Research Article

Effect of Yeast Culture (*Sacchromyces cerevisiae*) on Production Performance in Achai Cattle

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Abstract | The current study was carried out at Livestock Research & Development Station Surezai, Peshawar in order to examine the efficacy of yeast culture (*Saccharomyces cerevisiae*) on feed intake, milk yield, and milk composition of Achai cattle. Cows were kept in three groups A, B and C. All animals were fed with basic diet, comprising of green fodder, wheat straw and compound concentrate as per their maintenance and production requirement twice daily. Group A animals were considered as control with no supplementation of yeast culture, while Group B and C animals were supplemented with 20 g/day and 40 g/day of yeast culture respectively and were considered as treatment groups. Water was provided *ad libitum* to all groups. Yeast culture (YC) supplementation significantly ($p<0.001$) increased the average daily milk yield. The highest milk yield 10.84±1.17 kg/day was recorded for cows fed with 40g YC. Cows on 20 g YC ration produced higher milk fat 3.77±0.84% ($P<0.05$). Cows on 40 g yeast culture ration produced higher milk protein (3.43±0.04%). Higher ($P<0.05$) total milk solid not fat (SNF) content was recorded for animals fed with 20g yeast culture ration. Daily feed intake was significantly ($P<0.001$) different among groups, highest mean daily feed intake of 38.74±3.36 kg/day was found in group C. Economically ration having 40g YC produce 145.04 liter more milk, worth (145.04 X 70 = Rs.10152.8/-) than control group, while extra cost of yeast culture was Rs.4116/-, So, result in net profit of Rs: 6036.8/- during 7 week period. It is concluded that Achai cattle ration supplementing with high level of YC were observed with increased milk fat, feed intake, Protein, SNF and milk yield. Maximum production was observed with higher proportion of 40g YC as compare to other rations.

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Introduction

The Achai cattle are an undocumented indigenous cattle breed of Pakistan and are well adapted in Hindukush Mountains in north region of Pakistan (Saleem *et al*., 2013). This cattle have dairy and light draught qualities, having the ability to better utilize best in scarce fodder resources, and can achieve adequate production under mountainous and semi mountainous areas (Khan *et al*., 2008). This is a freely grazing, diseases resistant and have better performance in mountainous areas and better efficient compared to any other cattle breed of Pakistan, excluding Sahiwal, and Jersey crosses (Kenyanjui and Ali, 2009). In contrast to other cattle breeds of the country, better reproductive qualities have been noted in Achai cattle (Saleem *et al*., 2013). Although, production performance of Achai cattle breed is low as compared with other exotic and indigenous dairy breeds reared in Pakistan. Certain breeding programs such as crossing of Achai with exotic Jersey breed has been implemented in Khyber Pakhtunkhwa to increase the milk production potential of Achai breed of cattle. However, nutrition especially dietary supplementations which also plays vital role in the improvement of milk production potential of dairy animals. Globally, yeast products are commonly practiced as dietary supplement in the ration of lactating animals. It results in higher level of milk protein and fats which leads to increase milk production by manipulating ruminal volatile fatty acid production and rumen microbial population (Erasmus *et al*., 1992; Putnam *et al*., 1997). Previous literature proved the role of dietary supplementation of yeast culture on dry matter intake (DMI) and its subsequent affect on production of milk (Dann *et al*., 2000; Schingoethe *et al*., 2004). Moreover, digesability of goat has been improved with dietary yeast supplementation (Stella *et al*., 2007). Studies of supplementing lactating dairy cows with yeast culture (*Saccharomyces cerevisiae)* in feed were taken into consideration first by (Adams *et al*., 1981; Harrison *et al*., 1988). Garge *et al*. (2000) concluded that the factor responsible for significant increase in milk yield and milk composition in dairy cows is yeast culture which is a growth promoter.

The animal feed industry engrossed yeast culture (*S.cerevisae*) to study its effects in systemic approach by using it as feed supplement. Previously, the dietary effects of (*S.cerevisae*) in dairy cows on different aspects in various cattle breeds has been studied, however, their roles on production performance in Achai cattle has never investigated. Therefore, the current trial was carried out to ascertain the effect of dietary yeast culture (*S. cerevisiae*) supplementation on milk composition, milk yield, feed intake, and economics in Achai cattle farming.

Materials and Methods

The trial was carried ou at the Livestock Research and Development Station (LR & DS) Surezai, Peshawar. The animals handling and rearing protocols were ratified by ethical committee of the faculty of animal husbandry and veterinary sciences, the University of Agriculture Peshawar-Pakistan. Experimental feed to cattle was gradually increased until upto complete experimental ration in adaptation period of one week. Adaptation period was followed by two months (May-June) experimental period. The experiment was conducted in summer where the summer is very hot and the maximum recorded temperature during trials period was ranged from 36-41˚C (Figure 1). The animals were housed in a two-row front to front housing system.

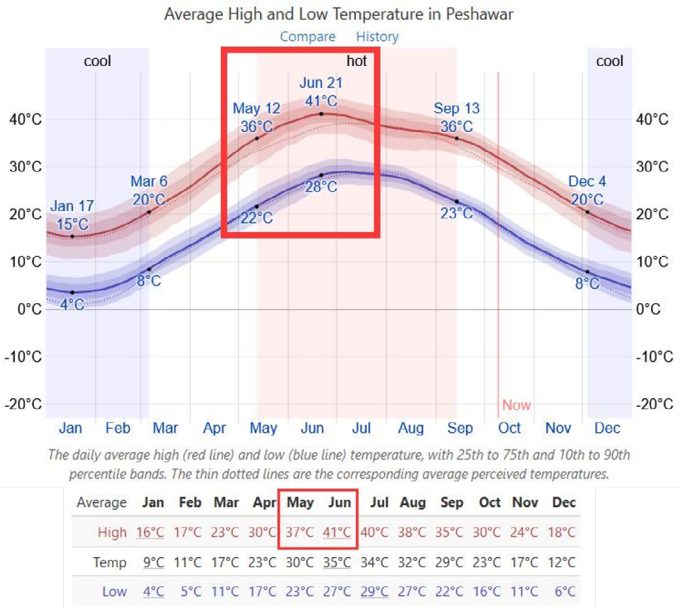

Figure 1: *Temperature history recorded in District Peshawar.*

Animal selection

A total number of 9 Achai cows on their first lactation were used in the current study. Animals selected were nearly of same lactation stage, age, body weight and mean total milk yield. All cows were permitted a circular vaccination and deworming against the common epidemic and parasitic diseases. Random distribution of all the experimental animals were done into

A, B and C namely 3group, each having 3 animals.

Feeding trial

At day zero weighing of all animals with empty stomach were done. Animals were offered to have the available daily ration which mainly comprising of green fodder, wheat straw and compound concentrate feed according to NRC standards. Sadabahar (Sorghum × Sudan) green fodder was fed to experimental animals. Group A animals were considered as control with no supplementation of yeast culture, while Group B and C animals were supplemented with 20 g/day and 40 g/day of yeast culture respectively and were considered as treatment groups. AB-MOS Yeast (*S. cerevisiae*) was used for research trial and was fed in meal farm. Water was provided *ad libitum*.

Feed intake

The following formula was utilized for determination of feed intake data on daily basis

$$\textit{Feed intake} = \textit{Feed offered} - \textit{Feed refused}$$

Milk Yield

The seven weeks milk yield data were recorded for experimental animals by hand milking twice daily as per routine milk practices at the station.

Milk composition

Lactoscan milk analyzer machine was used for chemical analysis of milk samples on weekly basis. Protein, Fats, Lactose and SNF were determined in milk samples collected from each experimental animal in labelled bottles.

Statistical Analysis

The General linear model (GLM) technique in statistical program (SAS, 1998) was utilized for the effect of yeast culture (*S.cerevisae*) on feed intake, milk yield, and milk composition by statistical analysis of data. Storage of data was done by utilizing Computer software excel, while Duncan multiple range test (DMR) was for mean comparison.

The Model used was:

$$Yijk = \mu + \alpha i + \beta j + \epsilon ijk$$

Where;

Yijk: Dependent variables; μ: Population Constant; αi: Effect of treatment; β_j: Effect of week; ϵijk: Error term.

Results and Discussion

All nine animals stayed clinically healthy throughout the whole experimental period. Research study of supplementation of *S. cerevisae* different levels on feed intake, milk yield and composition in the ration of early lactating Achai cows conducted at Livestock Research and Development Station Surezai has following results.

Effect of yeast culture supplementation on feed intake of Achai cattle

Effects of different level of yeast culture supplementation in the ration on daily feed intake of Achai cows are presented in Table 1. Statistical analyses of the data showed that different level of yeast culture in rations has significant (P<0.05) effect on feed intake of Achai cows. Cows fed on ration (40g yeast culture) had 4.64% and 2.11 % more feed intake than control and 20g yeast culture fed ration group respectively. Mean value revealed that group fed on ration having 40g yeast culture was recorded for maximum total mix ration (TMR) intake (38.74±3.36 kg day^{-1}), followed by group fed on ration having 20g yeast culture (37.92±3.36 kg day^{-1}), while minimum feed intake (36.82±3.36 kg day^{-1}) was recorded for control group.

Table 1: *Efficacy of Yeast Culture on milk yield (kg/day) and feed intake (kg/day) of Achai cattle.*

Group	Mean ± SE	Milk yield	P- Value
A. Control (0gm Yeast culture /day)	36.82^{c}±3.36	7.88^{c} ±1.17	0.0001
B. (20 gm Yeast culture / day)	37.92^{b}±3.36	10.11^{b} ±1.17	0.0001
C. (40 gm Yeast culture / day)	38.74^{a}±3.36	10.84^{a} ±1.17	

Means at different superscripts are different at $\alpha_{0.05}$

In current study Yeast culture (*S.cerevisiae*) supplementation recorded with affected feed intake. Ration with increasing level of yeast culture was observed with a linear rise in the intake. The feed intake increase might be due to beneficial effect of yeast culture itself, by providing a mixture of micronutrients to arouse growth of bacteria in the rumen, which in turn potentiating fermentation of fiber and end products utilization of fermented fibers to prevent their pooling in the rumen. These results agree with studies conducted by Erasmus *et al.* (1992), Stella *et al.* (2007), Schingoethi *et al.* (2004), Callaway and Martin (1997), Desnoyers *et al.* (2009) and Robinson and Garret (1999).

Effect of Yeast culture on milk yield of Achai cattle

Table 1 revealed effects of different level of yeast culture supplementation in the ration on milk yield changes of Achai dairy cattle. Mean value revealed that group C (40g yeast culture) were recorded with maximum milk yield (10.84 ±1.17 kg/day) while control group was recorded with minimum milk yield (7.88 ±1.17 kg/day). Cattle supplemented with (40g yeast culture) ration had 27.30% higher milk yield than control group (0g yeast culture). Whereas the group C had only 6.73% higher milk yields than group B (20g yeast culture) of the same experiment. A progressive increment in yeast dosage recorded with linear increment in milk yield. This increase in milk yield could be attributed to the fact that yeast culture provides growth factor in soluble form that stimulate cellulytic bacteria growth and leading to cellulose digestion. The findings of the current trial are also in correspondence with the work done by Kuderna *et al.* (2007) and Robinson and Garrett (1999).

Effect of yeast culture on milk composition

Milk fat (%): Fat content of Achai cows, fed on rations having different level of yeast culture is presented in Table 2. Statistical analysis of the data indicated that increase (P<0.05) milk fat of Achai cow was recorded with increase yeast culture in the ration. Control group had average milk fat 3.06±0.84%, 20g yeast culture group had average milk fat 3.77±0.84%, while 40g yeast culture group animals had average milk fat 3.43±0.84%. Animal in group B (20g yeast culture) produced 18.83 and 9.01 percent higher milk fat from control group and group C (40g Yeast culture), respectively. Fat content of milk was increased by having positive effects on stimulation of cellolytic bacteria and preferred orientation of fermentation to acetic acid production. The present results are analogous with the results of preceding study (Alshaikh *et al.*, 2002).

Milk protein (%): Effect of Yeast Culture on milk protein is presented in Table 2. Result support that increasing the concentration of yeast culture effect milk protein content (P<0.05). Among treatment, control group had average milk protein 3.15±0.04%, group B (20g yeast culture) had average milk protein 3.28 ±0.04% and group C (40g yeast culture) had average milk protein 3.43±0.04%. Cows in group C (40g yeast culture) produced 8.16 and 4.37% higher milk protein than control and group B animals, respectively. These results were in the opinion by Erasmus *et al.* (1992), by concluding that yeast culture supplementation significantly (p<0.05) increased methionine along with other limiting amino acids. This current work assists to support the study of Gunther (1989) who noted 16.3% and 8.4% increment in milk protein and yield, respectively.

Milk lactose (%): Table 2 presents changes in the data of milk lactose in response to various yeast culture containing rations. Statistical analysis of the data demonstrated that yeast culture supplemented in the ration has no significant (P>0.05) effect on milk lactose of Achai cows. Mean values showed that high lactose (4.62±0.04%) was recorded for group B, while control group animal produced (4.52±0.04%). These results agreed with results of Huber *et al.* (1989). Similar results were observed by Arambel and Kent (1990).

Table 2: *Milk profile of Achai cows (Mean± S.E) effected by ration having different level of yeast culture.*

Milk composition (%)	Treatment (Yeast culture supplementation)			
	0 g	20 g	40 g	P- value
Fat	3.06^{b}±0.84	3.77^{a}±0.84	3.43^{ab}±0.84	0.05
Protein	3.15^{bb}±0.04	3.28^{b}±0.04	3.43^{a}±0.04	0.0005
Lactose	4.52±0.04	4.63±0.04	4.56±0.04	0.24
SNF	8.38^{b}±0.06	8.64^{aa}±0.06	8.62^{a} ±0.06	0.001

Means at different superscripts are different at $\alpha_{0.05}$

Milk SNF (%): Effects of rations having different level of yeast culture on SNF content of Achai milk were presented in Table 2. It is revealed from the results that there was significant (P<0.05) effect of high level of yeast culture on milk SNF. Mean value shows that highest SNF (8.64±0.06) percent was recorded for group B (20g Yeast culture). While about same result for SNF content (8.62 ±0.06) percent was recorded for group C (40g Yeast culture), while control group produced 8.38±0.06%. Present result shows that animals in group B had produce 3% more SNF content in milk than control. These results were equivalent to the findings of Alshaikh *et al.* (2002) and Robinson and Garrett (1999).

Means comparison of overall parameters in relation to weekly effect

Figure 2 revealed the comparison of means of overall parameters of Achai cows supplemented with different levels of yeast culture: 0g, 20g and 40 g/day in relation to the effect of week. Table results shows that

Table 3: *Economics of Yeast culture different levels supplementation in the ration of Achai cattle.*

Treatment (a supplementation)	Milk yield (liters) increased vs control	Milk yield price (Rupees)	Y.C[a] cost (Rupees)	Net profit (Rupees)
(20 gm	109.27	109.27×70[b]=7648.9/-	2058	5590
(40 gm	145.04	145.04×70[b]=10152/-	4116	6036
Mean	127.15	8900.45/-	3528	5813

a: *yeast culture;* **b:** *per liter price.*

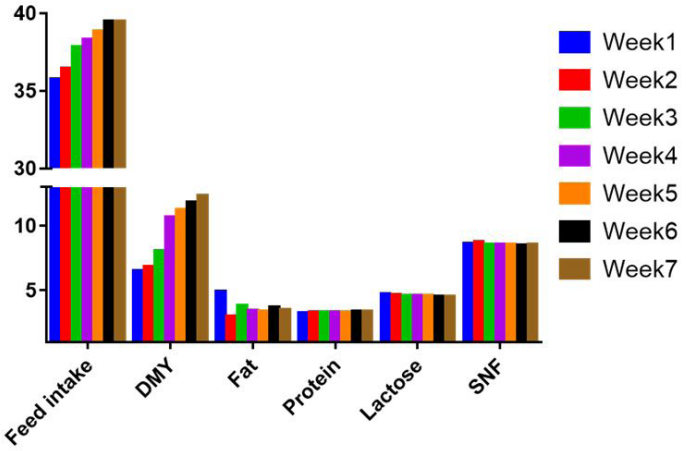

Figure 2: *Weekly effect of yeast culture on overall parameter of Achai cows.*

ascending weeks with continuous yeast culture feeding had a significant effect on mean feed intake which increased from 35.72kg in first week to 39.46kg in 7 week. Similarly ascending weeks with continuous feeding of yeast culture was recorded with significantly increase on mean daily milk yield which increased from 6.50 liter in first week to 12.30 liter in 7th week. Milk fat percentage was slightly increased by ascending weeks from 3.25 to 3.50, while protein percentage was also slightly increased from 3.24 to 3.37. Weeks of feeding showed no significant effect on lactose and SNF content.

Economics of yeast culture supplementation in ration of Achai cattle

Economics of yeast culture supplementation in the ration of Achai cattle has been shown in Table 3. Data showed that cows fed on ration (40g yeast culture) resulted in high net profit of Rs:6036/-, while (20g yeast culture) has a net profit of Rs:5590/-. The mean values recorded for milk yield(liters),extra cost of yeast culture (rupees), milk yield cost (rupees) and net profit (rupees) were 127.15,8900.45,3528 and 5813, respectively.

Conclusions and Recommendations

The conclusion made from the current study is that ration should be supplemented with 40 gm yeast culture to increase the milk yield and quality in Achai cattle.

Novelty Statement

The study is novel in finding out dietary supplementation of *Saccharomyces cerevisiae* which improves productivity and milk quality

Author's Contribution

Muhammad Hanif Khan: Executed and performed the research and wrote the manuscript.
Syed Muhammad Suhail: Conceived, planned and supervised the research.
Hayaz uddin: Assisted in research work.
Aitbar Khan and Rashid Ahmed Magsi: Helped in data analysis.
Rajwali Khan: Wrote, edited and revised the first draft.
Iftikhar Ahmed: Helped in revision.
Asim Ijaz and Khalid Khan: Edited the manuscript.

Conflict of interest

The authors have declared no conflict of interest.

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