J. Anim. and Poultry Prod., Mansoura Univ., Vol.7 (12): 439- 446 , 2016

Effect of Yeast Autolysate Feed Additive on Performance of Suckling and Growing Buffalo Calves

Phillip, Y. L.[1] and Dalia Iskander[2]
[1]Anim. Prod. Res. Inst., Agric. Res.Center, Dokki, Giza, Egypt.
[2]Anim. Health Res. Inst., Agric.Res . Center,Dokki, Giza, Egypt.

ABSTRACT

The present study investigates the effect of yeast (*Saccharomyces cerivisea*) autolysate (YA) on digestibility, rumen fermentation specially rumen microflora, blood parameters and growth of both suckling and growing buffalo calves Twelve suckling calves with an average body weight of 35.5±0.5 kg were randomly divided to three groups (4 calves each). The experimental period was divided into two phases, the first phase lasted 90 days after calving whereas, the second phase lasted 150 days started by weaning calves (90 days of age). In the first phase, animals in all groups suckled whole milk (WM) twice daily in addition to starter and berseem. In the second phase, animals were fed the basal rations composed of concentrate feed mixture (CFM), rice straw (RS) and berseem (Br). The experimental rations were R1: WM (control), R2: WM+ 5 ml of YA/h/d (5ml equal 1 gram of YA) and R3: WM+7.5 ml of YA, in the first phase. While during the second phase, the rations were R1: basal ration (control), R2: basal ration +35 of YA and R3: basal ration +50 ml YA. The results showed that addition of YA increased ($P<0.05$) digestibility of CP and CF, but it had no significant effect for other nutrients. The nutritive value as TDN was significantly ($P<0.05$) increased by addition of YA. Blood parameters (GPT, GOT and creatinine) and rumen fermentation were not affected by addition of YA except rumen pH which was significantly ($P<0.05$) higher for animal fed rations contained YA compared to the control. In the first phase, weaning body weight was significantly ($P<0.05$) increased by YA addition, on other hand, final body weight and ADG were not affected in the second phase. Feed conversion, daily profit, relative feed cost and relative daily profit were improved by treatment. Bacteriological examination revealed that the addition of YA decreased total aerobic bacterial count but it significantly ($P<0.05$) increased *Lactobacillus* count in feces of treated suckling calves with YA compared with control. Also, Lactobacillus count was significantly increased while; total number of aerobic bacteria was decreased in rumen fluid of growing calves by addition of YA. *In vitro* sensitivity of YA on the isolated three *E. coli* strains from control group revealed that there is strain variation in this respect as one strain (O27) showed the lowest count after treatment with yeast (less than 10 CFU) and the other two strains (O127 and un- typed strain). Results obtained revealed that using YA as feed additives for suckling and growing buffaloe calves tended to increase average daily gain, improved feed conversion and get more profit relative to feed cost or a relative daily profit. Moreover, addition YA appeared to decrease of aerobic bacteria with increase *Lactobacillus.*

Keywords: *buffalo calves, yeast autolysate, blood parameter, feed conversion*

INTRODUCTION

Fungi/yeast culture is among many microbial species which have been approved as feed additives (Dawson, 1992)**.** Vitamins, enzymes and some unidentified co-factors contained in yeast cells may improve rumen microbial activity, gut health parameters, increase rate of digestion and growth performance (Frizzo *et al.,* 2010; Kawakami *et al.,* 2010 and Frizzo *et al.,* 2011).

Yeasts (Saccharomyces cerevisiae) have been fed to animals either in the form of yeast by-products (breweries or distilleries) or commercial yeast products specifically produced for animal feeding such as yeast extract (YE) and yeast cultures or autolysate (Peppler, 1983). The YE is the common name for various forms of processed yeast products. it consists of the intracellular contents of yeast cell, with the cell wall removed. However, autolysates consist of both the intracellular and cell- wall fraction (Charlie, 1998). The cell wall constituents present of 15-20% of the cell's weight (on DM basis), it consists of glucan (1, 3 - 1, 6 β–glucan), mannans and small amount of chitin (Yannikouris *et al.,* 2004). The polysaccharides {(1, 3)-(1, 6) β-glucan} have the ability to bind mycotoxins (Yannikouris *et al.,* 2004 & 2006) and they have therapeutic properties on animal, fish and birds including anti-microbial, anti-inflammatory, anti-carcinogenic, and they accelerate wound healing (Brow and Golden, 2003; Yoshida *et al.,* 2005; Chen and Sevoiur, 2007). However, mannan oligosaccharides provide favorable condition for beneficial intestinal *Lactobacillus* spp. (Flickinger and Fahey, 2002). Also, they provide competitive binding sites for pathogens causing them to pass through the intestine, thus decreasing attachment and colonization (Newman, 1994).

Autolysis process means self- degradation of cellular constituents of a cell by its own enzymes following the death of cell, so this process begins with the death of the cell. At first, disorganization of membranous systems of the cell occurs. This permits the enzymes to contact with cellular constituents which are degraded and rendered soluble. However, yeast cell contains a wide of protein degrading enzymes which are located in vacuoles. Protease enzyme attacks proteins and breaks peptides and amino acids. Likewise, nuclease degraded RNA and DNA into nucleosides, mononucleotides and poly nucleotides. However, glucanase and proteinase enzymes degrade the cell wall to glucans and mannoprotein, which causes the cell wall to become porous. The autolysate leaks through the cell wall into the surrounding medium and the degradation process of cellular components continues to occur in the surrounding medium (Sommer, 1998).

Many researchers reported that yeast culture improved feed intake by cows (Robinson and Erasmus, 2009 and Ayad *et al.,* 2013); feed conversion, feed efficiency, growth rate of cows (Lascano *et al.,* 2009) and nutrient digestibility (Wohlt *et al.,* 1991) in cost effective manners (Hutjens, 2003). Ghazanfar *et al.* (2015) concluded that the average fecal population of *Lactobacillus* was greater in dairy heifers fed on milk supplemented with yeast than in control group. Yeast nucleotides had beneficial effect on feces scores;

moreover the total bacterial count increase in calves receiving inulin in diet (Barbara Król, 2011). The aim of the present study is to throw the light on the effect of yeast autolysate on buffalo's calves' performance and the total aerobic bacteria and *Lactobacillus* count in feces and rumen fluid of calves

MATERIALS AND METHODS

The present research was performed at Seds Research Station, Beni Sueif Governorate, Animal Production Research Institute, Agricultural Research Center, Ministry of Agriculture. Twelve suckling buffalo calves with an average body weight of 35.5±0.5 kg were distributed at random into three similar groups (4 calves each). The experimental period was considered into two phases; the first lasted 90 days after calving while the second lasted 150 days started from weaning (90 days of age). In the first phase, animals in all groups suckled whole milk (WM) twice daily in addition to the starter and berseem (Br). While, during the second phase, animals were fed a basal ration containing concentrate feed mixture (CFM), rice straw (RS) and berseem (Br). The chemical composition of feed ingredients is shown in Table (1).

Table 1. Chemical composition of feed stuffs ingredients.

Feedstuffs	DM%	Chemical composition on DM basis,%					
		OM	CP	CF	EE	NFE	ASH
Concentrate feed mixture (CFM)*	91.15	91.89	15.79	13.90	3.87	57.58	8.11
Rice straw (RS)	91.02	85.31	4.51	35.61	1.29	43.90	14.69
Berseem (Br)	18.00	87.83	13.47	21.16	2.13	51.07	12.17

- **CFM contained: 24% yellow corn, 35% un-decorticated cotton seed meal, 5% line seed meal , 20% wheat bran, 10% rice bran, 3% sugar cane molasses, 2% lime stone and 1% sodium chloride.**

The experimental rations in the first phase were, R1: WM (control), R2: WM+5ml of yeast autolysate (YA)/head/day (5ml of YA suspension equal 1 gram of YA) and R3: MW+ 7.5 ml of YA/head /day. In the second phase, the experimental rations were R1: basal ration (control), R2: basal ration +35 ml of YA/head/day and R3: basal ration +50ml of YA/head/day. Animals were fed on experimental rations to cover energy requirements accorrding to Ghoneim, 1967. The autolysate solution of active dry yeast was prepared by suspend 200g of dry yeast in one liter distilled water. The suspension was incubated at 55-60°C for 20 hrs. (Tanguler and Erten, 2008) and 10% NaCl was added to the suspension. The pH was adjusted to 5 using 2N NaOH and /or 2N HCl (Cahyanto *et al*., 2011).

A digestibility trial was conducted at the end of the second stage. Digestibility coefficients of nutrients were determined using acid insoluble ash (AIA) as amarker (Van Keulen and Young, 1977). Fecal samples were collected via the rectum twice (8 am and 4 pm) day from each calf during the last 7 days. Feces samples were dried in an electric forced air oven. The dried samples were then ground and composited for chemical analyses. The dry matter (DM), crude protein (CP), crude fiber (CF), ether extract (EE) and ash of feed ingredients, rations and feces were analyzed according to A.O.A.C. (1995). Rumen fluid samples were collected from each animal by a stomach tube at 4hrs post-feeding from each animal at the end of the digestibility trial. Ruminal liquor pH values were immediately measure by HANNA pH meter, model (HI 8424). Ruminal ammonia nitrogen was immediately determined according to Conway (1963). Rumen fluid samples were kept frozen at -20◦C for the analysis of total volatile fatty acids concentration by the steam distillation methods (Warner, 1964). Blood samples were collected from the jugular vein at 4hrs post-feeding and centrifuged for 20 min. at 3000 r.p.m. The supernatant was frozen and stored at -20◦C for subsequent analysis. ALT, AST and creatinine were determined by colorimetric method according to Reitman and Frankel (1957) and Schirmeister *et al.* (1964).

Bacteriological studies: at the end of the first phase fecal grab samples were collected from each animal to study: I–Enumeration of *Lactobacillus* spp. in feces of animals of the first phase: It was done according to (Mirlohi *et al*., 2008) using de-Mans Rogosa Sharpe (MRS) media. II-Enumeration of total aerobic bacterial count in the feces of animals of the first phase: It was done according to (Ghazanfar *et al.,* 2015). III–Determination of total aerobic bacterial count and *Lactobacillus* count in the ruminal juice of animals of the second phase: The technique described by (Barbara Król, 2011) for determination of TABC and *Lactobacillus* count in the rumen juice using MRS and nutrient agar media was followed. IV–Isolation, identification and serogrouping of *E. coli* from fecal swabs of control calves: It was done according to (Quinn, *et al*., 2002 and Edwards and Ewing, 1972) for isolation, identification and serogrouping of *E. coli* isolates from fecal swabs of control calves to use three *E. coli* isolates for studying the effect of YA on them experimentally (*In vitro*). V-*In vitro* detection the effect of YA on *E. coli* strains: It was done by the tube dilution methods according to (Cruickshank. *et al*., 1975).

Collected data were statistically analysed according to Snedecor and Cochran (1980) using one way analysis of variance using following the following model:

$$Y_{ij}=\mu+T_i+e_{ij}$$

Where: Y_{ij} is the analysed parameter, μ is the overall mean, T_i is the treatment effect and e_{ij} is the experimental error. Measured parameters were processed using the general linear model of SAS (2001) program. Differences among means were statistically compared for using Duncan's test (1955).

RESULTS AND DISCUSSION

Digestibility coefficients and feeding values:

Nutrients digestibility and feeding values of experimental rations fed during the second phase are presented in Table (2). Feeding diets with YA had no significant effect on digestibility values of DM, OM, EE and NFE; while; digestibility values of CP and CF were

significantly higher (P<0.05) for calves fed rations with YA (R2 and R3 *vs.* R1). This improvement in digestibility may be due to the positive impact cell wall on immune system of livestock (Morrison *et al. 2010*), the higher pH value by YA supplementation (Table 3) could responsible in making ruminal environment more favorable for activity of cellulolytic bacteria (Stewart, 1977) and/or may be due to the role of yeast cell wall poly saccharides (1, 3) (1, 6) β-D- glucan in animal nutrition and its ability to bind or adsorb mycotoxins and detoxify animal feed (YanniKouris *et al.*, 2004). Intracellular contents are rich in amino acids, vitamins and trace minerals; these could play as growth stimulants for microorganisms (Dawson, 1992). However, comparable studies evaluating effects of supplemental hydrolyzed yeast cell wall on digestion are limited. Swartz *et al.* (2016) reported that cows fed daily supplementation of enzymatically hydrolyzed yeast increased (P≤0.06) apparent digestibility of DM (55.6 *vs.* 54.1±0.8), OM (58.9 *vs.* 57.5±0.6), NDF (52.6 *vs.* 50.8±0.8) and ADF (46.8 *vs.* 45.2±0.9) compared to supplementation. No significant (P<0.05) effects of enzymatically yeast cell wall on digestion of DM, OM, NDF and N of steers were observed by Salinas-Chavira *et al*. (2015). Also, Merrill *et al.* (2007) recorded that yeast cell wall did not affect (P>0.13) DM, OM, or NDF digestibility. Mir and Mir (1994) and Kawas *et al.* (2007) reported similar results with yeast culture. An increase in fiber digestion by steers was however observed by Lei *et al. (2013)* when their diet was supplemented with yeast cell wall. Yeast supplementation consistently enhanced fiber digestion across a variety of diets and feeding practice (Zinn and Borquez, 1993; Plata *et al*., 1994 and LÓpez-Soto *et al.,* 2013*).* On the other hand, the apparent digestibility of DM, OM, CP, CF, NDF, ADF, cellulose, and hemicellulose were also greater (P< 0.05) in the diets containing mannan oligosaccharides (MOS) than in the control diet during rabbit fattening period (Bovera *et al*., 2012).

Table 2. Apparent digestibility and nutritive values of experimental rations as affected by YA supplementation.

Item	Treatments			±SE
	R1	R2	R3	
Digestibility coefficients%:				
DM	58.89	60.60	61.11	2.545
OM	62.59	61.93	65.06	3.838
CP	56.01[b]	61.17[a]	64.46[a]	1.065
CF	58.18[b]	65.54[a]	64.81[a]	2.127
EE	76.35	78.84	81.15	2.843
NFE	66.29	64.45	73.47	3.116
Nutritive value %:				
TDN	59.63[b]	60.89[ab]	65.57[a]	1.695
DCP	7.43	8.12	8.43	0.311

[a]and[b] means in the same row bearing different superscript are significantly (P<0.05) different .

R1:control, R2:35ml yeast autolysate and R3:50 ml yeast autolysate.

The nutritive value (TDN) of experimental rations was significantly (P<0.05) improved by feeding ration with 50 ml YA, while, the increase in TDN value was not significant for animals fed R2 ration contained 35 ml YA (Table 2), this may be due to high digestibility of fiber and protein. The digestible crude protein (DCP) value was insignificantly higher for animals fed R2 and R3 compared with control. Shwerab *et al*. (2010) reported that the nutritive values (TDN and DCP) of rations for lactating cows were significantly increased by addition dried yeast. The same findings were recorded by El-Kousy *et al.* (2010) who found that addition of yeast culture to ration of Friesian calves resulted in insignificant increases in TDN and DCP.

Rumen parameters

Addition of yeast autolysate significantly (P<0.05) increased ruminal pH values, while the concentrations of ruminal NH_3-N and total volatile fatty acids (TVFA,s) were not significantly affected (Table 3). Similar findings were also reported by Williams *et al.* (1991) who found that addition of yeast culture to steers diet increased (P<0.05) ruminal pH and had no effect on concentration of ruminal VFA. Also, Merrill *et al.* (2007) reported that increasing yeast cell wall supplementation from 20g/h/d to 60g/h/d didn't affect (P<0.01) ruminal NH_3-N, pH or total VFA,s. However, Vyas *et al.* (2014) found that ruminal pH and total VFA,s not affected when cows were fed ration containing dead yeast compared to the control, but ruminal NH_3-N was significantly increased with supplementation with live or dead yeast. On the other hand, calf fed diet Supplemented with yeast culture decreased (P<0.05) ruminal pH and increased (P<0.05) VFA concentration, while, NH_3-N concentration was not affected (Abdel-Khalek *et al*., 2000).

Table 3. Effect of YA on ruminal parameters.

Item	Treatments			±SE
	R1	R2	R3	
pH	6.24[b]	6.62[a]	6.63[a]	0.098
NH_3-N, mg/100 ml	12.26	10.47	12.08	1.29
TVFA's, mmol/ 100 ml	105.13	102	93.13	8.27

[a]and[b] means in the same row bearing different superscript are significantly (P<0.05)different.

R1: control, R2:35ml yeast autolysate and R3:50 ml yeast autolysate

Blood parameters

The values of blood constituents {GOT (AST), GPT (ALT)} and creatinine are illustrated in Table (4). Addition of autolysate had no significant effect on GOT, GPT activity and creatinine, this may be due to the normal physiological state of liver or kidney function. These results are in accordance with Boyed *et al.* (2016) who reported that the addition of Agrimos (yeast cell wall) to the diet of steers had no effect on blood parameters (urea nitrogen, creatinine and uric acid). Also, Abdel-khalek *et al.* (2000) and Shwerab *et al*. (2010) illustrated that addition of yeast culture did not affect activity of GOT and GPT in plasma of calves.

Table 4. Effect of YA on blood parameters.

Item	Treatments			±SE
	R1	R2	R3	
GOT, U/L	42.16	49.18	39.14	5.63
GPT, U/L	27.73	33.28	26.60	3.24
Creatinine, mg/100 ml	0.85	0.96	0.74	0.091

R1: control, R2:35 ml yeast autolysate and R3:50 ml yeast autolysate

Calves performance:

Effect of YA on performance of calves is shown in Table (5). At the first phase, data indicated that the values of weaning live body weight, total and average daily gain (ADG) were significantly (P<0.05) higher for calves fed

rations supplemented with YA and the highest values were observed with (R2). While, in the second phase, final body weight, total gain and ADG were insignificantly higher for R2 and R3 ration compared with control (R1). An autolysate of *Saccharomyces cerevisiae*, enriched in cell wall fragments, improve animal performance. Different mode of action of yeast and its derivatives (pathogen binding, influence on gut morphology, immune modulation and prebiotic effects in the rumen) contribute to the improvement of animal health and performance (Spring *et al.*, 2000; Davis *et al*., 2004; Rozeboom *et al*., 2005; Singh *et al.*, 2008 and Srinivas *et al.*, 2013)

Data in Table (5) revealed that feed conversion was improved by YA supplementation. The same trend was observed with daily profit, relative feed cost and relative daily profit. Similar studies regarding the evaluation of the effect of YE on feedlot growth performance of feedlot are limited. Salinas-Chvira *et al.* (2015) did not find significant differences in growth performance during an initial 139 day period; however, ADG was improved by feeding enzymatically hydrolyzed yeast from d 139 to d 229. They proposed that increased feed intake was the reason for improved ADG. Similarly, ADG and gain efficiency were improved in feedlot steer fed 2 or 5g/h/d yeast cell wall product as reported by Aragon *et al.* (2016), Lei *et al.* (2013) and Finck *et al.* (2010). Minor effect of including yeast cell wall extract on growth performance of pig (Park *et al.* 2016). Moreover, the improvement of growth performance of piglets was recorded by Gerritsen *et al*. (2012) and Eicher *et al*. (2006) after yeast cell wall addition on d-14 post-weaning. On the other hand, Boyed *et al*. (2016) observed that the addition of Agrimos (yeast cell wall produced from *Saccharomyces cerevisiae* contained mannan oligosaccharide and B-glucan) to diet of steers had no effect on final body weight and average daily gain, but feed efficiency was decreased (P<0.19), and inclusion of celmanox (enzymatically hydrolyzed yeast product) had no impact on growth performance in pig, but it reduced overall mortality resulting in net return (Levesque *et al.*, 2016). Also, Eicher *et al*. (2010) reported that growth performance and feed efficiency of dairy calves fed yeast cell wall B-glucan did not significantly differ (P>0.05) compared to control. Likewise, no significant differences were found in ADG of calves consumed milk replacer supplemented with 10g mannan oligosaccharide/calf/day (Morisson *et al.*, 2010).

Bacteriological results

Using of feed antibiotics in calf milk replacer was applied to prevent the high mortality of calves caused by their poor immunity as well as bacterial infections of digestive and respiratory tracts. Ruminant diets are often fortified by yeast products such as yeast culture and live yeast as a rumen fermentation stimulant, modulator or performance enhancer. The most commonly used yeast species is *Saccharomyces cerevisiae*, also known as baker's yeast (Stone, 2002).

The results in table (6) revealed that the addition of YA (5 –7.5ml / head) in the first phase decrease the total aerobic bacterial count (TAB) and significantly increase of *Lactobacillus* count in the feces of animals supplemented with YA in comparison to the control. In the second phase, *lactobacillus* count in the rumen fluid of calves significantly increased compared to the control while, TABC significantly decreased for calves fed ration contained YA (Table 6). This result was nearly agreed with Kawakami *et al*. (2010) who reported that the addition of yeast strain (CO119) to milk replacer significantly (P<0.05) decreased calf fecal scoring but only in the early lactation period.

Table 5. Effect of YA on growth performance and economic efficiency of calves.

Tem	Treatments			±SE
	R1	R2	R3	
First phase:				
Experimental period, day	90	90	90	
Birth live body weight, kg	35.5	35.5	35.75	0.618
Weaning live body weight, kg	92.5^{b}	97.25^{a}	95.00^{a}	0.777
Total gain ,kg	57.0^{c}	61.75^{a}	59.25^{b}	0.825
Mean daily gain, kg	0.633^{c}	0.686^{a}	0.658^{b}	0.009
Second phase:				
Experimental period, day	150	150	150	
Initial weight, kg	92.5^{a}	97.25^{b}	95.00^{b}	0.777
Final live body weight, kg	213.25	228	226	16.67
Total body gain, kg,	120.75	130.75	131	16.91
Average daily gain,kg	0.805	0.872	0.873	0.112
Average daily feed intake as fed:				
Concentrate, kg	2.675	2.845	2.808	
Straw, kg	0.925	0.982	0.971	
Berseem, kg	6.9	7.430	7.240	
Yeast autolysate, kg	0.000	0.007	0.010	
Mean DMI intake, kg	4.522	4.810	4.748	
Feed conversion (DMI,kg/gain,kg)	5.618	5.516	5.438	
Economic efficiency:				
Price of daily gain,LE	28.18	30.52	30.56	
Daily feed cost, LE	9.39	10.09	10.01	
Feed cost/kg gain,LE	11.66	11.53	11.47	
Daily profit,LE	18.79	20.47	20.55	
Relative feed cost, %*	100	98.89	98.37	
Relative daily profit,%**	100	108.97	109.37	

[a, b,] and [c] Means in the same row bearing different superscript are significantly *(P<0.05*differnt.*Relative feed cost, %=Feed cost, LE/kg gain (R2or R3)/R1. **Relative daily profit, % =Daily profit LE (R2, orR3)/R1. The price of concentrate feed mixture =2950LE/ton, rice straw=500LE/ton, berseem = 150LE/ton, one kg of daily gain = 35 LE, YA=15LE/kg,

Table 6. Average of *lactobacillus* and total aerobic bacterial in the examined fecal samples (first phase) and ruminal juice (second phase) of calves.

Bacteria	First phase			Second phase		
	R1	R2	R3	R1	R2	R3
	0 YA/h	5ml YA/h	7.5ml YA /h	0 YA/h	35ml YA/h	50ml YA/h
Lactobacillus spp.	7x107 ± 4x 106	11 x 108 ± 8 x 107	25 x 109 ± 4 x 104	$5x10^{6}$ ±2 $x10^{7}$	6 $x10^{6}$ ± $5x10^{6}$	$12x10^{8}$ ±11 $x10^{8}$
TAB	10x109 ± 3x 108	5 x 107 ± 3 x 107	3 x 105 ± 1 x 106	$32x10^{8}$ ± 9 $x10^{8}$	$13x10^{8}$ ± 7 $x10^{8}$	$9x10^{6}$ ± 5 $x10^{6}$

Results in this study are in agreement with those obtained by Ghazanfar *et al.* (2015) who concluded that the average fecal population of *lactobacillus* was greater in dairy heifer fed on milk supplemented with yeast than in control group. Yeast nucleotides had beneficial effect on feces scores, moreover the total bacterial count increase in calves receiving inulin in diet (Barbara Król, 2011). Supplementation of yeast culture (*Levucell SC* 20) 0.5 g/animal/day in the diet of graded *Murrah* buffalo bulls

increased the microbial population in the rumen (Singh *et al.,* 2008 and Srinivas *et al.,* 2013). On the other hand, Shin-Ichi *et al.* (2011) showed that the numbers of aerobic bacteria, coliform, bacilli and clostridia were not affected by supplementing of yeast strain (CO119). *In vitro* sensitivity of the YA on the isolated three *E. coli* strains from control groups (Table 7) revealed that there was strain variation in this respect as one strain (O27) showed the lowest count after treatment with YA (Less than 10 CFU) and for the other two strains, the count significantly decreased from 1.84 x 109 to 1.36 x 103 and from 6.8 x 109 to 4.8 x 109 for the strain (O124) and the (un-typed strain) respectively. Spring *et al.* (2000) and Barbara Król (2011) proved that numerous strains of *Escherichia coli* and *Salmonella* are attached to MOS (mannan-oligosaccharides) *in vitro.* Also, Ganner *et al*. (2013) noted that yeast cell wall fractions and YA products have been proposed to bind enteropathogenic bacteria and thereafter to possess prophylactic properties in the gut for the control of selective pathogenic bacteria such as *E. coli* and *Salmonella*. Among numerous candidate technologies, probiotics are thought to be prospective substitutions of antibiotics (Callaway *et al*., 2004).

Table 7. Effect of YA on *E. coli* strains (in vitro)

E. coli serogrouping	Bact. count CFU without treated by YA	Bact. count CFU treated by YA
O27	19.2 x 108	Less 10 CFU
O124	1.84 x 109	1.36 x 103
Un-typed strain	6.8 x 109	4.8 x 109

CONCLUSION

Results of this experiment revealed that the addition of YA for either sulking or growing buffalo calves tended to increase average daily gain, improve feed conversion and get more profit as a relative to feed cost or relative daily profit. Moreover, addition YA appeared to decrease aerobic bacteria and increase *Lactobacillus*. So it is recommended to use 5 ml /h/d and of YA for suckling and 35 ml /h/d for growing calves for improving their performance.

REFERENCES

A.O.A.C. (1995). Official Methods of Analysis (16th) Edt. Association of Official Analytical Chemists, Washington, D.C., USA.

Abdel-Khalek, A. E.; A. F. Mehrez and E. A. Omar (2000). Effect of yeast culture (*Lacto-Sacc*) on rumen activity, blood constituents and growth of suckling Friesian calves. Proc. Conf. Anim. Prod. In the 21th Century, Sakha, 18—20 April: 201-210.

Aragon, S. N.; F. R. B. Ribeirio; Pas, A. D. Hosford; A. J. Thompson; J. E. Hergenreder; M. A. Jennings; J. R. Corley; B. J. Jhonson (2016). Influence of yeast cell wall supplementation during the finishing phase on feedlot steer performance, carcass characteristics, and postmortem tenderness. The Professional Animal Scientist, vol.32, issue2, 192-200.

Ayad, M. A.; B. Benallou; M. S. Saim; M. A. Smadi and T. Meziane (2013). Impact of feeding yeast culture on milk yield, milk components, and blood components in algerian dairy herds. J. Veterinar. Sci. Technol., 4(135):2.

Barbara Król (2011). Effect of mannanoligosaccharides, inulin and yeast nucleotides added to calf milk replacers on rumen microflora, level of serum immunoglobulin and health condition of calves. Electronic Journal of Polish Agricultural Universities.Volume 14 Issue 2 Topic Veterinary Medicine.

Bovera, F.; A. Lestingi; F. Iannaccone; A. Tateo; and A. Nizza (2012). Use of dietary mannanoligosaccharides during rabbit fattening period: Effects on growth performance, feed nutrient digestibility, carcass traits, and meat quality. J. Anim. Sci., 90:3858–3866.

Boyed B. M.; T. L. Mader; C. J. Bittner; F. H. Hilscher; G. Wijffels; J. B. Gaughan; M. L. Sullivan; A. J. Cawdell-Smith and G. E. Erickson (2016). The effect of feeding a yeast supplement or finely ground fiber during the summer on body temperature, performance, and blood metabolites of finishing steers. Journal of Animal Science, 94: supplement2:180-180.

Brow, G. D. and S. Gordon (2003). Fungal β-glucans and mammalian immunity. Immunity , 19:311-315.

Cahyanto, M. N.; A. R. Sari and T. Utami (2011). Production of yeast extract from ethanol fermentation waste, The 12th ASEAN Food Conference, 16 -18 June, 2011 Bangkok.

Callaway, T. R.; R. C. Anderson; T. S. Edrington; K. J. Genoves and K. M. Bischoff (2004). What are we doing about *Escherichia coli* O157: H7 in cattle. J. Anim. Sci., 82:93-99.

Charlie, W. Stone (1998). Yeast products in the feed industry. A practical guide for feed professionals. Diamond V Mills, Inc. Cedar Rapids, Iowa Copyright 1998.

Chen, J. and R. Seviour (2007). Medicinal importance of fungal β- (1, 3), (1, 6) glucans. Mycol. Res., 111:635-652.

Conway, E. F. (1963). Modification analysis and volumetric error. Rev. ED. Look Wood. London.

Cruickshank, R.; J. P. Duguid; P. P. Marmionand R. H. Swain (1975). Medical microbiology. 2nd Ed.,Vol. 2. E.S Livingstone Limited Edinburgh, London and New York.

Davis, M. E.; C. V. Maxwell; G. F. Erf; D. C. Brown and T. J. Wistuba (2004). Dietary supplementation with phosphorylated mannans improves growth response and modulates immune function of weanling pigs. J. Anim. Sci., 82:1882–1891.

Dawson, K. A. (1992). Current and future role of yeast culture in animal production: A review of research over the past six years. In: Lyons TP (Ed.): Proceedings of Alltech's 8th annual symposium, Nicholasville, Kentucky. 1-23

Duncan, D. B. (1955). Multiple ranges and multiple F-tests. Biometric, 11:1.

Edwards, P. R. and W. H. Ewing (1972). Identification of Enterobacteriacae. Minneapolis, Burgess CP. Atlanta, USA (3rd Ed).

Eicher, S. D.; C. A. McKee; J. A. Carroll and E. A. Pajor (2006). Supplemental vitamin C and yeast cell wall β-glucan as growth enhancers in newborn pigs and as immunomodulators after an endotoxin challenge after weaning. J. Anim. Sci., 84:2352–2360.

Eicher, S. D.; I. V. Wesley; V. K. Sharma; and T. R. Johnson (2010). Yeast cell-wall products containing β-glucan plus ascorbic acid affect neonatal *Bos Taurus* calf leukocytes and growth after a transport stressor 1. J. Anim. Sci., 88:1195–1203.

El-Kousy, H. A.; G. A. El-Sayad; M. R. M. El-Mahdy; A. M. A. Salama; E. A. Afifi and M. A. Abdelhalim (2010). Effect of feed additives on daily gain, digestion coefficients, rumen fermentation and economic efficiency of Friesian calves. Egyptian J. Nutrition and Feeds, 13(2):259-270.

Finck D.; S. Parr; T. R. Young; J. A. Carroll; J. Corley; A. Estefan and B. Johnson (2010). Interactive effects of yeast and yeast cell wall material on feedlot performance during the receiving period of stressed beef cattle. J Anim. Sci., 88: E-Supplement 2383(abstract).

Flickinger, E. A. and G. C. Fahey, Jr. (2002). Pet food and feed applications of inulin, oligofructose, and other oligosaccharides. Br. J. Nutr., 87(Suppl. 2):S297–S300.

Frizzo, L. S.; L. P. Soto ; E. Bertozzi; M.V. Zbrun; M. L. Signorini; G. R. Sequeira, A. Rodriguez and M. R. Rosmini (2011). Intestinal populations of *Lactobacilli* and *coliforms* after in vivo *Salmonella* Dublin challenge and their relationship with microbial translocation in calves supplemented with lactic acid bacteria and lactose. Anim. Feed Sci. Technol., 170 (1):12-20.

Frizzo, L. SL. P. Soto; M. V. Zbrun; E. Bertozzi; G. Sequeira; R. R. Armesto and M. R. Rosmini (2010). Lactic acid bacteria to improve growth performance in young calves fed milk replacer and spray-dried whey powder. Anim. Feed Sci. Technol., 157 (3):159-167. Ganner *et al.* AMB Express 2013, 3:62

Ganner, A; C. Stoiber; J. T. Uhlik; I. Dohnal and G. Schatzmayr (2013). Quantitative evaluation of E. coli F4 and Salmonella Typhimurium binding capacity of yeast derivatives. AMB Express 2013, 3:62

Gerritsen, R.; G. J. Klaassen; G. Schuttert; S. M. G. Rouwers; H. K. Parmentier and F. Molist (2012). The effect of a mixture of dairy-based feed ingredients, vegetable fats, and yeast cell walls on performance and innate immunity of weaned piglets. J. Anim. Sci., 90:269–271.

Ghazanfar, S.; M. I. Anjum1; A. Azim and I. Ahmed (2015). Effects of dietary supplementation of yeast (*Saccharomyces cerevisiae*) culture on growth performance, blood parameters, nutrient digestibility and fecal flora of dairy heifers. The Journal of Animal & Plant Sciences, 25(1):53-59. ISSN:1018-7081.

Ghoneim, A. (1967). Animal Nutrition (Nutritional Requirements and Economic Rations) 6th Ed. Anglo Egyptian Bookshop, Cairo, Egypt.

Hutjens, M. F. (2003). Economics of Feed Additives. Penn State Dairy Cattle Nutrition Workshop.dasweb.psu.edu/pdf/hutjens1.pdf.

Kawakami, S. I.; T. Yamada; N. Nakanishi and Y. Cai (2010). Feeding of lactic acid bacteria and yeast on growth and diarrhea of Holstein calves. Anim. Vet. Adv., 9 (Issue: 7):1112-1114.

Kawas, J. R.; R. Garcia-Castillo; H. Fimbres-Durazo; F. Garza-Cazares; J. F. G. Hernandez-Videl; E. Olivares-Saenz and C. D. Lu (2007). Effects of sodium bicarbonate and yeast on nutrient intake, digestibility, and ruminal fermentation of light-weight lambs fed finishing diets. Small Rumin. Res. 67:149–156.

Lascano, G. J. ; G. I. Zanton ; M. F. Suarez-Mena and A. J. Heinrichs (2009). Effect of limit feeding highand low-concentrate diets with *Saccharomyces cerevisiae* on digestibility and on dairy heifer growth and first-lactation performance. J. Dairy Sci., 92(10): 5100-10.

Lei, C. L.; G. Z. Dong; L. Jin; S. Zhang; and J. Zhou (2013). Effects of dietary supplementation of montmorillonite and yeast cell wall on lipopolysaccharide adsorption, nutrient digestibility and growth performance in beef cattle. Livestock Sci., 158:57-63.

Levesque, C. L.; S. Jalukar; N. Gutierrez and J. F. Patience (2016). Inclusion of a hydrolyzed yeast product in grow/finish pig diets reduced mortality. Journal of Animal Science, 94: supplement2:71-71.

LÓpez-Soto, M. A.; Y. S. Valdés-Garcia; A. Plascencia; A. Barreras: B. I. Castro-Perez; A. Estrada-Angulo; F. G. Rios, A. Gomez-Vazquez, L. corona and R. A. Zinn (2013). Influence of feeding live yeast on microbial protein synthesis and nutrient digestibility in steers fed a steam-flaked corn-based diet. Acta. Agrc. Scand., section A. Anim. Sci., 63:39-46.

Merrill, M. L.; D. W. Bohnert; D. L. Harmon; A. M. Craig; and F. N. Schrick (2007). The ability of a yeast-derived cell wall preparation to minimize the toxic effects of high-ergot alkaloid tall fescue straw in beef cattle. J. Anim. Sci., 85:2596–2605.

Mir, Z. and P. S. Mir (1994). Effects of the addition of live yeast (*Saccharomyces cerevisiae*) on growth and carcass quality of steers fed high-forage or high-grain diets and on feed digestibility and in situ degradability. J. Anim. Sci., 72:537–545.

Mirlohi, M.; S. Soleimanian-Zad; M. Sheikh- Zeiondin; and F. Hossein (2008). Enumeration of *Lactobacilli* in the Fecal Flora of Infant Using Two Different Modified de-ManRogosa Sharpe Media under Aerobic and Anaerobic Incubation. Pakistan Journal of Biological Sciences, 11:876-881.

Morrison, S. J.; S. Dawson; A. F. Carson (2010). The effects of mannan oligosaccharide and *Streptococcus faecium* addition to milk replacer on calf health and performance. Volume 131, Issues 2-3, Pages 292–296.

Newman, K. (1994). Mannan-oligosaccharides: Natural polymers with significant impact on the gastrointestinal microflora and the immune system. Pages 167–174 in Biotechnology in the Feed Industry: Proceedings of Alltech's Tenth Annual Symposium. T. P. Lyons and K. A. Jacques, ed. Nottingham University Press, Nottingham, UK.

Park I.; J. Guo and S. W. Kim (2016). Effects of modified yeast cell wall extract on growth performance and health status of pigs fed diets with low level mycotoxins. Journal of Animal Science, 94: supplement2:73-73.

Peppler, H. J. (1983). Fermented feeds and feed supplements. In Biotechnology vol. 5, G Reed (ed.) VCH Publishing Co., Weinheim, West Germany.

Plata, P. F.; M. Mendoza; J. R. Barcena-Gama and M. S. Gonzalez (1994). Effects of a yeast culture (*Saccharomyces cerevisiae*) on neutral detergent fiber digestion in steers fed oat straw based diets. Anim. Feed Sci. Technol., 49:203-210.

Quinn, P.J.; B. K. Markyl; M. E.Carter; W. J. Donnelly and F. C. Leonard (2002). Veterinary Microbiology and Microbial Disease. Blackwell, U.K.

Reitman, A. and S. Frankel (1957). A colorimetric method for determination of serum glutamic oxaloacetic and glutamic pyruvic transaminases. Amer. J. Clin. Path., 28 (1): 64-70.

Robinson, P. H. and L. J. Erasmus (2009). Effects of analyzable diet components on responses of lactating dairy cows to *Saccharomyces cerevisiae* based yeast products: A systematic review of the literature. Anim. Feed Sci. Technol., 149 (3):185-198.

Rozeboom, D. W.; D. T. Shaw; R. J. Tempelman; J. C. Meguel; J. E. Pettigrew and Connolly (2005). Effect off mannan oligosaccharides and antimicrobial product in nursery diets on performance of pigs reared on three different farms. J. Anim. Sci., 83:2637- 2644.

SAS (2001). SAS user's guide: statistics, 6th Ed. Cary, N.C.: SAS institute, Inc. Cary. NC. USA.

Salinas-Chavira, J.; C Arzola; V. González-Vizcarra; O. M. Manríquez-Núñez; M. F. Montaño-Gómez; J. D. Navarrete-Reyes; C. Raymundo and R. A. Zinn (2015). Influence of feeding enzymatically hydrolyzed yeast cell wall on growth performance and digestive function of feedlot cattle during periods of elevated ambient temperature. Asian Australias J. Anim. Sci., 28:1288-1295.

Schirmeister, J.; H. Willmann; H. Kiefer and W. Hallauer (1964). The place of end ogenous creatinine clearance in evaluation of renal function. Dtsch.med Wschr., 89 :1940.

Shin-Ichi K.; Y. Tomoya; N. Naotoand C. Yimin (2011). Feeding of lactic acid bacteria and yeast affects fecal flora of Holstein calves. Journal of Animal and Veterinary Advances, 10 | Issue: 3 | Page No.:269-271.

Shwerab, A. M.; M. S. Khalel; A. A. Hassan and A. Z. Salem (2010). Influence of inoculants treatment of citrus pulp and dry yeast supplementation on phytonutrients concentrations, rumen fermentation and cows performance. Egyptian J. Nutrition and feeds, 13 (3):465-487.

Singh, G.; S. Kulkarni and R. Singh (2008). Effect of *Saccharomyces cerevisiae* (Yea-sacc1026). supplementation on rumen profile in buffaloes. Indian J. Anim. Sci., 78 (2):172-174.

Snedecor, W. and W. Cochran (1980). Statistical Methods. Iowa state University Press, Ames Iowa, seventh edition.

Sommer, R. (1998). Yeast extract: Production, properties and components. Food Australia, 50:181-183.

Spring, P.; C. Wenk; K. A. Dawson and K. E. Newman (2000). The effects of dietary mannanooligosaccharides on cecal parameters and concentration of enteric bacteria in the ceca of *salmonella*-challenged broiler chicks. Poult. Sci., 79:205–211.

Srinivas Kumar, D.; Ch. Srinivasa Prasad and R. M. V. Prasad (2013). Effect of yeast culture (*saccharomyces cerevisiae*) on ruminal microbial population in buffalo bulls. Buffalo Bulletin (June 2013) Vol.32 No.2

Stewart, C. S. (1977). Factors affecting the cellulolytic activity of rumen contents. Appl. Environ. Microbiol., 68:3441-3455.

Stone, C.W. (2002). The subtleties of yeast. Feed Mix, 10, 32-33.

Swartz, J. E.; D. W. Brake; E. E. Grings; E. A. Nelson; C. L. Wright; J. A. Walker; Blom, E. J. and G. A. Perry (2016). Effects of enzymatically hydrolyzed yeast supplementation and supplementation frequency on nitrogen balance and apparent diet digestibility in periparturient beef cows. Journal of Animal Science, 94: supplement2:169-170.

Tanguler, H. and H. Erten (2008). Utilization of spent brewer's yeast for yeast extract production by autolysis: The effect of temperature. Food and Bioproducts Processing 86:317.

Van Keulen, J. and B. A. Young (1977). Evaluation of acid insoluble ash as a natural marker in ruminant digestibility studies. J. Anim. Sci., 44 (2):282.

Vyas, D.; A. Uwizeye; R. Mohammed; W. Z. Yang; N. D. Walker; and K. A. Beauchemin (2014). The effects of active dried and killed dried yeast on sub-acute ruminal acidosis, ruminal fermentation, and nutrient digestibility in beef heifers. J. Anim. Sci., 92:724–732.

Warner, A. C. I. (1964). Production of volatile fatty acids in the rumen: Methods of measurements. Nut. Abst. and Rev., 34:339.

Williams, P. E. V.; C. A. G. Tait; G. M. Innes and C. J. Newbold (1991). Effects of the inclusion of yeast culture (*saccharomyces cerevisiae* plus growth medium) in the diet of dairy cows on milk yield and forage degradation and fermentation patterns in the rumen of steers. J. Anim. Sci., 69:3016-3026.

Wohlt, J. E.; A. D. Finkelstein and C. H. Chung (1991). Yeast culture to improve intake, nutrient digestibility and performance by dairy cattle during early lactation. J. Dairy Sci., 74:1395-1400.

Yannikouris, A.; G. Andre; L. Poughon; C. G. Dussap; G. Bertin; G. Jemint and J. P. Jouany (2006). Chemical and conformational study of the interactions involved in mycotoxins complexation with β-glucan. Bio macromolecules, 7(4):1147-1155.

Yannikouris, A.; J. Francois; L. Poughon; C. G. Dussap; G. Bertin; G. Jemint and J. P. Jouany (2004). Alkali extraction of β-glucans from *Saccharomyces cerevisae* cell wall and study of their absorptive properties towards zeralenone. J. Agric. Food Chem., 52 (11):3666-3673.

Yoshida, Y.; W. Yokoi; K. Ohishi; M. Ito; E. Naito and H. Sawada (2005). Effects of the cell wall of *Kluyveromyces marxianus* YIT8292 on plasma cholesterol and fecal sterol excretion in rats fed a high cholesterol diet. Biosci. Biotechnology. Biochem, 69:714-723.

Zinn, R. A. and J. L. Borquez (1993). Interaction of restricted versus *access* to feed on effects of yeast culture supplementation on digestive function in feedlot calves. Western Sec. Am. Soc. Anim. Sci., 44:424.

تاثير الاضافة الغذائية للخميرة المتحللة ذاتيا على اداء عجول الجاموس الرضيعة و النامية

يوسف لطفى فيليب[١] و داليا خيرى اسكندر[٢]

[١]معهد بحوث الانتاج الحيوانى- مركز البحوث الزراعية-وزارة الزراعة- الدقى – الجيزة

[٢]معهد بحوث صحة الحيوان - مركز البحوث الزراعية-وزارة الزراعة- الدقى – الجيزة

تهدف هذة الدراسة الى معرفة تاثير اضافة الخميرة المتحللة ذاتيا على معاملات الهضم والقيمة الغذائية وتخمرات الكرش وبعض قياسات الدم ومردود ذلك على معدل نمو العجول الجاموسى الرضيعة والنامية. تم استخدام ١٢ عجل جاموسى رضيعة بمتوسط وزن ٣٥.٥ كجم ±٠.٥ قسمت عشوائيا على ٣ مجاميع (٤ حيوانات /مجموعة). تم تقسيم فترة التجربة الى مرحلتين, الاولى ومدتها ٩٠ يوم تبدا من الولادة وحتى الفطام والمرحلة الثانية تبدا من الفطام وتستمر لمدة ١٥٠ يوم. فى المرحلة الاولى كانت العجول فى كل المجاميع ترضع لبن كامل بالاضافة الى البادئ والبرسيم بينما كانت تتغذى على العليقة الاساسية والتى تتكون من العلف المركز وقش الارز والبرسيم. العلائق التجريبة فى المرحلة الاولى كانت كالتالى:المجموعة الاولى: لبن كامل, المجموعة الثانية:لبن كامل +٥ مل خميرة متحللة ذاتيا/راس/يوم, المجموعة الثالثة: لبن كامل +٧.٥ مل خميرة متحللة ذاتيا/راس/يوم وكانت العلائق فى المرحلة الثانية, المجموعة الاولى: غذيت على العليقة الاساسية, المجموعة الثانية : العليقة الاساسية+٣٥ مل خميرة متحللة ذاتيا/راس/يوم, المجموعة الثالثة: العليقة الاساسية+٥٠ مل خميرة متحللة ذاتيا/راس/يوم. اظهرت النتائج ان اضافة الخميرة فى المرحلة الاولى ادت الى زيادة الوزن معنويا عند الفطام وكذلك معدل النمو اليومى فى حين ان الاضافة فى المرحلة الثانية لم تؤثر معنويا على الوزن النهائى ومعدل النمو اليومى بينما تحسن كل من معدل التحويل (كجم عليقة/كجم نمو) والربح اليومى. ادت اضافة الخميرة فى المرحلة الثانية من التجربة الى زيادة معدلات هضم كلا من البروتين والالياف بينما لم تتاثر معاملات الهضم الاخرى هذا بالاضافة الى زيادة القيمة الغذائية في صورة مركبات الغذائية الكلية المهضومة (TDN). واضافة الخميرة لم تؤثر معنويا على قياسات الدم وتخمرات الكرش باستثناء قيم pH الكرش فقد زاد معنويا بالمقارنة بمجموعة المقارنة. اظهرت الدراسة الميكروبية الى نقص البكتريا الهوائية وزيادة بكتريا اللاكتوباسيلس فى روث العجول الرضيعة كذلك زادت اعداد بكتيريا اللاكتوباسيلس وانخفضت اعداد البكتيريا الهوائية فى سائل الكرش للعجول النامية نتيجة اضافة الخميرة المتحللة ذاتيا وايضا اظهرت الدراسة المعملية على ٣ عترات لبكتريا القولون التى تم عزلها من مجموعة الكنترول الى نقص عددها نتيجة اضافة الخميرة.ومن هنا يتضح انة يمكن استخدام الخميرة المتحللة ذاتيا (٧ مل/ راس للعجول الرضيعة و ٣٥ مل/راس للعجول النامية) لتحسين الحالة الصحية للحيوان وتحسين معدلات الهضم الذى يكون لة مردود فى تقليل تكلفة الانتاج وزيادة الربح.