

Dietary Supplementation of *Saccharomyces Cerevisiae* on Production and Health Status In Lactating Dairy Cattle

Abstract number: 22442

Dr. Shakira Ghazanfar
PhD-Microbiology



Quaid-i-Azam University
PAKISTAN



MAIN ISSUE

Important ruminal-gut microbial flora

A. Main Beneficial Bacteria

1. *Lactobacillus* sp.
2. *Lactococcus* sp.
3. *Bifidobacterium*

B. Main Harmful Bacteria

1. *E. coli*
2. *Enterobacter* sp.
3. *Enterococcus* sp.

Nutrient digestion and ruminal-gut microbes

The **diversity** and **function** of **ruminal gut microbes** is very important in **feed digestion**. The way the nutrient are digested in GIT in ruminants they have a crucial input on **growth, health and productivity** (Fuller, 1989)

SOLUTION TO THE PROBLEM

1. Use of Antibiotic (Bayatokotar et al., 2011)

- ❑ Improves gut health and improves productivity of milking animals

Draw backs

- Human health concerns
- Emergence of antibiotic resistance strains
- Banned

2. Use of Balance Diet

3. Use of Microbial Feed Additives (Puniya et al., 2015)

Alternative agent

- ❑ Microbial feed additives or probiotics helps in the establishment and maintenance of suitable type of microbes in gastrointestinal tract (GIT)
- ❑ Reduces pathogenic bacteria in GIT and improves productive performance of milking animals (Musa et al., 2009)

Innovative Solution of the Problem

- In this context, there is a dire need to propose an empirical study that focuses on **probiotic utilization** and its efficiency in **local dairy** animals.
- **Little work** has been conducted regarding the use of probiotics to enhance the performance of dairy animal.
- From this line of research, we conducted an **empirical study** to check the impact of **probiotic yeast** on the performance of **local breed** under the **control environment**.

OBJECTIVES

1. To study the **comparative impact** of *Saccharomyces cerevisiae* (Yea-Sac¹⁰²⁶) and **locally isolated yeast** on **PRODUCTION AND HEALTH STATUS** in **dairy cattle**

Phase II

Isolation, Identification and Characterization of Yeast

Yeast Identification

- 1. Morphological identification**
- 2. Biochemical identification**
- 3. Molecular Identification**

1. Probiotic Characteristics

- **Enzymatic potential**
- **Bile tolerance test**
- **Cholesterol lowering effect**

2. Anti-microbial Activity

3. Selection of Yeast Strain

4. Propagation of Yeast Strain

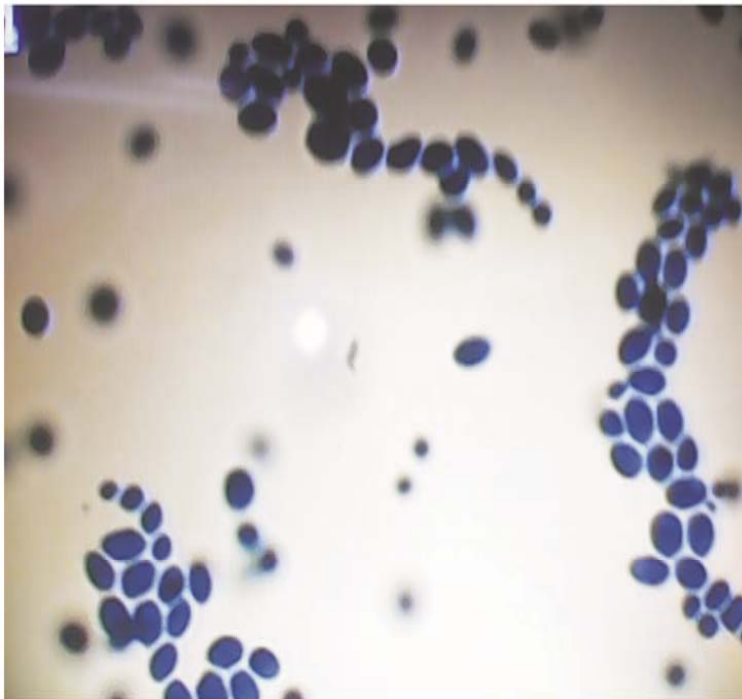
5. Preparation of Probiotic Feed

Results Phase I

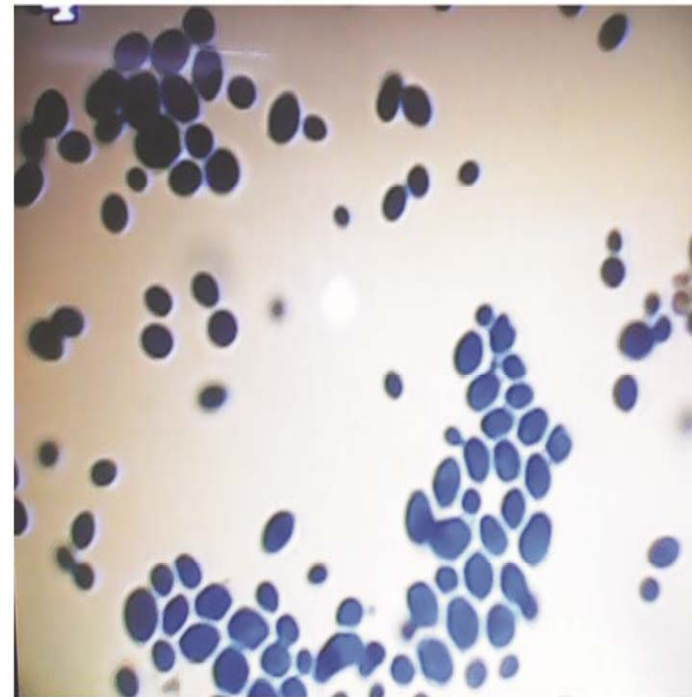
Identification of YEAST

Parameters	Yeast Strains	
	QAUSC03	QAUSC05
Morphological Characteristics		
Cell shape	Ellipsoid to elongate	Ellipsoid to elongate
Colony morphology	Circular	Circular
Colony surface	Smooth/Slimy	Smooth
Colony colour	Off-white	Pinkish
Colony elevation	Pulvinate	Umbonate
Colony margin	Entire	Entire
Biochemical Characteristics		
Glucose fermentation	+	+
Catalase	+	+
Fructose	+	+
Microbe identified	<i>Saccharomyces cerevisiae</i>	<i>Saccharomyces cerevisiae</i>

Simple Staining of Isolated Yeast Strains

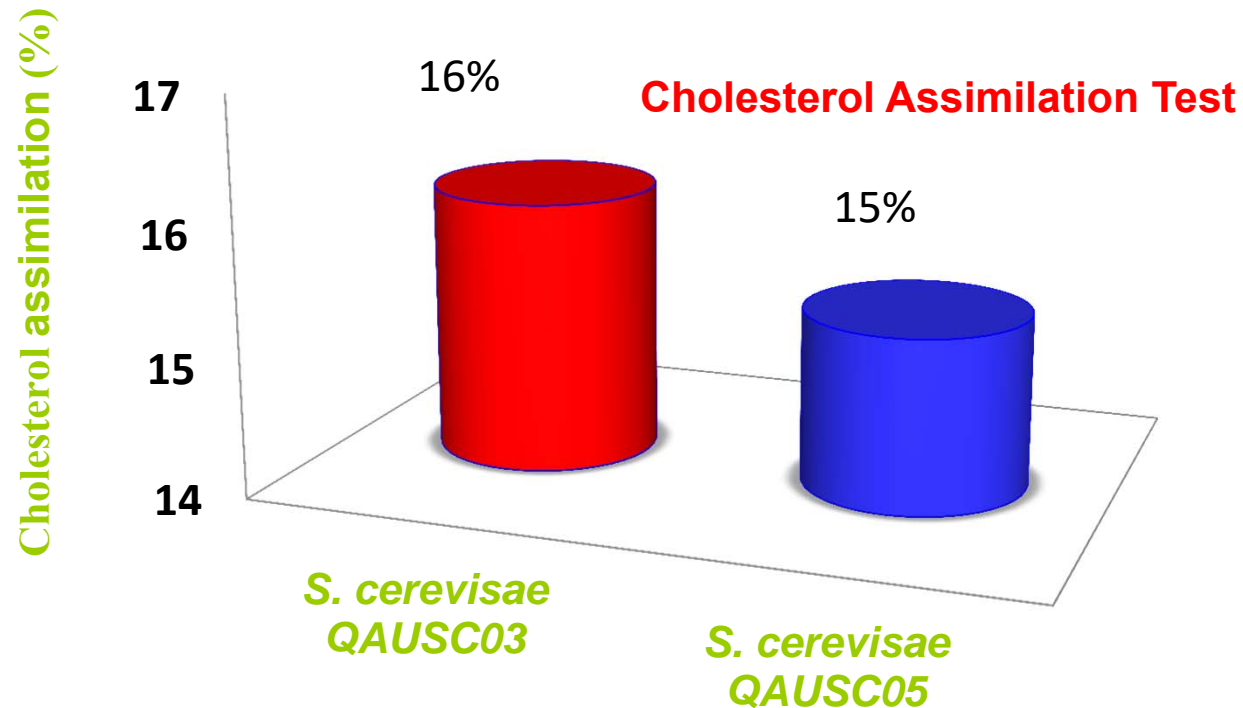


S. Cerevisiae QAUSC03



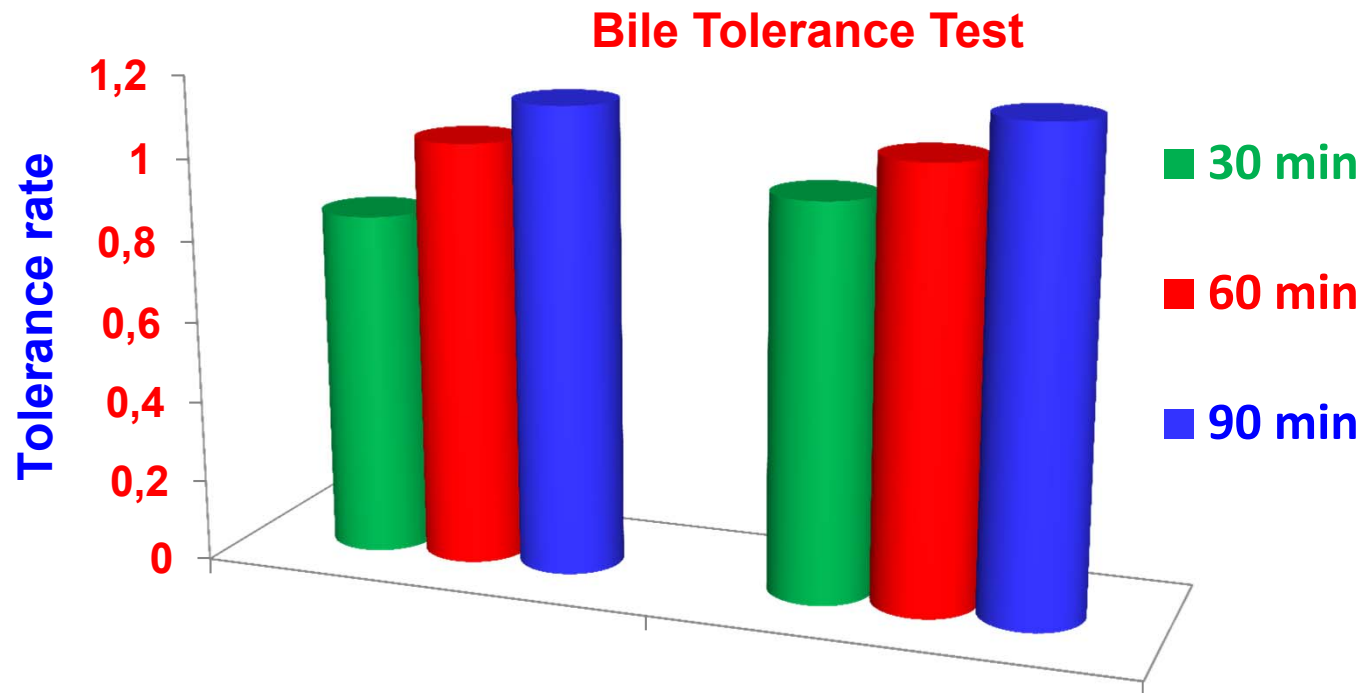
S. Cerevisiae QAUSC05

Probiotics Characteristics-Cholesterol Assimilation



Results indicated that the **QAUSC03** strain having comparatively better cholesterol lowering effect than **QAUSC05**

Probiotics Characteristics- Bile-Tolerance



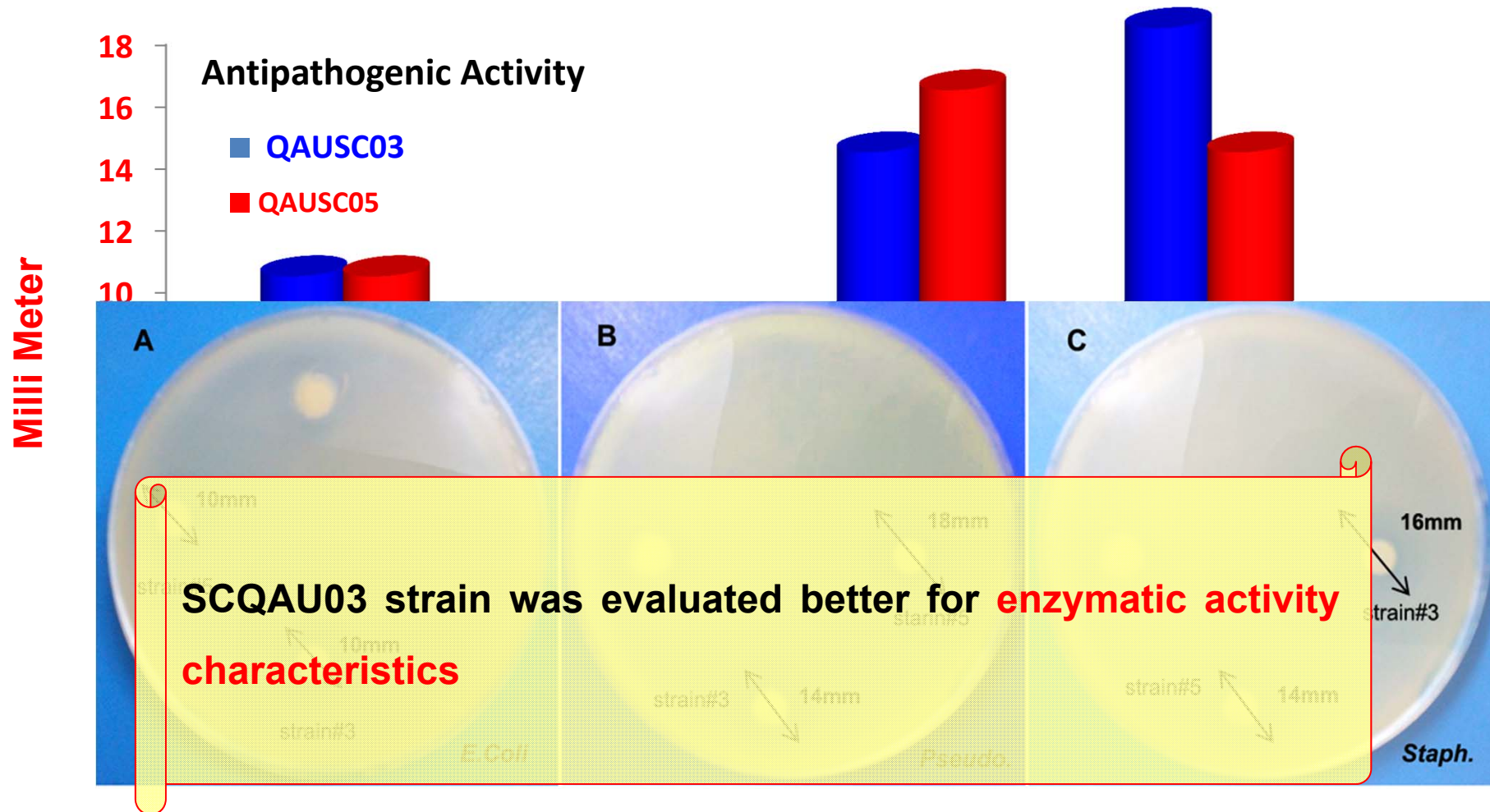
Results indicated that the **QAUSC03** strain having comparatively better bile tolerance than **QAUSC05**

Probiotics Characteristics - Enzymatic Activities

Enzymatic activities	QAUSC03	QAUSC05
Amylolytic acitivity	-	-
Cellulolytic acitivity	+++	++
Proteolytic acitivity	++	+

Both yeast strains displayed significant **cellulolytic** and **proteolytic** activity but no **amylolytic activity**

Probiotics Characteristics- Antipathogenic Activity



Conclusion Phase I

On basis of comparatively **higher potential for enzymatic activity** and **probiotic properties SCQAU03** strain was selected for further supplementation in **lactating dairy cattle feed**



Phase -II

To study the comparative impact of *S. cerevisiae*¹⁰²⁶ and locally isolated yeast on performance of dairy cattle

Parameters Studied

- ❑ **Productive performance:** Daily milk and feed Intake & feed efficiency
- ❑ **GIT health performance:** *Enterococcus, Lactobacillus, Enterobacter*
- ❑ **Immunity:**
 1. **Hematological Study:** Erythrocyte, Leukocyte, Hemoglobin, Lymphocytes, Monocytes, Eosinophils.
 2. **Serum Minerals Study:** Ca, P, Na, K
 3. **Blood Chemistry Study:** Glucose, Urea, Cholesterol
- ❑ **Economic analysis:**

Sampling Plan

- **Blood samples:** 0 and 60 days
- **Fecal sampling:** 0, 30 and 60 days
- **Milk sampling:** 0,10, 20, 30, 40, 50 and 60 days

Statistical Analysis

- **ANOVA** under CRD, using **LSD** (Steel and Torrie, 1984).

Results Phase II

Preparation of Probiotic Feed

Table 1: Chemical Composition of
Y

Probiotic feed preparation:

Probiotic feeds were formulated to add yeast at the rate of 2.5×10^7 cfu/g commercial available yeast and 1.7×10^8 locally isolated yeast and in control feed.

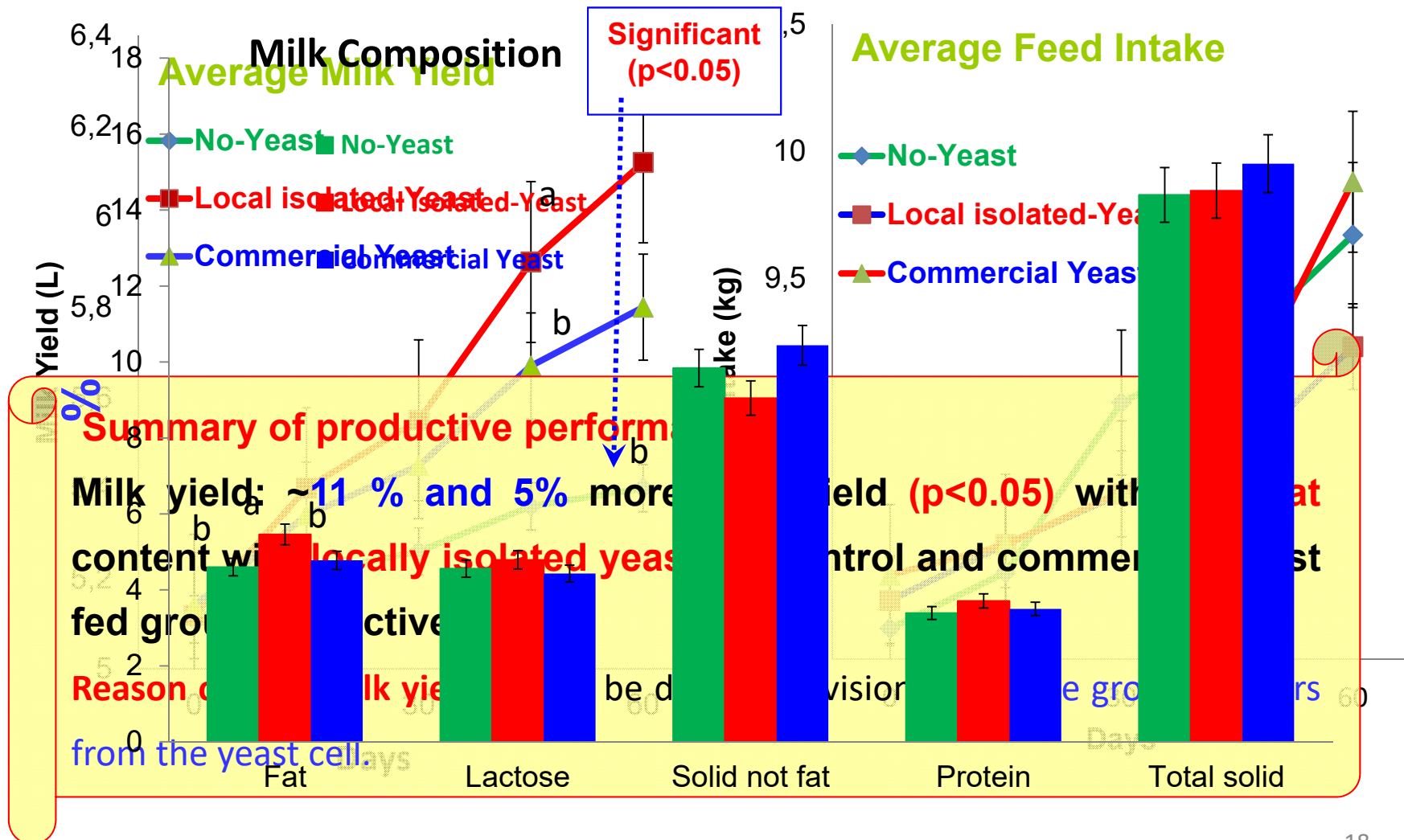
Advantage of Probiotic feed

1. Enhance nutritive values
2. Improve protein contents

Table 2: Preparation of Probiotic Feed

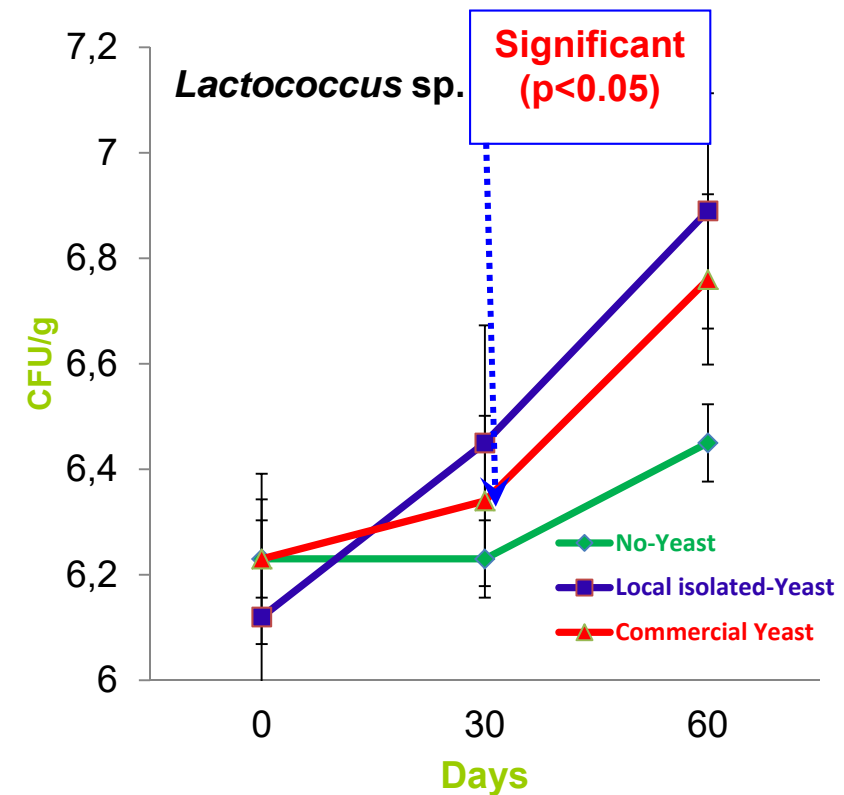
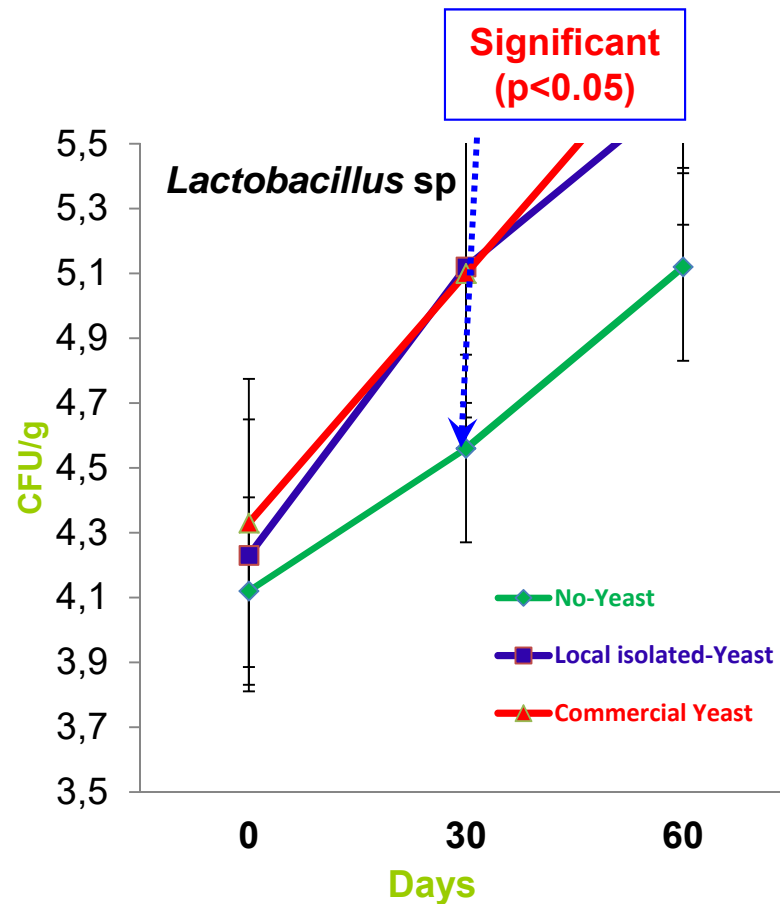
Feed Ingredients (%)	Control feed	Commercial Probiotic feed	Laboratory Probiotic feed
Maize	11	11	11
Rice	25	25	25
Molasses	08	08	08
Straw	23	23	23
Yeast addition	No	Yes	Yes
Feed composition (%)			
Protein	13 ± 0.5	12 ± 0.8	14 ± 0.7
Fiber	15 ± 0.7	14 ± 0.4	13 ± 0.6

Productive Performance of Dairy Cattle



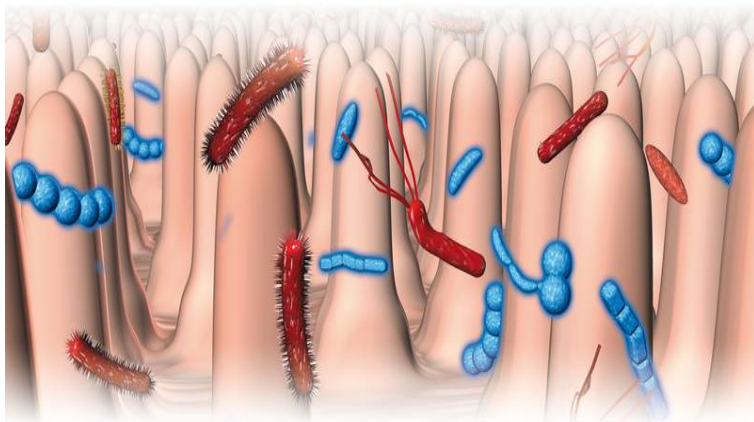
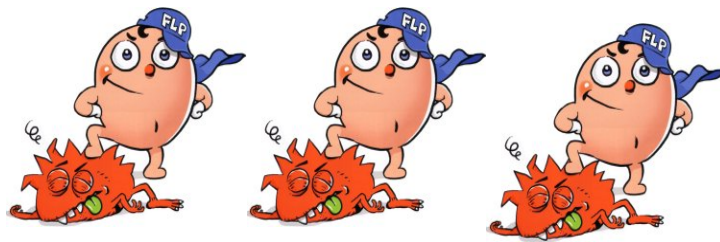
a, b values on the same row with different superscripts differ significantly (P < 0.05)

Quantitative Analysis (cfu/g) of Ruminal Gut Flora



***Lactobacillus* and *Entrococcus* sp population significantly (p<0.05) increases in the yeast fed animals**

Gut Health Performance of Dairy Cattle



Lab-Yeast supplemented improved (p<0.05) gut microbial balance resulting in increase digestion rate and better health performance

Reason: That improvement might be due to **Cellulolytic activity** of the LAB-Yeast cell

Economics Efficiency of Dairy Cattle

Parameters	Control	LAB-Yeast	COM-Yeast
Feed intake (Kg/day)	3.00	3.00	3.00
Value of feed @ Rs.11.50/ Kg	34.50	34.50	34.50
Yeast Intake (g/day/animal)	0.00	8.00	10.00
Cost of yeast @ Rs.1.25/g COM ; 1.65/g LAB)	0.00	13.20	12.50
Total cost /day /animal	192.52	203.68	201.00
<p>Economic Efficacy: Cattle fed on locally isolated yeast is 6.9% and 4% more economical than control feed and commercial yeast respectively</p> <p>Overall Economic Impact:</p> <p>Locally isolated yeast supplementation saved Rs. 562 in dairy cattle of Sahiwal breed</p>			
Net profit /Lit milk Rs.	34.35	36.72	35.34

Conclusion Phase II

Locally isolated yeast **improved** the profile of ruminal-gut microbial flora and produced **11.76 %** significantly ($p < 0.05$) more milk yield and saved **Rs. 562** in dairy cattle of *Sahiwal* breed



DIETARY SUPPLEMENTATION OF SACCHAROMYCES CEREVISIAE ON MILK YIELD, MILK COMPOSITION AND NUTRIENT DIGESTIBILITY IN LACTATING DAIRY CATTLE

S. Ghazanfar^{1,3}, M. I. Anjum¹, F. Husan², M. Qbtiya³, M. Afzal², I. Ahmed⁴ and M. Imran³
¹Animal Nutrition Program, Animal Sciences Institute, National Agricultural Research Centre, Park Road, Islamabad-45500, Pakistan
²Livestock Research center, National Agricultural Research Centre, Park Road, Islamabad-45500, Pakistan
³Department of Microbiology, Faculty of Biological Sciences, Quaid-i-Azam University Islamabad-45320, Pakistan
⁴National Institute for Genomics & Advanced Biotechnology, National Agricultural Research Centre, Park Road, Islamabad-45500, Pakistan.

DIETARY SUPPLEMENTATION OF SACCHAROMYCES CEREVISIAE ON PRODUCTION AND HEALTH STATUS IN LACTATING DAIRY CATTLE

S. Ghazanfar^{1,3}, M. I. Anjum², F. Hassan², I. Ahmed¹, M. Qbtiya³, M. Afzal² and M. Imran³
¹Institute of Microbial Culture Collection of Pakistan, National Agricultural Research Centre, Park Road, Islamabad-45500, Pakistan. ²Animal Sciences Institute, National Agricultural Research Centre, Park Road, Islamabad-45500, Pakistan. ³Department of Microbiology, Faculty of Biological Sciences, Quaid-i-Azam University Islamabad-45320, Pakistan
 *Corresponding authors: shakim_akmal@yahoo.com and m_imran766@hotmail.com

ABSTRACT

Balance diet is one of the important factors in livestock productivity. Inadequate and unbalanced diet is considered a major constraint for livestock promotion in Pakistan. The uneven dietary patterns result in dysbiosis in rumen. This leads to reduced growth rate, low milk production and poor reproductive performance. Under such situation, production of livestock can be increased through treat dysbiosis by supplementation of probiotic-yeast that may stabilize rumen pH, increase microbial population, improve gut microbial balance and consequently improve nutrient utilization and digestion efficiency resulting in enhanced growth rate, feed efficiency and milk yield. Many commercially available probiotic products available are imported and are not suitable for our local breed. Therefore, this study is planned to compare laboratory prepared dairy commercially available probiotic yeast divided into three equal groups. Group I fed @ 3 kg concentrate, 8 kg maize silage and 30 kg oats fodder per animal. Group II fed control diet plus 10⁷ CFU/g *S. cerevisiae* while group III fed control diet plus laboratory prepared yeast (8g/day/animal) corresponding to 3.13x10¹⁰ cfu/g *S. cerevisiae* for 60 days. Results revealed that LAB supplementation was significantly better in both yeast supplemented groups than control group. However, milk protein, lactose, total solid and fat content remained unchanged. Nutrient digestibility of LAB was better than the other groups. From this study it can be concluded that supplementation of LAB yeast improved milk production and milk fat content in dairy cattle is cost effective than COM yeast supplemented group.

KEY WORDS:

Proc 3 Int Workshop Dairy Science Park, Nov 16-18, 2015

unbalanced diet is considered the performance. Under such situation production and consequently improved growth rate of our local animals. Therefore, this study on lactating dairy cattle were randomly divided into three groups: control group, yeast supplemented group (COM) and yeast supplemented group (LAB). Results revealed that LAB supplemented group produced more milk than control group. However, milk protein, lactose, total solid and fat content remained unchanged. Nutrient digestibility of LAB was better than the other groups. From this study it can be concluded that supplementation of LAB yeast improved milk production and milk fat content in dairy cattle is cost effective than COM yeast supplemented group.

SUMMARY

Locally isolated yeast
ECONOMICALLY improve PRODUCTION
PERFORMANCE in dairy cattle with out
any adverse effect.

CONCLUSION

Yeast supplementation results in improve growth and production performance in dairy animals. Locally isolated yeast strain may be adopted well in the cattle gut than exotic probiotics.



Scope of common DNA based methods for the study of rumen bacterial population

G Shakira*¹, IH Mirza¹, A Latif²

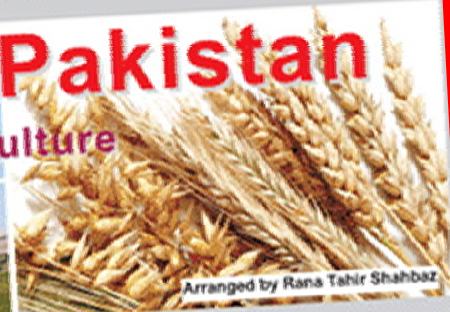
^{1,2}Animal Sciences Institute, National Agricultural Research Centre, Islamabad; ¹Quaid-i-Azam University, Islamabad, Pakistan

The Nation, Islamabad

Sunday, February 10, 2013

Sustainable Development of Pakistan

Energy - Education - Agriculture - Investment Culture



Arranged by Rana Tahir Shahbaz

CIIT supporting development goals

COMSATS Institute of Information Technology (CIIT), a Degree Awarding Institute (DAI) in higher education, was established in 1996 as a Centre of Excellence of the Commission on Science and Technology for Sustainable Development in the South (COMSATS), which is an inter-governmental organization with 21 member states in three continents; Asia, Africa and Latin America. CIIT established its first campus in 1998 at Islamabad and was chartered as a DAI by the Government of Pakistan in August 2000. The journey of success continued for CIIT when it opened up campuses in Lahore, Abbottabad, Wah, Attock, Sahiwal and Vehari. This expansion continues as future campuses are planned at Jaffarabad, Gujrat, and Gujrat Khan. In order to contribute in the education sector in every possible manner, CIIT started its distance learning program in June 2012 by launching its virtual campus.

Improving livestock productivity in Pakistan

SHAKIRA GHAZANFAR, PH.D SCHOLAR

The major constraint in the development of livestock sector of Pakistan is poor availability of nutrients. Slow growth rate, low milk yield, and poor reproductive and health performance are the major consequences of imbalanced nutrition. Imbalances of nutrients can also affect the activity of certain enzymes, thereby impairing the overall immune function of the animal. According to estimates, milk consumption is growing at a rate of 7-9% per annum while milk production is growing at an average of only 3% per annum (Economic Survey, 2005-06). On the other hand, various studies showed that not a single one out of 80 milk sample reached the required compositional quality accepted as standard in Pakistan. Poor hygiene, malpractices, lack of preservation technology, cooling facilities and sanitation conditions are the main causes of losses

in quantity and poor quality of milk. Most dairy cows enter into negative energy balance due to imbalanced diet during early lactation leads to poor reproductive performance. Proper feeding management can provide adequate energy during early lactation and lead to a carryover effect resulting in improved energy status and reproductive performance.

Studies carried out at many places in Pakistan clearly indicate that with proper feeding the production of existing animals can be increased by 38 to 35%. Many micro-organisms have been approved as additives. Among them the *Saccharomyces cerevisiae* has been found to exert a positive effect on the ruminant's production through an increased dry matter intake (DMI) by 1.8% and milk yield by 1.8 kg/day. It has also positive effect on milk fat content and milk urea nitrogen. A recent meta-analysis of 157 experiments demonstrated that yeast addition

increased feed intake, rumen pH, rumen volatile fatty acid, and organic matter (OM) digestibility. It also decreased lactate production, increase desirable bacterial population, increased the hemicelluloses degradability and nutrient digestibility, and had significant effects on milk production.

Another advantage of use of the yeast culture is that the benefit to cost ratio of YC supplementation in dairy cattle is 4:1.

In recent years, due to increased consumer's concern about safety, quality of animal products and environmental issues, the current purpose of using microbial feed additives is not only to increase productivity but also to contribute to lower the risk of ruminant digestive carriage of human pathogens. *S. cerevisiae* is generally recognized as safe (GRAS) by the Food and Drug Administration (FDA) and thus is appropriate for use in animal feeds. Four factors can be con-

sidered to determine if a feed additive should be used i.e. anticipated response, economic return, available research, and field responses. Fermented yeast culture has emerged as a cost effective product that has many benefits to ruminants. The ability of *S. cerevisiae* to stimulate growth appears to be related to their ability to remove oxygen from rumen. YC has ability to produce glutamic acid and may enhance the palatability of feeds for ruminants. It has also positive effect on utilization of energy from feedstuffs.

S. cerevisiae supplementation is highly responsive to age, diet and geographical location of animal. Few studies have been reported to evaluate the effect of YC on production performance to the diet of Sahiwal cattle in Pakistan. If we give YC supplementation during the early lactated period, it can be useful for the increased milk production in cost effective manners in local breed of Pakistan.

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Experiment Animals, NARC, (2013)



Experiment Animal, NARC, (2014)



Isolation and characterization of **nutritionally important lactic acid bacteria** from **dairy cattle (Sahiwal)** gut

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Dr. Shakira Ghazanfar
PhD-Microbiology



Quaid-i-Azam University
PAKISTAN

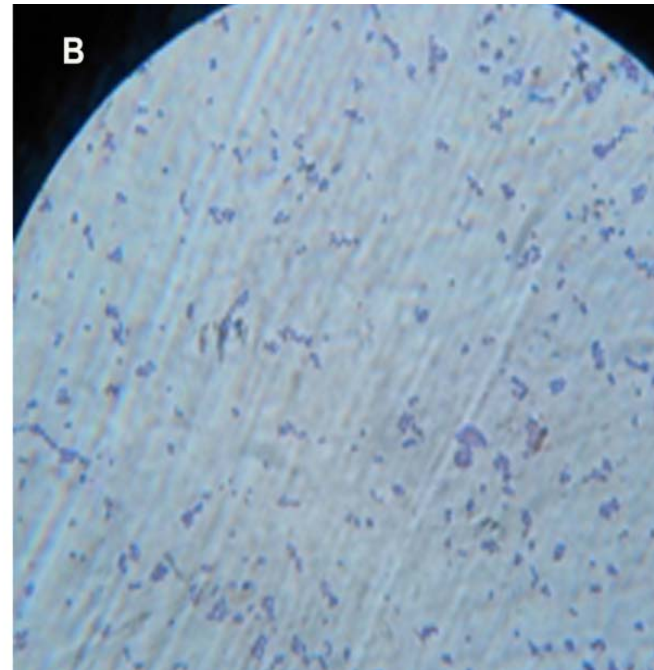
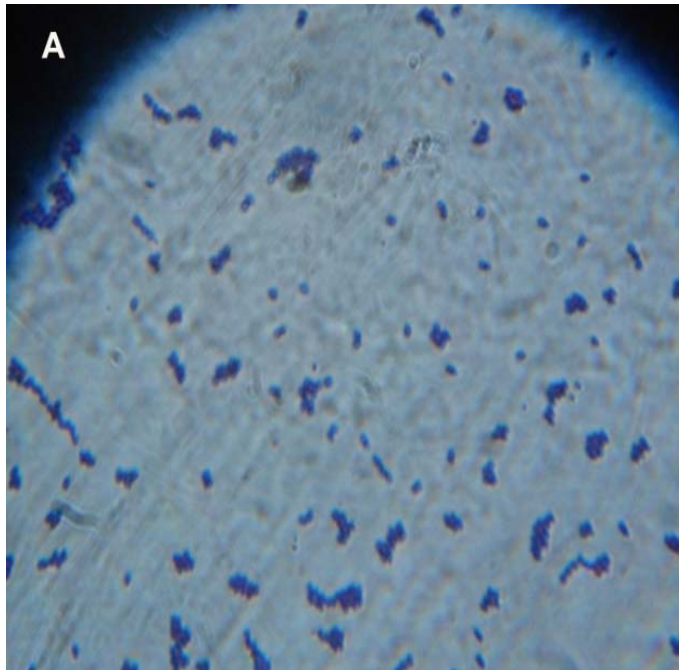


Lactic acid bacteria

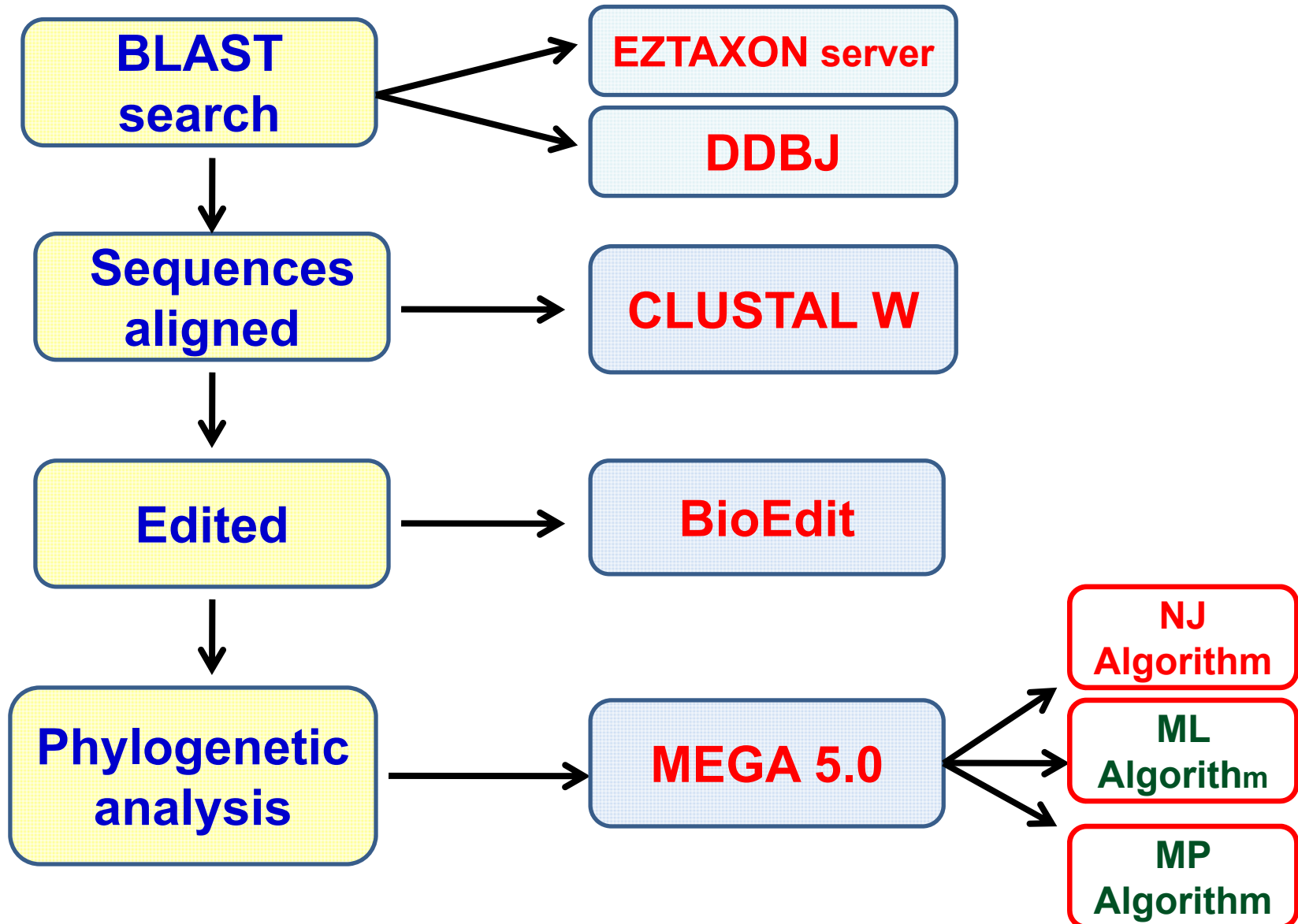
Lactic acid bacteria regulate the **metabolic pathways** and activities of **gut micro flora** and aids in host resistance mechanism. These also used as natural food preventive to **improve food safety**. There is still a **scarcity** of information on the lactic acid bacterial diversity of livestock species such as cattle (*Fuller, 1989*)

So that present study was conducted to highlight the **gut LAB diversify** of **dairy cattle**.

Gram Staining of Isolated LAB strains



Phylogenetic analysis of isolates based on 16S rRNA Gene Sequencing



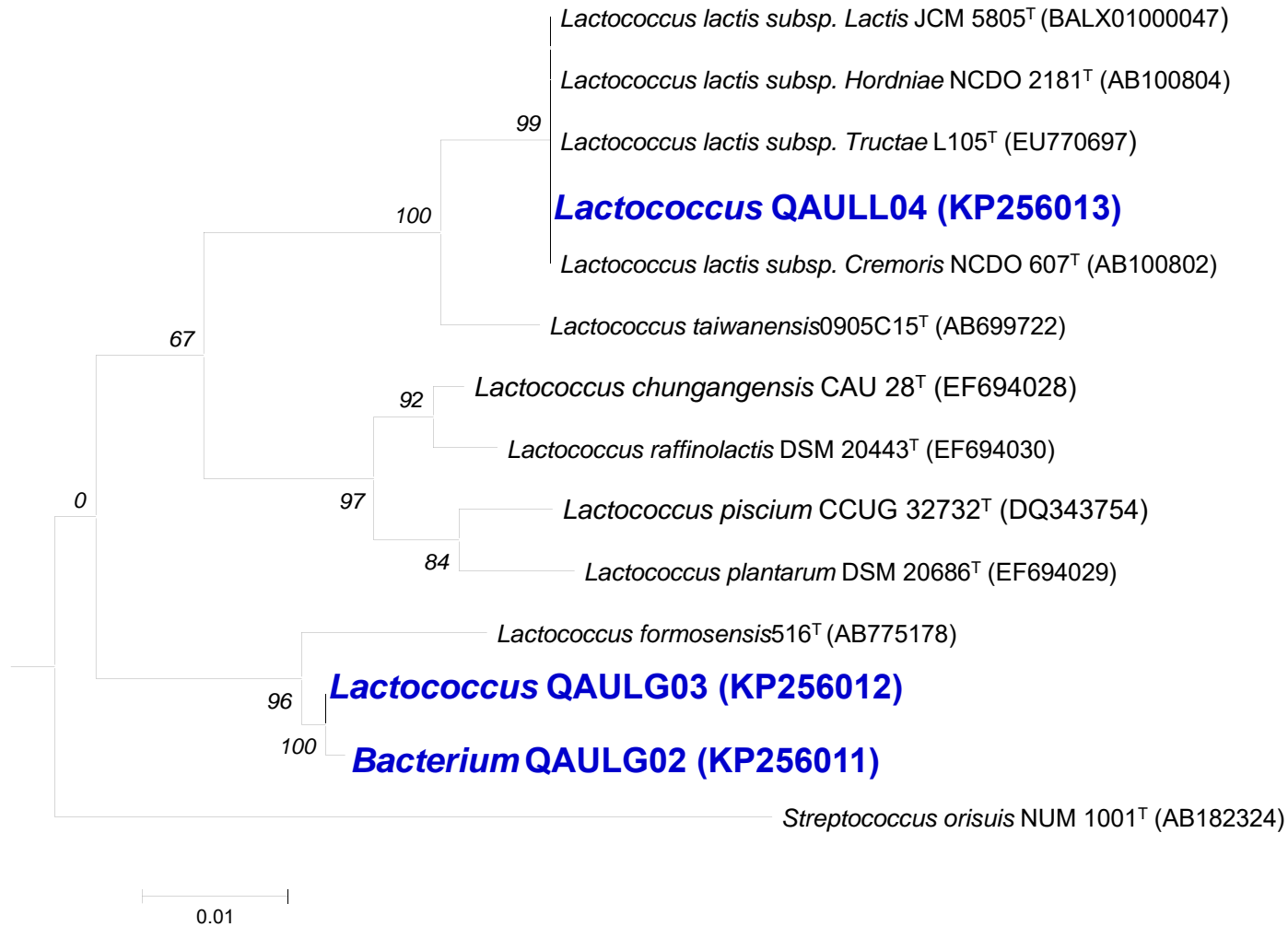
BLAST search results based on **16S rRNA** gene
Sequence on **EZTAXON** Server (<http://147.47.212.35:8080>)

Strain ID	Strain Genus	Accession Numbers (DDBJ)	Closely related species	% Similarity
QAULG04	<i>Lactobacillus</i> sp.	KP256013	<i>L. sake</i>	100
QAULG02	<i>Lactococcus</i> sp.	KP256011	<i>L. garvieae</i>	99.9
QAULG05	<i>Enterococcus</i> sp.	KP256014	<i>E. faecium</i>	100
QAUEV12	<i>Escherichia</i> sp.	KP256020	<i>E. asburiae</i>	99.5

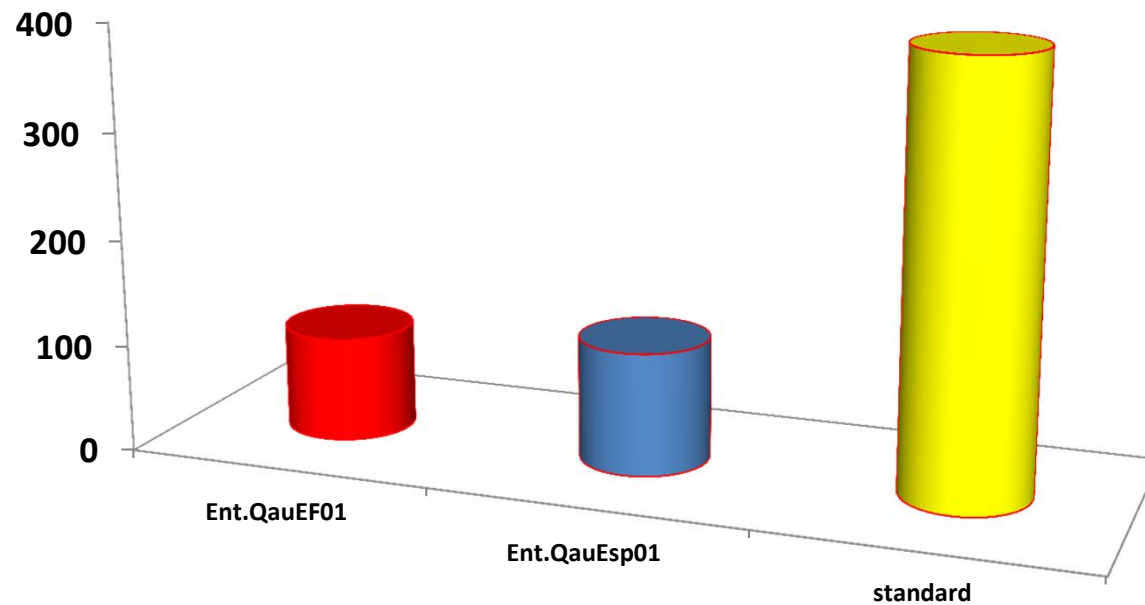
BLAST search results based on **16S rRNA** gene
Sequence on **EZTAXON** Server (<http://147.47.212.35:8080>)

Strain ID	Strain Genus	Accession Numbers (DDBJ)	Closely related species	% Similarity
QAUEV16	<i>Escherichia sp.</i>	KP256022	<i>E. asburiae</i>	99.5
QAULG06	<i>Lactococcus sp</i>	KP256009	<i>L. lactis</i>	100
QAUSG08	<i>Enterococcus sp</i>	KP256016	<i>E.hirae</i>	100
QAUSK01	<i>Enterococcus sp</i>	KP256018	<i>E. faecium</i>	100
QAUBL11	<i>Bacillus sp</i>	KP256019	<i>B. licheniformis</i>	99.9

Phylogenetic relationship of QAULL04, QAULG03 and QAULG02 with closest relatives inferred from sequences of 16S rRNA gene

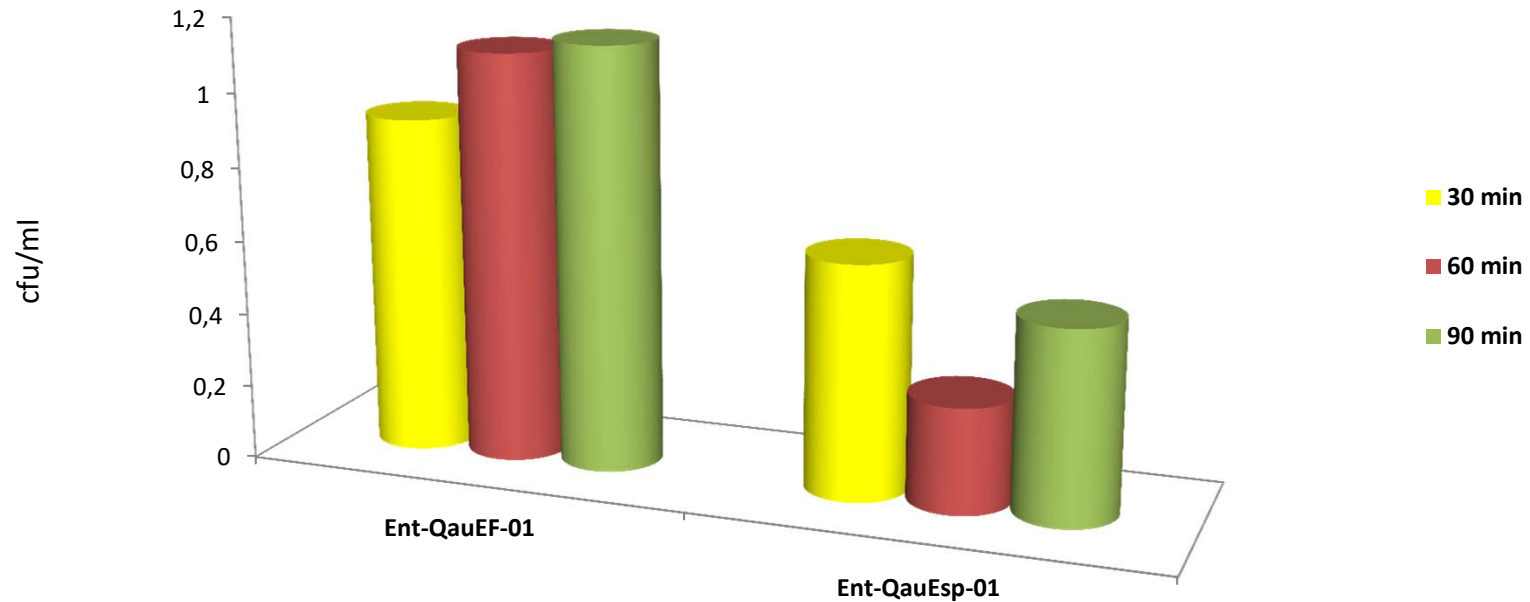


Probiotics Characteristics-Cholesterol Assimilation



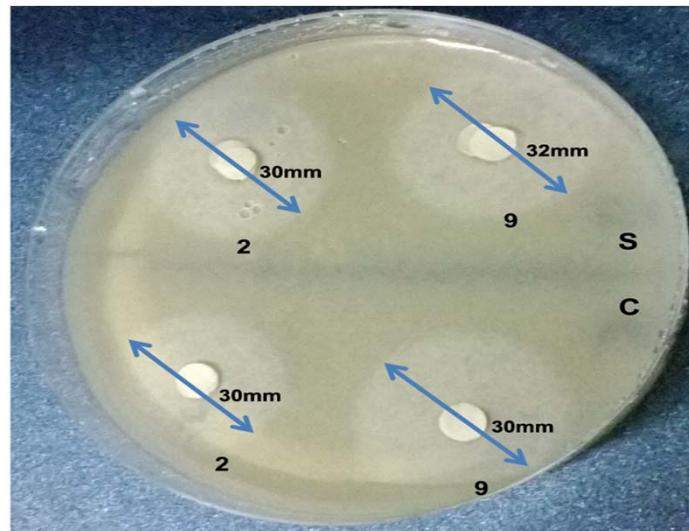
Results indicated that the **both** strains having **good cholesterol lowering effect**

Probiotics Characteristics- Bile-Tolerance



Results indicated that the **both** strains having good **bile tolerance**

Probiotics Characteristics- Antipathogenic Activity



SCQAU03 strain was evaluated better for **enzymatic activity characteristics**

SUMMARY

This preliminary study showed that the fecal flora of dairy cattle is rich in **LAB population**, which may be utilized in various industrial applications.