.

Economic efficiency:

Average feed cost per day, price of average weight gain per day, net income, and economic efficiency was calculated as a percentage of income to feeding cost. Economic efficiency explained as a percentage of net income to feeding cost accorded to 2020 market prices.

Statistical analysis:

Data were subjected to statistical analysis as one-way ANOVA, using general linear model procedure adapted by IBM SPSS STATISTICS (2014). Differences among means were tested according to Duncan (1955) whenever the differences were significant.

RESULTS AND DISCUSSION

Nutrients digestibility and feeding values:

Feeding values and nutrients digestibility as responded by probiotic bacteria and allzyme supplementation are shown in Table (2). Probiotic bacteria (T2) observed significantly (P<0.05) the highest digestibility of DM, OM and EE then allzyme (T3), while the control (T1) had the least values. At the same time, T2 and T3 supplementation helped to increase (P<0.05) significant the digestibility of CP and CF than T1 while, digestibility recorded higher values with T3 than T2. Nutritive value as TDN and DCP appeared significant (P<0.05) higher with T2 and T3 compared to T1 (control) as shown in Table (2). Probiotic bacteria and allzyme led to improving the degradability of protein, soluble and structure carbohydrates in rumen. Beauchemin *et al.*, (2003) found that fibrolytic enzymes supplemented to feed high in concentrate not showed significant differences resulted compared to enzyme supplemented to feed high in roughage. Rumen pH represented an essential factor in fiber degradation. Cattle are fed diets with high percentage of concentrate; ruminal pH is decrease to range between 5.8 to 6.2, which led to decrease fiber digestion in rumen because the normal cellulolytic organisms within the rumen need a pH of 6.5 or more for optimal multiplication and growth. Moreover, multiplication of these organisms may stop at pH under 6.0 (Zinn and Ware, 2003). It clarified that the supplementation of that may improve the digestive system for degradation of fiber fraction in the rations led to increase the performance of beef cattle. Qiao *et al*., (2009) reported that *B. licheniformis* enhanced digestibility for NDF, ADF and OM while *B. subtilis* had no clear effect on characteristics of rumen fermentation, duodenal microbial nitrogen flow and ruminal digestibility of nutrient. Fibrolytic enzymes have been used to increase the digestion of fiber in rations and other components found in animal feed (Pinos-Rodrı´guez*et al*., 2008). Cellulase and xylanase are generic terms for groups of specific enzyme activities, such that two products with identical labels for enzyme level may differ in effects on ruminal fiber digestion because commercial enzyme preparations were a complex of various enzymes (Adesogan, 2005). Generally, using probiotic bacteria or enzyme such as an allzyme compound as a supplementation of feed for growing Friesian steers appeared to significantly (P<0.05) increase in most of nutrient digestibilites. Moreover, the feeding values as TDN and DCP showed the same previous trend. The results were similar to those found by Zeid *et al*., (2008).

Table 2. Nutrients digestibility and feeding values by steers fed different treatment rations.

Items	Treatments (T1)	(T2)	(T3)	±SE
	Nutrients digestibility %:			
DM	61.87c	67.12a	65.15b	0.32
OM	64.77c	68.90a	66.37b	0.39
CP	61.30b	64.10a	63.61a	0.28
CF	64.71b	67.42a	66.94a	0.34
EE	77.81b	79.30a	77.89b	0.18
NFE	69.45b	70.60ab	71.23a	0.15
	Nutritive values %:			
TDN	64.64b	66.24a	66.38a	0.26
DCP	8.55b	8.94a	8.87a	0.05

a ,b, c: means in the same row with different superscripts are significantly (P<0.05) different.

Rumen fermentation activity:

Parameters rumen fermentation is showed in Table (3). Rumen pH one of the main critical measurements, that affect fermentation of microbial in the tract and influences its function. Ruminal pH recorded values at zero and 3 hrs showed significantly (P<0.05) lower with probiotic bacteria and allzyme additives in T2 and T3 compared to T1. The pH values are inverse relation with the concentration of total VFA. Cellulolytic bacteria don't grow at ruminal pH less than 6 (Zinn and Sallinas, 1999). Also, the concentration of ammonia-N in rumen liquor at zero and 3 hrs showed significantly decreased (P<0.05) with probiotic bacteria and allzyme additive compared control and was higher at 3 hrs than that of zero time. However, the concentration of TVFA's in rumen at zero and 3 hrs increased significantly (P<0.05) with added probiotic bacteria or allzyme than control. These results related to that probiotic bacteria and allzyme supplementation stimulates rumen microorganisms utilizing ammonia nitrogen and degraded soluble and structure carbohydrates producing volatile fatty acids. These results similar to Sun *et al.* (2012) who found that ruminal pH reduced by 2.7% to 3.0% (P < 0.01), whereas (NH_3-N) and TVFA's (P < 0.05) increased with *Bacillus subtilis natto* additive for dairy cows. Qiao *et al.* (2009) mentioned that adding *B. licheniformis* to the feed led raising microbial crude protein pass into duodenum (p<0.05) and reducing the NH_3-N concentration in ruminal fluid (p<0.05), but the total VFA concentration in ruminal fluid was reduced (p<0.05). Kondratovich *et al.* (2019) reported that ruminal pH average decreased (P = 0.01), but there a tendency (P = 0.06) toward improved total VFA was observed on enzyme-fed steers. Abd El-Galil (2006) and AbouElenin *et al*. (2016) found that higher NH3-N and TVFA's concentrations at 3 hrs after feeding

Table 3. Rumen fermentation activity of steers fed experimental rations.

Items	Treatments (T1)	(T2)	(T3)	±SE
	pH			
Zero	6.98a	6.74b	6.68b	0.14
3hrs	6.60a	6.37b	6.31b	0.11
	NH3-N(mg/100 ml)			
Zero	19.90[a]	17.75[b]	17.86[b]	0.18
3hrs	24.62[a]	21.40[b]	21.81[b]	0.36
	TVF's(meq/100ml)			
Zero	13.00[b]	15.63[a]	15.46[a]	0.15
3hrs	16.15[b]	19.25[a]	18.79[a]	0.16

a, b: means in the same row with different superscripts are significantly (P<0.05) differ.

Blood plasma biochemical:

Blood plasma biochemical for steers in the different treatment are shown in Table (4). Probiotic bacteria and allzyme additives revealed significant raise (P<0.05) in total protein and globulin concentrations in from 6.40 and 3.03 g/dl in T1 to 6.77 and 3.50 g/dl in T2 versus 6.80 and 3.48 g/dl in T3. Consequently, albumin to globulin ratio decreased significantly (P<0.05) in T2 and T3 compared to T1.Albumin to globulin ratio was 1.11, 0.93 and 0.95 for T1, T2 and T3, respectively. The obtained values were done in the normal range being 0.80 to 1.15 indicating good steers health. However, the supplementations did not affect the albumin, creatinine concentrations and liver enzymes activity of AST and ALT were not shown significantly changed by additives and wear nearly similar for the tested groups. These results are in agreement with those obtained by Mousa and Marwan (2019) who found that blood biochemical analysis in *Basillissubtilus* treated animals recorded an increase significantly (P≤0.05) in total globulin and protein in plasma of buffalo calves. Saleem *et al.* (2017) reported that there was significant increase in concentration of serum total protein (p<0.05) with probiotic additives compared to the control group. With the exception of serum total protein concentration, all blood metabolites were not significantly different between probiotic and control treatments of lambs. Mohamed and Gada (2014) showed the presence of significant differences in both total protein and globulin in two groups of dairy cows supplemented with enzymes, and insignificant difference in the activity of AST and ALT in the blood serum. Abou Elenin *et al.* (2016) obtained that blood total protein, albumin, globulin, AST, ALT and creatinine were significantly higher (p<0.05) for animals fed rations containing biological additives in comparison with control ration. On the other hand, Zeid *et al.*, (2008) showed significant (P<0.05) higher in total protein and globulin of blood serum of animal fed bacteria or enzyme supplementation. At same time, the author reported significant (P<0.05) decrease with creatinine, GOT and GPT concentration.

Table 4. Effect of experimental rations on some blood parameters

Items	Treatments			MSE
	(T1)	(T2)	(T3)	
Total protein (g/dl)	6.40[b]	6.77[a]	6.80[a]	0.35
Albumin (g/dl)	3.37	3.27	3.32	0.14
Globulin (g/dl)	3.03[b]	3.50[a]	3.48[a]	0.31
Albumin: globulin ratio	1.11[a]	0.93[b]	0.95[b]	0.11
Creatinine mg/100 ml	0.79	0.74	0.76	0.06
ALT	11.30	11.00	11.17	1.14
AST	16.13	15.40	15.60	1.56

a ,b: means the same row with different superscripts are significant (P<0.05) differ.

Feed intake:

Results of feed intake (Table 5) revealed that the intake of CFM, corn silage and alfalfa hay and also total DM intake tended to increase with probiotic bacteria and allzyme additives. Whereas, the TDN and DCP intake increased significantly (P<0.05) in supplemented animals (T2 and T3) compared to not supplemented animals (T1). Increases in TDN and DCP intake could be attributed to the play role of bacteria and allzyme additives in improving the TDN and DCP (Table 3). There was a small difference in daily DM feed intake when comparing control rations with other treated rations. However, the intake from TDN and DCP decreased in control group when compared with supplemented groups. Cruz *et al.* (2014) found positive effects of probiotics that decreased the antibiotics used by reducing the effect of pathogenic organismes and increasing dry matter intake of crossbred steers finished in a feedlot system. Moreover, Sujani and Seresinhe (2015) stated that using exogenous enzymes in ruminant diets had positive results on feed intake.

Table 5. Average daily matter intake of concentrate, corn silage, alfalfa hay by Friesian steers.

Items	Treatments			MSE
	(T1)	(T2)	(T3)	
Daily feed intake, (kg/h/d) as fed:				
Concentrate feed mixture (CFM)	7.18	7.44	7.42	
Corn silage (C.S)	9.19	9.51	9.49	
Alfalfa hay	1.09	1.13	1.13	
Total intake (kg/h/d) as DM:				
DM	9.990	10.340	10.310	0.08
TDN kg/day	6.458[b]	6.849[a]	6.844[a]	0.05
DCP kg/day	0.854[b]	0.924[a]	0.914[a]	0.01

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

Live body weight and weight gain:

DW gain and LBW of steers in the different treatment groups are shown in (Table 6). Initial LBW at the beginning of experiment was not shown significant different between tested groups. Whereas, end live body weight, weight gain and average daily gain were significantly (P<0.05) the highest with probiotic bacteria followed by allzyme additives while, the least is control. Average daily gain of steers in T2 and T3 improved significantly (P<0.05) by 17.12 and 14.41% compared with T1, respectively. The improvement in body weight gain of supplemented calves in T2 and T3 might be attributed to enhancing rumen fermentation activity (Table 3) and increase TDN and DCP intake (Table 5). These results are obtained in agreement with Balci *et al.* (2007) who obtained better average daily gains and total weight gains with adding fibrolytic enzyme to steer's feed. Vargas *et al.* (2013) reported that fibrolytic enzymes as supplementation led to enhance growth finished steers. Salem *et al.* (2011) found that enzyme addition led to increase live weight gain in sheep and goats. Cruz *et al.* (2014) recorded the beneficial impact of probiotics products as replacer feed supplementation to prophylactic use of antibiotics by reduce the effect of undesirable organism, generally promoting growth performance. Arowolo and He (2018) stated that using probiotic supplementation products have a positive effect on ruminant growth performance.

Table 6. Effect of feeding experimental rations on average body weight (kg) and daily gain (kg).

Items	Treatments			MSE
	(T1)	(T2)	(T3)	
Initial weight, kg	287.00	286.25	287.50	6.01
Final weight, kg	453.50[b]	480.75[a]	478.00[a]	6.51
Total weight gain, kg	166.50[b]	194.50[a]	190.50[a]	5.42
Average daily gain, (kg)	1.11[b]	1.30[a]	1.27[a]	0.14
ADG improvement %	00.00[b]	17.12[a]	14.41[a]	0.73

a ,b and c means in the same row with different superscripts differ are significant (P<0.05) differ.

Feed conversion:

Data of feed conversion (Table 7) clarified that feed conversion was improved significantly (P<0.05) by steers supplemented with probiotic bacteria and allzyme. The quantity amounts required per kg weight gain from DM, TDN and DCP were significantly (P<0.05) the highest for T1 compared to T2 and T3. It could be shown that the probiotic with ration T2 appeared to lower feed intake as DM, TDN and DCP kg per kg weight gain. So, feed conversion as feed intake/kg weight gain recorded significantly (P<0.05) lower by 13.15, 10.44 and 8.16% as DM, TDN and DCP per kg weight gain in T2, respectively. Versus decreasing percentages in feed intake as DM, TDN and DCP per kg weight gain with T3 were 10.86, 7.96 and 6.81%, respectively, with using allzyme and feed additives. The results obtained by Balci *et al.* (2007) shown agreement with better feed conversion rates with the supplementation of fibrolytic enzyme used in commercial steer's feed. Vargas *et al.* (2013) found that as enzyme level increased, feed conversion was linearly improved in finished steers. Beauchemin *et al.* (2003) found that adding fibrolytic enzymes to the animals finishing diets improved feed efficiency by 6 to 12%. Cruz *et al.* (2014) indicated that the positive effects of probiotics as feed supplementation may due to decrease the load of harmful bacteria, upgrading feed conversion efficiency and increase nutrient utilization efficiency. Arowolo and He (2018) stated that probiotic additives have a positive impact on feed utilization by ruminants.

Economic efficiency:

Effects of probiotic bacteria and allzyme supplementation on efficiency of economic of fattening Friesian crossbred steers are shown (Table 7). Daily feed expenses was significantly (P<0.05) the highest for T2 followed by T3 compared to T1 control steers. The increases in feed expenses for supplemented groups were attributed to the increase of feed intake (Table 5) as well as the cost of additives. However, feed cost per kg weight gain was significantly (P<0.05) the lowest for supplemented group T2 then T3 than steers fed ration without supplementation (T1), which attributed to the increase of average daily gain (Table 6). Price of daily gain and daily profit as well as economic efficiency were significantly (P<0.05) higher for T2 and T3 compared to T1. These improvements in economic parameters might be due to the increase of daily gain with additives as shown (Table 6). Economic efficiency expressed as the ratio between price of daily gain and daily feed cost increased by 9.94 and 8.19% for T2 and T3 compared with T1, respectively. Data found in Table (7) showed significant higher (P<0.05) for the profit and economic efficiency with T2 and T3 then the control rations (T1). So, the using probiotic bacteria or allzyme as feed additives in ration of growing Friesian calves tended to increase daily profit and economic efficiency. These results are similar to those obtained by Hesham *et al.* (2013) stated that group supported with probiotics achieved the best impact value compared to group supplemented with prebiotic and control group. Soliman *et al.* (2016) found that growing lambs eat diet supplemented with probiotic (DFM) was the highest in economic efficiency % (EE). However the growing lambs in control group showed the lowest results. Abou-Elenin *et al.* (2016) reported that economic efficiency recorded the lowest value with the control ration to isolated bacteria had the highest value which followed by isolated bacteria.

Table 7. Feed conversion and economic efficiency of steers fed the experimental rations.

Items	Treatments (T1)	(T2)	(T3)	±SE
Feed conversion (kg feed/kg gain):				
Feed as DM	9.000[a]	7.954[b]	8.118[b]	0.17
Feed as TDN	5.818[a]	5.268[b]	5.389[b]	0.12
Feed as DCP	0.769[a]	0.711[b]	0.720[b]	0.01
Economic efficiency *				
Daily feed cost, L.E	35.69[b]	37.99[a]	37.69[a]	2.26
Feed cost/kg gain, L.E	32.15[a]	29.22[b]	29.68[b]	2.12
Price of daily gain, L.E	61.05[b]	71.50[a]	69.85[a]	3.54
Daily profit, L.E	25.36[b]	33.51[a]	32.16[a]	2.18
Economic	1.71[b]	1.88[a]	1.85[a]	0.13
Economic %	70.96[b]	87.86[a]	85.43[a]	3.37

a ,b and c means in the same row with different superscripts are significant (P<0.05)differ.

***Calculation based on the following price in Egyptian pound (L.E) per kg, CFM = 3.9 L.E. /kg, silage=0.60 L.E. /kg, alfalfa hay =2 L.E. /kg, probiotic bacteria =200 L.E. /kg, allzyme=200 L.E. /kg, and one kg of live body weight was 55 L.E.**

CONCLUSION

From previous results it could be summarized that probiotic bacteria or allzyme supplementation for fattening crossbred Friesian steers led to improve digestibility, rumen fermentation, blood parameters and feed intake. Moreover, animals fed feed additives showed higher daily gain and economic efficiency with no negative effect. Feed intake, body weight gain, feed conversion and economic efficiency.

REFERENCES

Abd El-Galil, E.R.I. (2006). Effect of biological treatments on silage and feeding value of roughages in ruminants. Ph.D. Thesis, Faculty of Agriculture, Ain-Shams University, Egypt.

Abou-Elenin, Ebtehag I.M.; Etab R. Abd El-Galil;K.E.I. Etman and H.M. El-Shabrawy (2016).Improvement of rumen fermentation and performance of growing lambs by adding natural microbial resources. Asian J. Anim. Sci., 10 (3): 202-212.

Adesogan, A.T. (2005).Improving forage quality and animal performance with fibrolytic enzymes. Proc. Annual Florida Ruminant Nutrition Symposium, Gainesville, Florida, p. 91-109.

AOAC (2000).Official Methods of Analysis. 17th Edn., Association of Official Analytical Chemistry, Arlington, Virginia, USA.

Arowolo, M.A. and J.He(2018). Use of probiotics and botanical extracts to improve ruminant production in the tropics: A review. Anim. Nutr., 4(3): 241-249.

Arriola, K.G.; S.C. Kim; C.R. Staples and A.T.A. desogan (2011).Effect of fibrolytic enzyme application to low and high concentrate diets on the performance of lactating dairy cattle. J Dairy sci., 94: 832-841.

Bala, P.; R. Malik and B. Srinivas (2009).Effect of fortifying concentrate supplement with fibrolytic enzymes on nutrient utilization, milk yield and composition in lactating goats. J. Anim. Sci., 80: 265-272.

Balci, F.; S. Dikmen; H. Gencoglu; A. Orman; I.I. Turkmen and H. Birick(2007). The effect of fibrolytic exogenous enzyme on fattening performance of steers. Bulgarian J. Vet. Med., 10: 113-118.

Baloyi, T. F. (2008). Effects of exogenous fibrolytic enzymes on in vitro fermentation kinetics of forage and mixed feed substrates. MSc (Agric.) thesis, Stellenbosch University, Stellenbosh, South Africa.

Beauchemin, K.A.; D. Colombatto; D.P. Morgavi and W.Z. Yang(2003).Use of exogenous fibrolytic enzymes to improve feed utilization by ruminants. J. Anim. Sci., 81: E37-E47.

Callaway, T.R.; R.C. Anderson; T.S. Edrington; K.J. Genovese and K.M. Bischoff (2004). What are we doing about Escherichia coli O157: H7in cattle? J Anim Sci., 82: 93–99.

Colombatto, D.; F.L.Mould; M. K. Bhat and E.Owen (2003). Use of fibrolytic enzymes to improve the nutritive value of ruminant diets: A biochemical and in vitro rumen degradation assessment. Anim. Feed Sci. Technol, 107: 201-209.

Cruywagen, C.W. and L.Goosen (2004). Effect of an exogenous fibrolytic enzyme on growth rate, feed intake and feed conversion ratio in growing lambs. S. Afr. J. Anim. Sci., 34(Suppl. 2: 71-73.

Cruz, O.T.B.; M.V. Valero; F. Zawadzki; C.E. Eiras; D.C. Rivaroli and R.M. Prado (2014).Effect of glycerine and essential oils (Anacardium occidentale and ricinus Communis) on animal performance, feed efficiency and carcass characteristics of crossbred bulls finished in a feedlot system. Ital J Anim Sci., 13(4): 3492.

De Ondarza, M.B.; C.J. Sniffen; L. Dussert; E. Chevaux; J. Sullivan; PAS and N. Walker (2010). CASE STUDY: multiple-study analysis of the effect of live yeast on milk yield, milk component content and yield, and feed efficiency. Prof Anim Sci., 26: 661–666.

Duncan, D.B., 1955. Multiple range and multiple F tests. Biometrics, 11: 1-42.

Elghandour, M.M.Y.; A.Z.M. Salem; J.S.M. Castaneda; L.M. Camacho; A.E. Kholif and J.C.V. Chagoya (2015). Direct-fed microbes: a tool for improving the utilization of low-quality roughages in ruminants. J. Integr. Agric., 14: 526–533.

Eun, J.S.;K. A. Beauchemin and H. Schulze (2007).Use of exogenous fibrolytic enzymes to enhance in vitro fermentation of Alfalfa hay and Corn silage. J. Dairy Sci., 90: 1440-1451.

Hesham, H.; M.Badawi; M.El-Sayed and M.A.Ali (2013). Effects of Commercial Feed Additives on Performance, Economic Efficiency, Blood Metabolites and Some Maintenance Behaviour in Goats. J. Vet. Sci. Med.Diagn., 2(2):1-7.

Hillal, H.; G. El-Sayaad and M. Abdella (2011).Effect of growth promoters (probiotics) supplementation on performance, rumen activity and some blood constituents in growing lambs.ArchivTierzucht. 54(6): 607–617.

IBM SPSS STATISTICS (2014).Statistical package for the social sciences, Release 22, SPSS INC, Chicago, USA.

Khalid, M.F.; M.A. Shahzad; M. Sarwar; A.U. Rehman; M. Sharif and N. Mukhtar (2011). Probiotics and lamb performance: a review. Afr. J. Agric. Res., 6(23): 5198–5203.

Khan, R.U.; N. Shabana; D. Kuldeep; K. Karthik; T. Ruchi and M.A. Mutassim (2016). Direct-fed microbial: beneficial applications, modes of action and prospects as a safe tool for enhancing ruminant production and safeguarding health. Int. J. Pharm., 12: 220–231.

Kondratovich, L.B.; J.O. Sarturi; C.A. Hoffmann; M.A. Ballou; S.J. Trojan and P.R.B. Campanili (2019). Effects of dietary exogenous fibrolytic enzymes on ruminal fermentation characteristics of beef steers fed high- and low-quality growing diets. J. Anim. Sci., 97(7): 3089-3102.

Kumar, S.; N. Singh; S. Sihag and S. SihagZile, (2018).Role of Digestion Modifiers as Feed Additives in Ruminants- A Review. International Journal of Agriculture Sciences, 10: 5272-5275.

Mohamed, Ghada A.E. (2014). Investigation of some enzymes level in blood and milk serum in two stages of milk yield dairy cows at Assiut city.Assiut Vet. Med. J., 60(142): 110-120.

Mousa, S. and A.A. Marwan (2019).Growth Performance, rumen fermentation and selected biochemical indices in buffalo calves fed on *Basillissubtilus* supplemented diet. Inter. J. Vet. Sci., 8(3): 151-156.

Mudgal, V. and R.P.S. Baghel (2010).Effect of probiotic supplementation on growth performance of pre-ruminant Buffalo (Bubalusbubalis) calves.Buffalo Bull., 29(3): 225-228.

NRC (2000).Nutrient Requirements of Beef Cattle: Seventh Revised Edition: Update 2000. Washington, DC: The National Academies Press.

Pinos-Rodrı´guez, J.M.; S.S.Gonza´ lez; G.D. Mendoza; R. Ba´ rcena; M.A.Cobos; A.Herna´ ndez and M.E. Ortega (2002). Effect of exogenous fibrolytic enzyme on ruminal fermentation and digestibility of alfalfa and rye-grass hay fed to lambs. Journal of Animal Science 8:3016-3021.

Qiao, G.H.; A.S. Shan; N. Ma; Q.Q. Ma and Z.W. Sun (2009).Effect of supplemental bacillus cultures on rumen fermentation and milk yield in Chinese Holstein cows. J. Anim. Physiol. Anim. Nutr., 94: 429–436.

Robinson, P.H. (2002). Yeast products for growing and lactating dairy cattle: impact on rumen fermentation and performance. Dairy Rev., 9: 1–4.

Saleem, A.M.; A.I. Zanouny and A.M. Singer (2017). Growth performance, nutrients digestibility, and blood metabolites of lambs fed diets supplemented with probiotics during pre- and post-weaning period. Asian Australian J. Anim. Sci., 30(4): 523–530.

Salem, A.Z.M.; M. El-Adawy; H. Gado; L M. Camacho ; M. Gonzalez – Ronquillo ; H. Alsersy and B. Borhami (2011). Effects of exogenous enzymes on nutrients digestibility and growth performance in sheep and goats. Trop. Subtrop. Agroecosyst., 14: 867-874.

Schneider, B.H. and W.P. Flatt (1975).The evaluation of feeds through Digestibility Experiments.The University of Georgia Press Athens 30602.

Soliman,S.M.; A.M. El-Shinnawy and A.M. El-Morsy (2016).Effect of probiotic or prebiotic supplementation on the productive performance of Barki lambs.J..Animal and Poultry Prod., Mansoura Univ., 7(10): 369- 376.

Sujani, S. and R.T. Seresinhe (2015).Exogenous Enzymes in Ruminant Nutrition: A Review. Asian Journal of Animal Sciences, 9(3): 85-99.

Sun, P.; JQ.Wang and L.F. Deng (2012).Effects of Bacillus subtilis natto on milk production, rumen fermentation and ruminal microbiome of dairy cows.Animal, 7(2):216-22.

Thornton, P.K. (2010). Livestock production: recent trends, future prospects. Philos. Trans. R. Soc. Lond. B. Biol. Sci., 365(1554): 2853–2867.

Van Keulen, J. and B.A. Young (1977).Evaluation of acid insoluble ash as a digestibility studies. J. Anim. Sci., 44: 282.

Vargas, J.M.; G.D. Mendoza; M.D.S. Rubio-Lozano and F.A. Castrejon(2013). Effect of exogenous fibrolytic enzymes on the carcass characteristics and performance of grain-finished steers. Anim. Nutr. Feed Technol., 13: 435-439.

Wamer, A.C.I. (1964). Production of volatile fatty acids in the rumen, method of measurements.Nutr.Abstr.and Rev., 34: 339.

Zeid, A.M.M.; A.M.A Mohi-Eldin.; I.M.E. Shkweer and Ebtehag, I. M. Abouelenin and Fathia A. Ibrahim (2008). Effect of using natural feed additives on performance of dairy Friesian cows. Egyptian J. Anim. Pro., 45 Suppl. Issue, Dec. (2008):537-547.

Zinn, R. A., and R. A. Ware (2003). Personal Communication. Univ. of California, Davis, CA.

Zinn, R.A. and J. Salinas (1999). Influence of fibrozyme on digestive function and growth performance of feedlot steers fed a 78% concentrate growing diet. Proceedings of the Alltech's 15th Annual Symposium on Biotechnology in the Feed Industry, (BFI'99), Lexington, KY, USA, p. 313-319.

تأثير استخدام الاضافات البيولوجية على اداء الحيوان

1- تاثير إستخدام بكتريا البروبيوتك أو الأضافات الأنزيمية على الأداء الأنتاجى للعجول الفريزيان النامية

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أستخدم فى هذا البحث عدد 18 عجل بقرى خليط بمتوسط وزن 286.91 كجم وعمر حوالى 15 شهرا لدراسة تأثير أستخدام البروبيوتك بكتريا أو الأنزيمات على تسمين الحيوانات. قسمت الحيوانات إلى ثلث مجاميع متماثلة (6 فى كل مجموعة) و غذيت جميع الحيوانات على عليقة أساسية تحتوى على 65% علف مركز + 25% سيلاج أذرة + 10% دريس برسيم حجازى (المجموعة الأولى مقارنة) أو إضافة 5 جم بروبيوتك بكتريا (المجموعة الثانية) أو إضافة 4 جم أنزيم (المجموعة الثالثة) وأستمرت التجربة 150 يوما بمزرعة شركة المنار بالطريق الصحراوى. أظهرت النتائج زيادة معاملات الهضم لجميع العناصر الغذائية للمجموعات التى تغذت على الأضافات وكانت الزيادة معنوية أكثر للمجموعة الثانية التى غذيت على بروبيوتك بكتريا مع زيادة القيمة الغذائية بشكل معنوى مع أستخدام البكتريا أو الأنزيمات مقارنة بالكنترول. وأظهر نشاط الكرش أرتفاع تركيز pH أرتفاعا معنويا للمجموعة الثانية والثالثة عند صفر , 3 ساعات وظهر هذا الأتجاه مع تركيز الأحماض الدهنية الطيارة بعكس تركيز الأزوت الأمونيا فقد أنخفض مع المجموعات التى تغذت على الأضافات سواء عند صفر أو 3 ساعات من أخذ العينة. من ناحية أخرى أرتفعت نسبة بروتين الدم والجلوبيولين فى المجموعات المعاملة (الثانية والثالثة) أرتفاعا معنويا. وأظهرت قيم وتركيز الألبيومين والكرياتنين ونشاط أنزيمات الكبد ALT و AST أنخفاضا مقارنة بالمجموعة الكنترول إلا أن هذا الأنخفاض لم يكن معنويا. كما أظهرت النتائج أيضا أرتفاعا فى معدل النمو اليومى بشكل معنوى فى المجموعة الثانية والثالثة التى غذيت على البكتريا والأنزيم عل التوالى. هذا وكانت تكاليف التغذية للمجموعة (الثانية والثالثة) الأقل مقارنتا بالمجموعة المقارنة وتبع ذلك أرتفاع فى الكفاءة الغذائية و الأقتصادية. من هذه الدراسة يمكن أستخدام البروبيوتك بكتريا و الأنزيمات كإضافة فى علائق تسمين العجول الفريزيان و التى أظهرت تحسن فى معاملت الهضم العليقة وزيادة معدلات النمو اليومى وأرتفاع الكفاءة الغذائية مع خفض تكاليف التغذية لأنتاج 1 كجم وزن حى.