INNSPUB

International Journal of Biosciences | IJB |
ISSN: 2220-6655 (Print) 2222-5234 (Online)
http://www.innspub.net
Vol. 10, No. 4, p. 288-294, 2017

RESEARCH PAPER OPEN ACCESS

Study on the effects of dietary supplementation of inactive dry yeast (*Saccharomyces cerevisiae*) on feed intake, body weight gain and fecal microbiota of crossbreds steers

Kamran Ali[1], Ihsan Ullah[1], Hayaz Uddin[1], Shakira Ghazanfar[*2], Mustansar Ali Ghazanfar[3]

[1]*Department of Livestock Management and Animal Breeding & Genetics, Faculty of Animal Husbandry and Veterinary Sciences, The University of Agriculture, Peshawar, Pakistan*

[2]*Institute of Microbial Culture Collection of Pakistan, National Agricultural Research Centre, Park Road, Islamabad, Pakistan*

[3]*Ministry of Planning Commission, Pak Secretariat, Islamabad, Pakistan*

Key words: Yeast culture, Body weight, Body condition score, Fecal flora

http://dx.doi.org/10.12692/ijb/10.4.288-294 Article published on April 30, 2017

Abstract

Livestock industry is showing great interest in the use of feed supplements for improving performance of the farm animal. The objective of this research study was to determine the effect of inactive dry yeast (*Saccharomyces cerevisiae*) on feed intake, average daily weight gain, feed conversion ratio (FCR) and fecal microbiota of crossbreds steers. For this purpose, twelve male steers of cross breed (135±5 kg and 14 to16 months of age) were randomly divided into three equal groups (four animals in each group). In group 1(A-0) steers were fed control diet, group II (B-10) cows were fed control diet plus commercially available yeast at the rate of 10g/d/animal while group III (C-20) steers were fed control diet plus commercially available yeast at the rate of 20g/d/animal. Results showed that feed intake, total weight gain, average daily gain and FCR were significantly ($P<0.05$) higher in group III as compared to other groups. On the other hand body condition scores were not significantly ($P>0.05$) effective by yeast supplementation. The outcomes of fecal microbiota study showed that the average fecal population of *Lactobacillus* (CFU/g) was significantly ($P<0.05$) higher, while *Coliform* (CFU/g) was significantly ($P<0.05$) lower with in group III than in other groups which leads to improved gut health. These results concluded that dietary supplementation of inactive dry yeast has an enhancing effect on growth performance and gut health in the crossbred steers without any adverse effects.

* **Corresponding Author:** Shakira Ghazanfar ✉ shakira_akmal@yahoo.com

Introduction

In ruminates the digestion process depends on the structure and numbers of the rumen and GIT microbiota (Shakira *et al.,* 2013), so it is crucial for rumen microbial ecosystem to show stable function. Disturbance of this ecosystem may lead to destruction of animal productivity (Uyeno *et al.,* 2017). Dry yeasts are commonly used in animal nutrition to improve growth and production performance by enhancing gut microbial balance (Chaucheyras *et al.,* 2008).

It is noted that yeast have a beneficial impact on the ruminal gut microbial balance by establishing the beneficial microbial species and preventing harmful bacteria species from the GIT (Uyeno *et al.,* 2015). It was presumed that the use of yeast as feed supplements multiplied in the GIT and released useful metabolites products, which may effects feed utilization (Arambel and Kent, 1990).

If the yeast could not able to multiply in the prevailing conditions of the GIT, at how, the yeast cells components may affects the fermentative process positively (Magalhaes *et al.,* 2007). Yeast cells stimulated the favorable microbial growth in the rumen and stabilized the rumen pH. Dry yeast (*Saccharomyces cerevisiae)* is a good source of nutrients (protein, vitamins, minerals, carbohydrates) that make up the cell wall, and a significant amount of nucleotides (Ahmad *et al.,* 2012). Therefore, it can be used as a cheaper source of the nutrients for dairy animals. Inactive dry yeast is also a good source of protein (400 to 550g/kg of crude protein). Addition of dry yeast improved growth performance of growing animals (Martin and Nisbet., 1992).

It increased the rumen microbial population and enhanced fermentation rate in rumen (Shehu *et al.,* 2014). Inactive dry yeast (inactive cells of *Saccharomyces cerevisiae)* is normally characterized by its very fine texture and specific taste which may interfere with dry matter intake (DMI) of the animals. Many researchers reported that yeast culture has a positive effect on daily feed intake feed conversion ratio and growth (Ayad *et al.,* 2013).

Yeast addition has improved the nutrient digestibility (Shakira *et al.,* 2015) that put a good effect on health status of dairy animals (Agazzi *et al.,* 2014). Yeast addition led to a significant increase microbial biomass in the rumen. There is evidence that addition of yeast culture (*Saccharomyces cervisiae*) with animal ration improve weight gain of growing heifers (Shakira *et al.,* 2015).

It has been concluded that yeast culture addition change feed and digestive performance and also improve daily weight gain (Mutsvangwa *et al.,* 1992). Yeast improved feed taste (Yalcin *et al.,* 2011), rumen function (Szucs *et al.,* 2013), and milk yield (Poppy *et al.,* 2012). It also increases the feed efficiency of energy utilization and improves blood metabolites and increasing bacterial nitrogen flow to the small intestine which stimulate protein synthesis in young calve (Erasmus *et al.,* 1992). Mostly the studies published have observed the effcets of live yeast strains of yeast (*Saccharomyces cerevisiae*) on the fiber digestion, animal performance and feed utilization (Fortina*et al.,* 2011). Limited data is available on the impact of dead YC on animal performance. The aim of the present study was to evaluate the impact of inactive dried yeast (*Saccharomyces cerevisiae*) supplementation on the feed intake, average daily weight gain and fecal flora of crossbred steers.

Materials and methods

Experimental layout

This study was conducted at LR & DS Surezai, Peshawar. Twelve male crossbred steers at 135±5kg age and 14 to 16 months were used in this experiment. The experimental steers were divided into 3 groups A-0, B-10 & C-20 each group, having 4 steers on the basis of age and body weight.

Feeding management

All experimental animals were fed individually on ration containing wheat straw as a basal feed along with specially formulated concentrate (shandar Vanda) of LR & DS Surezai Peshawar (Table 1).

Animals in group A were kept as a control (0% Yeast Culture) in the ration, while the ration of animals in group B & C top dressed on daily basis with 10& 20 g of dried yeast culture per animals. Adaptability for steers was given before the start of the treated ration, during this period the feed of experiment was gradually increased until the steers were shifted to complete trail period for 60 days. Clean drinking water was available to all experimental animals round the clock.

Growth performance

Daily feed intake was noted by weighing feed offered to and refused by the animals. Feed efficiency was calculated as amount of kilograms of feed intake per kilogram of weight gain. This experiment lasted for 60 days.

Fecal microbial flora counts

Fecal sampling was collected from steers for fecal flora study at 0 and 60days of experiment. Samples were labeled with respect to their particular origin and transferred to the laboratory for fecal coli form and *Lactobacillus* counting by the method given by Shakira *et al,* (2015). Briefly, one gram of fecal material was mixed in Trypticase Salt Solution (TSS) and allowed to vortex for 15-20 minutes at 40Hz and then aseptically shifted in reagent bottle.

Trypticase Salt Solution was used to give better cellular osmotic and nonlytic conditions. Man, Ragosa and Sharpe agar (MRS) (Oxoid, Basingstoke, UK) was used for *Lactobacillus* and macconkey agar media was used for coliform isolation. The macconkey agar and MRS agar plates were incubated aerobically at 37C^{0} for 48h. Colony counts were determined using standard microbiological techniques (Bertin, 2005). Colony counts were done manually with numbers over 300 designated as too numerous to count (TNTC).

Body condition scores

All experimental steers, BCS was recorded by measuring the thickness of fat over the lumber and tail head area was estimated and was assigned a score from 1 (weak) to 4 (fat). Data on BCS was recorded fortnightly for each experimental and entered in excel sheet for determining the changes in the body condition of calves in different flow of nutrition.

Statistical analysis

The data was statistically analyzed using Analysis of Variance of Various Technique (ANOVA) under complete randomized design (CRD). Means of different were tested by using least significant difference (Steel, 1997).

Results and discussion

Effects of yeast culture on feed intake

Microbial based feed supplements are very useful strategy to fight recent challenges with production performance of the animals. Yeast culture has a significant ($P<0.05$) effect on feed intake in animals (Table 2). The feed intake was gradually increased with linear increase yeast culture level in the ration and it might be due to beneficial effects of yeast culture on the feed taste.

The glutamic acid present inside the yeast cell might be effect the feed taste. On the other hand yeast cell stimulate bacterial growth in the rumen because it provides a mixture of micro-nutrients to increase fiber fermentation rate inside the rumen. These results are in conformity with the conclusion of Lesmeister *et al,* (2004), who proved that improved DMI with yeast culture in the diets to Holstein calves. Same with the case of Desnoyers *et al,* (2009) his study show that yeast supplementation increased feed intake significantly higher in dairy animals.

Williams *et al,* (1991) reported that improve feed intake may be due to beneficial changes on the fibrolytic rumen bacteria.

Yeast culture effect on live body weight

Poor growth rate in dairy animals is associated with imbalanced nutrition. The use of yeast culture would increase the growth rate in animals in economical way to improve production. The increased daily weight gain in the yeast fed group (C) in our study might be due to beneficial effect of yeast culture on rumen, which results in improved feed utilization and growth rate (Table 3). Yeast culture supplementation improved digestive functions, fermentative and microbial activities are modify beneficially in the rumen (Denev *et al.,* 2007).

Yeast supplements stimulate the growth of beneficial microorganisms (anaerobes and cellulolytic bacteria) in the rumen which increased the growth rate (Dawson and Newman, 1988; Dawson *et al.*,1990; Sara *et al.,* 2004; Fallon and Earley, 2004).

Our results were in line with the work done by Lesmeister *et al,* (2004), who fed yeast culture (*Saccharomyces cerevisiae*) based diet to Holstein calves and find out significant (P<0.05) increased growth rate.

Effect on body condition score

Mean changes in BCS showed that yeast culture (*Saccharomyces cerevisiae*) supplementation in the rations have significant (P < 0.05) effect on BCS of crossbred steers, being highest for group C (Tale 4). That increased may be due to rumen fermentation beneficially effect of yeast culture, which result in high feed intake and proper utilization of the end product of fermentation.

This result is in line with the finding of Ayad *et al,* (2013), who studied the effect of yeast culture supplementation on body condition score, milk production and some biochemical parameters in peri-partum dairy cows and find out stabilization of BCS with reduction of reserve mobilization after calving. Supplementation of yeast culture enhanced the fermentative and digestive functions in the rumen which can usefully modify microbial activities. (Denev *et al.,* 2007).

Yeast culture improve fiber digestion due to stimulated rumen fungi in dairy animals resultantly increased the BCS (Chaucheyras *et al.,* 1995).

Effect of yeast on the fecal flora

Mean changes in coliform species showed that yeast culture (*Saccharomyces cerevisiae*) supplementation in the rations have significant (P<0.05) effect on crossbred steers, being highest for group C and lowest for control group (Table 5). The *Lactobacillus* population in feces is a widely used index for estimation of balance of gut microbial balance.

It is estimated that higher numbers of coli form indicates dysbiosis (Fuller, 1989).

L*actococcus* is a genus of lactic acid bacteria and mostly it is non-pathogenic bacteria (Farah *et al.,* 2016). Mean changes in bacterial *Lactobacilli* showed that yeast culture (*Saccharomyces cerevisiae*) supplementation in the rations has significant (P < 0.05) effect on crossbred steers being highest for group C and lowest for control group.

Yeast culture supplementation in the feed has positive effect on *Lactobacillus* population in our study. Our results are in agreement with finding many other studies who reported *that Lactobacillus* in the fecal samples increases with yeast supplementation (Agazzi *et al.*, 2014*)*. Overall results indicate that yeast supplementation may have an ability to reduce the pathogenic bacteria *(i.e. E. coli*) and increase the beneficial bacteria (*Lactobacillus* sp).

The yeast culture may have beneficial effects on health of the animals by improving its weight gain and intake.

Table 1. Estimated ingredients and nutrient composition of concentrate feed of shandar Vanda at LR & DS Surezai Peshawar.

Item	Control diet
Chemical composition (% DM)	
Dry matter	91.77
Crude protein	16.40
NDF	22.33
ADF	11.15
Ash	11.19
Calcium	0.71
Total phosphorous	0.66
Ingredients (%)	
Cotton seed cake	20.00
Mustard seek cake	18.00
Maize oil cake	15.00
Rice polish	7.00
Wheat bran	10.00
Wheat grain	6.00
Corn gluten 20 %	6.00
Corn gluten 30 %	6.00
Cane molasses	10.00
Urea	0.50
Dicalcium phosphate	0.50
Limestone power	0.50
Sodium chloride	0.50
Cost per kg	18.14

Table 2. Effect of dietary yeast supplementation on dry matter intake, body weight gain and feed conversion ratio (Means ± SEM) in cross breed steers.

Parameters	Groups		
	A	B	C
Average daily DM intake, kg	4.19^{b}±0.01	4.26^{b}±0.09	4.33^{a}±0.01
Average daily body weight gain, kg	0.52^{b}±0.02	0.60^{b}±0.05	0.70^{a}±0.08
Feed conversion ratio (kg feed/kg gain)	8.00^{b}±0.49	6.82^{b}±0.52	6.09^{a}±0.44

$^{a, b}$ Values on the same row with different superscripts differ significantly ($p<0.05$); In group A (A-0) steers were fed control diet, group B (B-10) cows were fed control diet plus commercially available yeast at the rate of 10g/d/animal while group C (C-20) steers were fed control diet plus commercially available yeast at the rate of 20g/d/animal.

Table 3. Effect of dietary yeast supplementation on growth rate(Means ± SEM) in cross breed steers.

Growth characteristics	Groups		
	A	B	C
Average initial body weight, kg	137.59.±3.87	136.43±3.60	134.55±3.25
Average final body weight, kg	169.00^{b}±2.31	173.45^{b}±3.10	176.7^{a}±5.45
Average mean body weight, kg	31.66±1.56	37.02±0.50	42.15±2.20
Average daily body weight gain, kg	0.52^{b}±0.02	0.60^{b}±0.05	0.70^{a}±0.08

$^{a, b}$ Values on the same row with different superscripts differ significantly ($p<0.05$); In group A (A-0) steers were fed control diet, group B (B-10) cows were fed control diet plus commercially available yeast at the rate of 10g/d/animal while group C (C-20) steers were fed control diet plus commercially available yeast at the rate of 20g/d/animal.

Table 4. Effect of dietary yeast supplementation on body score condition (Means ± SEM) in cross breed steers.

Parameters	Groups		
	A	B	C
Initial body condition score	3.00±0.00	3.00±0.00	3.00±0.00
Final body condition score	3.25^{b}±0.14	3.37^{b}±0.12	3.87^{a}±0.12
Changes in body condition score	0. 25^{b}±0.1	0.37^{b}±0.12	0. 87^{a}±0.12

$^{a, b}$ Values on the same row with different superscripts differ significantly ($p<0.05$); In group A (A-0) steers were fed control diet, group B (B-10) cows were fed control diet plus commercially available yeast at the rate of 10g/d/animal while group C (C-20) steers were fed control diet plus commercially available yeast at the rate of 20g/d/animal.

Table 5. Effect of dietary yeast supplementation on fecal flora (Means ± SEM) in cross breed steers.

Bacteria	Groups		
	A	B	C
Coliforms	3.77^{b}±0.00	53.57^{b}±0.00	53.34^{a}±0.00
LAB (*Lactobacilli*)	5.23^{b}±1.35	5.99^{b}±0.87	7.34^{a}±0.66

$^{a, b}$ Values on the same row with different superscripts differ significantly ($p<0.05$); In group A (A-0) steers were fed control diet, group B (B-10) cows were fed control diet plus commercially available yeast at the rate of 10g/d/animal while group C (C-20) steers were fed control diet plus commercially available yeast at the rate of 20g/d/animal.

Conclusion

It can be concluded that dietary addition of inactive dry yeast (*Saccharomyces cerevisiae*) at the rate of 20g/animal as fed basis, improved average daily gain, feed conversion ratio and better health in growing steers without any adverse effects. Yeast culture is one of the supplementary feed sources for livestock, especially for ruminants.

References

Agazzi A, Tirloni E, Stella S, Maroccolo S, Ripamonti B, Bersani C, Caputo JM, Dellorto V, Rota N, Savoini G. 2014. Effects of species-specific probiotic addition to milk replacer on calf health and performance during the first month of life. Annals of Animal Science **14(1),** 101-115. https://doi.org/10.2478/aoas-2013-0089.

Ahmad S, Hinch G, Prior J, Thomas P, Burrell D. 2012. The role of extension in changing the dairy industry in Pakistan: The Journal of Animal and Plant Sciences **22(2),**113-116.

Arambel MJ, Kent BA. 1990. Effect of yeast culture on nutrient digestibility and milk yield response in early to mid-lactation dairy cows. Journal of Dairy Science **73,** 1560-1563. https://doi.10. 3168/jds.S0022-0302(90)78825-X.

Ayad MA, Benallou MS, Saim MA, Smadi MA, Meziane T. 2013. Impact of feeding yeast culture on milk yield, milk components, and blood components in Algerian dairy herds. Journal of Veterinary Science Technology **4,** 135-140. https://doi.10.4172/2157-7579.1000135.

Bertin G, Spring P, Fallon R, Earley B. 2005. Benefits of yeast culture (Yea Sacc®1026) supplementation on performance of bull calves. Nutritional Biotechnology in the Feed and Food Industry (Suppl. 1), Lexington, KY, USA pp. 107.

Chaucheryras FG, Fonty G, Bertin P, Gouet S. 1995. In vitro utilization by a ruminal acetogenic bacterium cultivated alone or in association with an Archea methanogen is stimulated by a probiotic strain of *Saccharomyces cerevisiae*. Applied and Environmental Microbiology **61,** 3466-3467.

Chaucheyras F, Walker ND, Bach A. 2008. Effects of active dry yeasts on the rumen microbial ecosystem: Past, present and future. Animal Feed Science and Technology **145(1),** 5-26.

Dawson KA, Newman KE. 1988. Fermentationsin rumen-simulating continuous cultures receiving probiotic supplements. Journal of Animal Science **67,** 500.

Denev ST, Peeva P, Radulova N, Stancheva G, Staykova G, Beev G, Todorova P, Tchobanova S. 2007. Yeast Cultures in Ruminant Nutrition. Bulgarian Journal of Agricultural Science 357-374.

Desnoyers M, Reverdin S, Bertin G, Duvaux-Ponter C, Sauvant D. 2009. Meta analysis of the influence of *(Saccharomyces cerevisiae*) supplementation on ruminal parameters and milk production of ruminants. Journal of Dairy Science **92,** 1620-1632. https://doi.10.3168/jds.2008-1414.

Erasmus LJ, Botha PM, Kistner A. 1992. Effect of yeast culture supplement on production, rumen fermentation, and duodenal nitrogen flow in dairy cows. Journal Dairy Science **75,** 3056-3065. https://doi.10.3168/jds.S0022-0302 (92)78069-2.

Fallon RJ, Earley B. 2004. Effects of Yea-Sacc ®1026 inclusion on the performance of calves offered *ad labium* concentrates. Proceedings of the 20th Annual Symposium Nutritional Biotechnology in the Feed and Food Industries. Lexington, KY, USA, May 24-26, pp. 76.

Farah N, Sadia M, Shakira G, Tahir SS, Naseem R, Muhammad I. 2016. Isolation, characterization and application of indigenous lactic acid bacteria in milk fermentation. International Journal of Biosciences **9(6),** 415-430. https://doi. org/10.12692/ijb/9.6.415430.

Fortina R, Battaglini LM, Opsi S, Tassone M, Renna M. 2011. Effects of Inactivated Yeast Culture on Rumen Fermentation and Performance of Mid-Lactation Dairy cow. Journal of Animal and Veterinary Advances **10(5),** 577-580. https://doi. 10.3923/javaa.2011.577.580.

Hossain FM, Islam MM, Aara M, Iliyas N. 2014. Supplementing probiotics (*saccharomyces cerevisiae*) in multiparous crossbred cows ration provoke milk yield and composition. Online Journal of Animal Feed Resources **4,** 18-24.

Lesmeister KE, Heinrichs AJ, Gabler MT. 2004. Effects of supplemental yeast (*Saccharomyces cerevisiae*) culture on rumen development, growth characteristics, and blood parameters in neonatal dairy calves. Journal of Dairy Sciences **87(6),** 1832-1839. https://doi.10.3168/jds.S0022-0302 (04)73340-8.

Magalha FS, Lima FS, Branco AF, Yoon I, Santos JE. 2007. Effect of feeding yeast culture on performance health and immunocompetence of dairy calves. Journal of Dairy Science**91,** 1497-1509. https://doi.10.3168/jds.2007-0582.

Martin SA, Nisbet DJ. 1992. Effect of direct-fed microbes on rumen microbial fermentation. Journal of Dairy Science **(75),** 1736-1744. https://doi.10. 3168/jds.S0022-0302 (92)77932-6.

Mutsvangwa T, Edwards IE, Topps IE, Paterson GFM. 1992. The effect of dietary inclusion of yeast culture (Yea-sac) on patterns of rumen fermentation, food intake and growth of intensively fed bulls. Animal Production **55,** 35. https://doi.org/ 10.1017/S0003356100037247.

Poppy GD, Rabiee AR, Lean IJ, Sanchez WK, Dorton KL, Morley PS. 2012. A meta-analysis of the effects of feeding yeast culture produced by anaerobic fermentation of *Saccharomyces cerevisiae* on milk production of lactating dairy cows. Journal of Dairy Science **95(10),** 6027-6041. https://doi.10. 3168/jds.2012-5577.

Sara A, Cighi V, Odagui A, Sichet C. 2004. The effect of Yea-Sacc ®1026 on performance in sheep. Proceedings of the 20th Annual Symposium, Nutritional Biotechnology in the Feed and Food Industries: May 24-26: 76.

Shakira G, Anjum MI, Azim A, Ahmed I. 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 and Plant Sciences **25(1),** 53-59.

Shakira G, Mirza IH, Latif A. 2013. Scope of common DNA based methods for the study of rumen bacterial population. Bangladesh Journal of Animal Sciences **41(2),** 141-146.

Steel RGD, Torrie JH. 1997. Principles and Procedures of Statistics; A Biometrical Approach. 3rd Ed, McGraw-Hill, New York, USA.

Sune RW. 1998. The yeast culture (Saccharomyces cerevisiae) strain 1026 as manipulator of ruminal fermentation in relation to milk yield and composition. Scientific Papers **3(1),** 70-79.

Szucs JP, Suli A, Halasz T, Arany A, Bodor Z, 2013. Effect of live yeast culture *Saccharomyces cerevisiae* on milk production and some blood parameters. Scientific Papers Animal Sciences and Biotechnologies **46(1),** 40-44.

Uyeno Y, Shigemori S, Shimosato T. 2015. Effect of Probiotics/Prebiotics on Cattle Health and Productivity. Microbes Environments **30(2),** 126-132. https:// doi: 10.1264/jsme2.ME14176.

Uyeno Y, Kiyoshi A, Toshiya H, Hiroshi Y, Hiroaki Y, Tsuneko Y, Kenji K, Minoru I, Shiro K, Makoto H. 2017. Effects of supplementing an active dry yeast product on rumen microbial community composition and on subsequent rumen fermentation of lactating cows in the mid-to-late lactation period. Animal Science Journal **88(1),** 119-124. https://doi: 10.1111 /asj.12612.

Williams P, Tait G, Innes GM, Newbold CJ. 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. Journal of Animal Sciences **69,** 3016-3026.

Yalcın S, Suzan Y, Pinar C, Arif O, Cemalettin B, Onder E. 2011. The nutritive value of live yeast culture (*Saccharomyces cerevisiae*) and its effect on milk yield, milk composition and some blood parameters of dairy cows. Asian-Australas Journal of Animal Sciences **24(10),** 1377-1385. https://doi.org/ 10.5713/ajas.2011.11060.