EFFECT OF *Saccharomyces cerevisiae* AND ACETOHYDROXAMIC ACID ON GROWTH PERFORMANCE OF INDIGENOUS CATTLE

A THESIS
BY

SONJOY KUMAR SARKER
Registration No. 1405109
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MASTER OF SCIENCE (MS)
IN
ANIMAL SCIENCE

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[Submitted to the Department of General Animal Science and Nutrition, Faculty of veterinary and animal science, Hajee Mohammad Danesh Science and Technology University, Dinajpur in partial fulfillment of the requirements of the degree]

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Approved as to style and contents by

(Dr. Md. Nurul Amin)	**Prof. Dr. Md. Abdul Hamid**
Supervisor	**Co-supervisor**

Prof. Dr. Md. Abdul Hamid
Chairman, Examination Committee
and
Chairman
Department of General Animal Science and Nutrition

Hajee Mohammad Danesh Science and Technology University,
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DEDICATED TO.....

My Beloved family, I could never be here without cordial help, love and inspiration of them.

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The Author

ABSTRACT

The aim of the study was to evaluate the effect of *Saccharomyces cerevisiae* and acetohydroxamic acid on growth performance of indigenous cattle. An experiment was conducted using indigenous cattle in Masumpur, Dinajpur, Bangladesh. The experiment was conducted with total 12 indigenous bull aged between 2.0 years to 2.5 years. These bulls were randomly divided into three (3) experimental groups, identified as T_0, T_1 and T_2. Here T_0 group was control group and these bulls were reared with *ad libitum* rice straw and fresh water. T_1 group was supplemented with Urit (Acetohydroxamic acid, 2 g in feed/bull/day) with regular ration and ad libitum rice straw and fresh water. T_2 group was treated with A-Max (Saccharomyces cerevisiae, 18 g feed/bull/day) with regular ration and *ad libitum* rice straw and fresh water. The animals were kept in a shed and fed separately. Initial live weight was taken at the start of the experiment and then weekly up to 11 weeks (77 days of age) by using digital balance. In this experiment, the live weight was not significantly differed ($P>0.05$) among the experimental groups but treatment group exert slightly higher live weight and it was 44.75, 51.25 and 54.00 kg in T_0, T_1 and T_2, respectively. After 11 weeks of experiment average weight gain differed significantly ($P<0.05$) among the groups and it was 3.73, 4.27, 4.52 kg/day/bull in T_0, T_1 and T_2, respectively. The net income was 3858.02, 5166.83 and 5562.74 Tk. kg in T_0, T_1 and T_2, respectively which shows significantly ($P<0.05$) higher net profit in treatment groups than the control one. It may be concluded that Acetohydroxamic acid (Urit) and *Saccharomyces cerevisiae* (A-Max) may have the potentials to improve growth performance of indigenous bull and may be used in beef fattening program.

Key words: Growth rate of indigenous bull, *Saccharomyces cerevisiae*, Acetohydroxamic acid, Net profit.

ABBREVIATION

% = Percentage

Mt = Metric ton

kg = Kilogram

et al. = Et alic (and others)

± = Plus-minus

> = Greater than

< = Less than

/ = Per/Slash

Fig. = Figure

etc. = Et cetera (L) and other

Sig. = Significance

SE = Standard Error

p = Probability

No. = Number

N = Number of animals

GDP = Gross domestic product

BBS = Bangladesh bureau of statistic

BER = Bangladesh Economic Review

DAE = Department of Agricultural Extension

DLS = Directorate of Livestock Serveces

GNP = Gross National Product

UMS = Urea Molasses Straw

UMB = Urea Molasses Block

GO = Government Organization

SPSS = Statistical Package of Social Sciences

ADG = Average daily gain

HMDB= Human Metabolome Database

FDA = Food and Drug Administration

DFM = Direct-Fed Microbial

FGTP = Fermented Green Tea Probiotics

LUB = Lactic Acid Utilizing Bacteria

LAB = Lactic Acid Producing Bacteria

DMI = Dry Matter Intake

NRC = National Research Council

AHA = Acetohydroxamic Acid

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CHAPTER I

INTRODUCTION

Bangladesh is a densely populated developing country and its economy mostly depends on agriculture, it employs 47% of the total labor force and comprises 16% of the country's GDP (CIA, 2016). The livestock resources of Bangladesh are mainly based on cattle, goat, sheep, buffalo, and poultry. In Bangladesh about 23.79 million cattle are distributed throughout the country (BBS, 2015-16). Although the growth of livestock production is the second highest among all other sub-sector of agriculture in Bangladesh (BER, 2014), the production and consumption of livestock products is still much lower in consumption with other countries. In the recent days, India has tightened its border with Bangladesh to prevent the crossing of cattle in Bangladesh. So a many people in our country are ready to deal in cattle as it is a profitable business. In several Southeast Asian countries such as Indonesia, Malaysia, Philippines and Thailand there is an increasing trends of meat consumption (Skunmun *et al*., 2002). Bangladesh stands in 18th position which is about only 7.13 kg per capita per year among meat consumption of 180 countries in the world, (DLS, 2009) compared to the USA of 124 kg and the global average of meat consumption is 38 kg (Smith *et al*., 2007). The quantitative production of meat in Bangladesh in 2015-2016 was 61.52 Lakh metric tons against the total demand of 70.52 Lakh Metric Ton (120 gm/day/head), Still there was a deficiency of 9.00 Lakh Metric Ton (Livestock Economy at a Glance 2015-16, DLS). According to the report, the requirement of animal protein per head per day is 120 g whereas the availability is only 106.0 g (Livestock Economy at a Glance 2015-16, DLS). And there is a gap

between demand and production. The increasing price of meat is a matter of concern. So, it is important that we produce enough meat and fulfill our national demand. Beef fattening can play an important role to satisfy the animal protein requirement in Bangladesh. Beef fattening is also a developing sector for employment and improving socio economic condition of rural masses by generating profitable employment and expanding family income particularly small and marginal farmers in rural areas. Beef fattening is an effective instrument of alleviating poverty for the rural poor people in Bangladesh.

In beef cattle production, good nutrition and management plays a significant role. Due to lack of optimum level of nutrition, disease control, proper housing management practices, efficient reproductive performance and efficient systematic breeding programmed etc, and for disease condition, sometimes the beef fattening programs is not profitable. These animals are kept mainly in the stall with limited grazing on the roadside; fallow land etc. where green grass is not available, and paddy straws are the staple feed. And nowadays some farmers use inorganic fertilizer, pesticides, growth stimulating substances like hormones, steroids etc. are using in Bangladesh for beef cattle production. For a profitable beef fattening balance ration is very much essential, and some feed additives or feed supplement is also helpful for fattening.

Gut health of the animals can be improved by feed additives, like probiotics which results in increased digestion rate and better growth performance (Frizzo *et al*., 2010; Kawakami *et al*., 2010; Many microbial species have been used as feed additives; *Saccharomyces cerevisiae* (Yeast) is one of them, has been found to exert a positive effect on the ruminant's production. Mode of action of yeast depends on the rumen

microbial population. Different vitamins, enzymes and some unidentified cofactors are present in yeast cells that may expand the microbial activity and growth rate in rumen (Dawson *et al*., 1992). Many researchers reported that (Robinson and Erasmus, 2009; Ayad *et al*., 2013); Yeast culture improved feed intake, feed conversion efficiency, growth rate (Lascano *et al*., 2009) and nutrient digestibility (Wohlt *et al*., 1991) in cost effective manners (Hutjens, 2003). Yeast (*Saccharomyces cerevisiae)* improves health status of animals by its positive effects on blood hematology (Agazzi *et al*., 2014). Hemicelluloses degradability and some important nutrient digestibility increased by yeast (*Saccharomyces cerevisiae)* supplementation, Lascano *et al* (2012) and Lesmeister *et al* (2004) reported that. In the absorption of some minerals, the addition of yeast culture has many positive effects (Cole *et al*., 1992) and improves the metabolic heath of animals (Dolezal *et al*., 2011). Microbial feed additive (*Saccharomyces cerevisiae)* help as a tool to maintain the microbial balance of intestine, result prevention of diarrhoea (Abu *et al*., 1996; Galvao *et al*., 2005; Timmerman *et al*., 2005), and improved fecal bacterial flora of the ruminants (Kawakami, 2010). Here maximum times these animal are supplied with paddy straw as staple feed.

Another feed supplement Acetohydroxamic acid is a Urease Inhibitor. The mechanism of action of acetohydroxamic acid is as a Urease Inhibitor (FDA Pharmacology Summary from FDA Pharm Classes). Acetohydroxamic Acid, a synthetic drug derived from hydroxylamine and ethyl acetate, is similar in structure to urea. Acetohydroxamic Acid has no direct antimicrobial action and does not acidify urine directly. It is used, in addition to antibiotics or medical procedures, to treat chronic urea-splitting urinary infections (metabolic description from HMDB).

And according to Sunhy Biology Company acetohydroxamic acid (URIT) increase urease activity in ruminant's rumen non-competitively. Acetohydroxamic acid (URIT) Slowing down the decomposing speed of urea in rumen, synchronize the ammonia releasing and its utilization by ruminant microorganism, or keeping them relatively balance; preventing animal from ammonia poisoning. Acetohydroxamic acid (URIT) Improves utilization efficiency of exogenous and endogenous ammonia—N, increase the synthesized quantity of microbial protein. It also save protein feedstuff, increases the digestive speed of crude feed in rumen, and improves growth performance of animals. It prevents ammonia odor in farm, prevents protein deficiency disease, increase immunity against disease and acetohydroxamic acid (URIT) helps to fattening of cow. Acetohydroxamic acid (URIT) has fewer side effects in also overdose (2 or 3 times more than normal dose).

In Dinajpur district large numbers of beef cattle are found. Most of the beef cattle are fattened by unscrupulous cattle traders. They used traditional way for beef fattening. There is little information available in Bangladesh for the use of *Saccharomyces cerevisiae* (A-Max) or Acetohydroxamic acid (URIT) is available in Bangladesh and that's why this research work that been conducted to see the effect of these on the better growth rate.

Keeping in view, the present study was undertaken to analyze the effect of yeast culture *Saccharomyces cerevisiae* (A-Max) and Acetohydroxamic acid (URIT) on body growth performance, and cost of beef cattle production by a rural farmers with the following objectives:

a. Comparative study on the growth performance of beef cattle by supplementation of *Saccharomyces cerevisiae* (A-Max) and Acetohydroxamic acid (Urit) in feed.

b. To analyze the cost benefit ratio of the beef cattle production.

CHAPTER II

REVIEW OF LITERATURE

This chapter presents the review of relevant literatures, which consist of cattle fattening, feed additives and the effects *Saccharomyces cerevisiae* (A-Max) and Acetohydroxamic acid (URIT, Urit contain Acetohydroxamic acid 10%) and other related topics on body growth performance of beef cattle. Many researchers have been conducted researches in these topics. But in Bangladesh, limited research work has been performed.

2.1 Cattle fattening concept

Short time cattle fattening is the process in which high amount of meat is produced through extra feeding of UMB (Urea Molasses Block), UMS (Urea Molasses Straw), Urea treated straw or application of other different drug. It is the fact that rice straw is the major crop residue being used as sole feed for cattle and buffaloes in Bangladesh. The productivity of cattle especially beef cattle production largely depends upon the efficient utilization of poor quality rice straw with low nitrogen content and low digestibility due to high lignin and silica content. Cattle contribute about 95% of draught requirement, 98% of milk produced and 56% of meat sold in the market (BBS, 2001). Beef in Bangladesh, usually comes mostly from the unproductive old aged bullock, cows, culled animals of the farm and partly also from the imported animals from the neighboring country.

2.2 Importance of beef cattle rearing in Bangladesh

A large amount of total beef comes from growing animal. During Eid-ul-Azha and other religious festival people generally prefer to sacrifice growing animal for their religious festival. And other than these festival everyday many cattle is slaughted for meat. However, cattle fattening for beef production has become an important and profitable business for the small farmers. The population of major livestock species has been increasing day by day with rapid increase in demand for meat, although there are differences in growth rates of its population among countries. Livestock population is increasing in Bangladesh day by day. Table 2.1 shows trends in Livestock population in Bangladesh.

Table 2.1: Livestock population of Bangladesh (in lakh number)

Livestock Species	Cattle	Buffalo	Sheep	Goat
2006-07	228.70	12.10	26.80	207.50
2007-08	229.00	12.60	27.80	215.60
2008-09	229.76	13.04	28.77	224.01
2009-10	230.51	13.49	29.77	232.75
2010-11	231.21	13.94	30.02	241.49
2011-12	231.95	14.43	30.82	251.16
2012-13	233.41	14.50	31.43	252.77
2013-14	234.88	14.57	32.06	254.39
2014-15	236.36	14.64	32.70	256.02
2015-16	237.85	14.71	33.35	257.66

Source: Livestock Economy at a Glance 2015-16, DLS

Livestock generally lives on fibrous and crop by-products inedible to human beings, this is common in Bangladesh. Animals (cattle, sheep, goat, and buffalo etc.) convert low quality feeds into high quality food (meat, milk, and eggs) for human consumption. Crop residues and cereal by products as well as grasses, tree leaves and aquatic plants are the main feed resources for livestock. Rearing of beef cattle is much easier than dairy cattle rearing, and in cattle fattening farm one labor can maintain 12-15 cattle and in small scale fattening program any one can easily run it in their home.

2.3 Present status of small scale cattle fattening in Bangladesh

Cattle fattening for beef production has become an important and popular business of the small farmers in Bangladesh. To generate income and increase employment beef fattening plays an important role.

Sarma (2011) conducted an investigation about small scale farming enterprise; there he showed that fattening is an important component of the agribusiness sector of the economy with great economic, aspects of poverty reduction and social implications. In Bangladesh a large number of farmers involved in cattle fattening, just before 3 or 4 months of Eid-ul-Azha (Muslim festival), when they sell the animals with profitable prices. This has become an important and popular business of the small farmers in Bangladesh. He has collected data from 120 nomadic farmers and this study showed the profitability as well as operational economics efficiency of cattle fattening enterprise of Rajbari District. He also showed that BDT 5559 income comes from per cattle considering every cost. Here farmers used three years old cattle for beef fattening.

Ahmed *et al.* (2010) conducted an experiment to investigate the systems of management in small scale cattle fattening programs in different place of Bangladesh. They have been collected these data from 215 respondents of 24 districts in 52 upazilla who were involved in small scale cattle fattening though interviews. In their study they show that 70.40% were farmers, 11.70% businessman, 9.18% physicians, 2.04% doctors had own land and 8.80% respondents had no own land. About 40.90% respondents selected cattle on the basis of age and 14.0, 25.6 and 16.7% respondents selected on the basis of breed, age and sex, respectively. Most of the respondents (79.10%) fattened cattle for 3 - 6 months and rest fattened for a prolonged period. About 90.20% respondents used own capital for cattle fattening and 2.30, 4.20 and 3.30% respondents took bank loan, NGO loan and lending for cattle fattening, respectively. About 31.60% respondents provided existing traditional cattle shed. About 79.50% did not have any training on cattle fattening whereas about 20.50% respondents had taken short training on cattle fattening. About 63.70% respondents used cattle fattening tablets, 27.00% respondents used urea molasses straw (UMS) and 51.00% followed conventional feeding. About 72.60% vaccinate the cattle by themselves and about 76.30% took help from veterinary surgeon for treatment of their cattle. About 45.00% reported shortages of animal feed, 50% reported lack of credit and 95.00% reported high cost of feed as the major problems of small scale cattle fattening..

In Bangladesh it is obvious from the experience over generation, that an almost exclusive diet of rice straw, with little or no supplementation covers the nutritional needs of livestock, but that stunts the growth. According to Tareque (1985), out of

29.1 million tons of available roughage for ruminants in Bangladesh rice straw alone contributes around 23.5 million (81 %) and green grasses only 1.6 million tons.

Baset (2002) reported that in many areas small scale commercial beef fattening program has already been started. Paddy straw is the important crop residue; contribute the major portion of the fibrous part of the diet of the beef cattle. For beef fattening in Bangladesh farmers use rice straw of traditional varieties, green grass, sugarcane tops, wheat and rice bran, molasses, pulse bran and locally available resources such as pumpkin, carrot, banana, vegetable by products, rice gruel, boiled rice bran, oil cakes etc., but Rice straw is the basal feed for ruminants with low nutritive value and low digestibility. The chemical treatment of straw and feed additives or feed supplement is the most effective and economic method to improving the quality and this resulted higher body weight, dressing percentage and also in better carcass quality than untreated straw. For beef fattening farmers used three years old cattle and maximum growth rate between 1.1 years to 1.4 years of age. Cattle fattening period is 4.5 months in rural areas of Bangladesh.

Ali *et al*., (1993) reported that throughout the year Aman and Boro straw found to be used in almost all cattle production system. The amount of straw produced is usually calculated from grain production data are seldom measured directly. Such calculations are based on grain: straw ratios and with rice a ratio of 1:1 is generally assumed.

2.4 Feed additives in beef fattening

A feed additive is a food supplements for farm animals that cannot get enough nutrients from regular meals that the farmers provide and include vitamins, amino

acids, fatty acids, and minerals. Feed additives can effectively improve production levels, efficiency, and animal health. Feed additives are appropriate not only in cattle finishing operations, but also in cow- calf and stocker grazing operations. The primary effects of feed additives are increasing feed efficiency and/ or improving average daily gain.

Luebbe *et al.* (2013) conducted an experiment to determine the effects of feeding two commercially available direct-fed microbial (DFM) on finishing steer performance fed steam flaked corn based diets. Dietary treatments included a control diet without DFM, and two commercially available products (10-G and Bovamine). No significant differences were observed among treatments for animal performance or carcass characteristics. However, numeric advantages were observed for average daily gain (ADG) and feed efficiency when cattle were fed a DFM.

Ko, *et al.* (2010) conduct an experiment on 60 Hanwoo calves comprising five feed additive groups, with 12 calves in each group, to determine the effects of additives at pre- and post-weaning on growth performance and blood profile. This groups were control, antibiotic (Neomycin 110 ppm), illite (2.00%), fermented green tea probiotics (FGTP, 0.50%) and mixed additives (FGTP 0.25%, illite 1% and licorice 0.10%) are introduced. The calves were offered experimental pellet feeds ad libitum and after one month were supplied with imported timothy hay. They moved freely within the group and suckled their mother's milk during the pre-weaning stage (birth to 3 months) and were separated from their dam during the post-weaning stage (4-5 months). During the pre-weaning stage, the highest average daily gain (ADG) was recorded in the antibiotic- and mixed additive-fed groups followed by FGTP, control and illite groups. In the post-weaning stage, significantly higher total weight gain and

ADG were recorded in both the FGTP and mixed additive groups compared to the other groups ($p<0.05$). Feed efficiency of mixed additive- and illite-fed calves were almost similar with antibiotic-fed calves compared to the other two groups, but the ADG was lowest in illite-fed calves during the pre-weaning stage. In contrast, post-weaning calves fed FGTP and mixed additives showed better feed efficiency. The values of hematological indices, differential leukocyte count, blood proteins and immunoglobulin among the additive-fed calves were not significantly differed ($p>0.05$), although hemoglobin and hematocrit values were lower in FGTP compared to control, but similar in mixed additive and antibiotic groups. These results indicate no detrimental effects of feed additives on the blood profile of calves at both pre- and post-weaning age. Serum albumin in post-weaning calves of all feed additive groups were similar but significantly lower ($p<0.05$) than in the control group. Post-weaning, IgM was significantly lower ($p<0.05$) in illite-fed calves compared to other treatment groups, but there was no difference at pre-weaning. Considering all factors, the mixed feed additives and FGTP can be the replacement feed formula for antibiotic for Hanwoo beef calf production, especially when used post- weaning.

Sarker *et al.* (2010) performed an experiment to evaluate and compare the effect of growth promoter 'Megavit-DB' on growth performance of indigenous Red Chittagong (RC) and Holstein Crossbred (HC) bull calves. Here , six RC and six HC bull calves were assigned into four treatment groups having three calves in each as RCT0 (RC without Megavit-DB), RCT1 (RC with Megavit-DB), HCT0 (HC without Megavit-DB) and HCT1 (HC with Megavit-DB) and daily DM intake of different treatment groups were found almost similar. The daily average live weight gains were 0.27±0.05, 0.36±0.01, 0.36±0.01 and 0.45±0.05 kg/d, feed conversion

efficiency were 9.08±0.16, 7.47±1.07, 7.13±1.24 and 6.16±0.27 and the average net returns (Tk.) were 1473.33±87.00, 2060±76.38, 1910±86.60 and 2776.67±44.10 for RCT0, RCT1, HCT0 and HCT1 treatment groups, respectively. Here daily average live weight gain and feed conversion efficiency were significantly ($p<0.05$) higher in HCT1 than that from RCT1, HCT0 and RCT0. Accordingly, the average net returns were found significantly ($p<0.05$) higher in HCT1 than RCT1, HCT0 and RCT0. It may be concluded that Megavit-DB may have the potentials to improve growth performance of both HC and RC and may be used in cattle fattening program.

Seo *et al.* (2010) studied that direct-fed microbial (DFM) are dietary supplements that inhibit gastrointestinal infection and provide optimally regulated microbial environments in the digestive tract. As the use of antibiotics in ruminant feeds has been banned, DFM have been emphasized as antimicrobial replacements. Microorganisms that are used in DFM for ruminants may be classified as lactic acid producing bacteria (LAB), lactic acid utilizing bacteria (LUB), or other microorganisms including species of Lactobacillus, Bifidobacterium, Enterococcus, Streptococcus, Bacillus and Propionibacterium strains of Megasphaera elsdenii and Prevotella bryantii and yeast products containing Saccharomyces and Aspergillus. Yeast DFM may reduce harmful oxygen, prevent excess lactate production, increase feed digestibility, and improve fermentation in the rumen. DFM may also compete with and inhibit the growth of pathogens, stimulate immune function, and modulate microbial balance in the gastrointestinal tract. LAB may regulate the incidence of diarrhoea, and improve weight gain and feed efficiency. LUB improved weight gain in calves. DFM has been reported to improve dry matter intake, milk yield, and fat corrected milk yield and milk fat content in mature animals. However, contradictory

reports about the effects of DFM, osages, feeding times and frequencies, strains of DFM, and effects on different animal conditions are vailable. Cultivation and preparation of ready-to-use strict anaerobes as DFM may be cost-prohibitive, and dosing methods, such as drenching, that are required for anaerobic DFM are unlikely to be acceptable as general on-farm practice. Aero-tolerant rumen microorganisms are limited to only few species, although the potential isolation and utilization of aero-tolerant ruminal strains as DFM has been reported. Spore forming bacteria are characterized by convenience of preparation and effectiveness of DFM delivery to target organs and therefore have been proposed as DFM strains. Recent many studies have supported the positive effects of DFM on ruminant performance.

Gomes *et al.* (2009) was done an experiment to evaluate the effects of the supplementation of feed additives on carcass quality in beef cattle, 72 Nellore steers (339.5kg, 20-month old) were feedlot finished and fed for 91 days one of the following diets: 1) control with no additives; or added of 2) live yeast culture; 3) monensin; or 4) the association of both additives. renal, pelvic, and inguinal fat and hot carcass weights were recorded and carcass was split into muscle, bone, and trimmable fat observe after slaughter of these cattle and the Carcass Longissimus muscle area and subcutaneous fat thickness at the 12th rib were measured and steaks of Longisimus muscle were taken to determine meat color, shear force, drip, and cooking losses. Carcass dressing percentage was increased by Yeast but there were no effects on hot carcass weight, Longissimus area, subcutaneous fat thickness, percentage and weight of retail cut yield and trimmings. Carcass pH, meat color, fat content, shears force, and drip losseshas no effect after using the Feed additives.

Supplementation of yeast, monensin or the association of both additives had no important effects on carcass traits and on meat quality of feedlot finished steers.

2.4 *Saccharomyces cerevisiae* (A-Max) and Acetohydroxamic acid (URIT) as feed supplement

Saccharomyces cerevisiae is a species of yeast. It has been helpful to winemaking, baking, and brewing since ancient times. It is believed to have been originally isolated from the skin of grapes. Now many yeast use as a feed additives; *Saccharomyces cerevisiae* (Yeast) is one of them, has been found to exert a positive effect on the ruminant's production. (Reference: Wikipedia)

Scientific classification of *Saccharomyces cerevisiae*

Kingdom	:	Fungi
Phylum	:	Ascomycota
Subphylum	:	Saccharomycotina
Order	:	Saccharomycetales
Family	:	Saccharomycetaceae
Genus	:	Saccharomyces
Species	:	*S. cerevisiae*

Many researchers have been conducted researches *Saccharomyces cerevisiae* as animal feed supplement, but in Bangladesh, limited research work has been performed. Some of the review is below:

Broadway *et al.* (2015) were done an experiment on live supplements Enhance Immune Function and Performance in beef producing cattle. Yeast (*Saccharomyces cerevisiae*) have been reported to have positive effects both directly and indirectly on the immune system and its subsequent biomarkers, thereby mitigating negative effects associated with stress and disease. These yeast-based products have also been reported to simultaneously enhance growth and performance by enhancing dry matter intake (DMI) and average daily gain (ADG) perhaps through the establishment of a healthy gastrointestinal tract. These products may be especially useful in times of potential stress such as during birth, weaning, early lactation, and during the receiving period at the feedlot. Overall, yeast supplements appear to possess the ability to improve animal health and metabolism while decreasing morbidity, thereby enhancing profitability of these animals.

Ghazanfar *et al.* (2015) done an experiment on the effect of dietary supplement of Yeast (*Saccharomyces cerevisiae*) on growth and performance of cattle, where they conducted a 120 day feeding trial, 8 cattle heifers (87±5.00 kg and 6 to 7 months) were randomly divided into two equal groups of four animals each (control and supplemented). During the trial, heifers in both the groups were offered National Research Council (NRC) recommended diet with or without yeast supplementation. They formulated the diet by adapting the small dairy breed's heifer's nutrients requirements for growth rate of 0.60 kg/day considering body weight of 100 kg. The heifers in the supplemented group fed with *Saccharomyces cerevisiae*; Yea-Sac1026 (Alltech Inc., Nicholasville, KY), 5 g/animal/day. The effects of *Saccharomyces cerevisiae* on growth performance, blood parameters, nutrient digestibility, fecal coliform and Lactobacillus were studied. Average dry matter intake (DMI) was not

different among both groups; whereas average daily weight gain was higher ($p<0.05$) in supplemented compared with control group. The digestibility of dry matter, organic matter, crude protein, neuter detergent fiber and acid detergent fiber was higher ($p<0.05$) in yeast supplemented group compared with control group. They found that yeast-supplementation increased ($p<0.05$) the eosinophil and hemoglobin levels and erythrocytes and leukocytes counts. The average fecal population of Lactobacillus was greater ($p<0.05$) with yeast-supplemented than in control group. Finally they concluded that incorporation of *Saccharomyces cerevisiae* in the NRC recommended diet improved growth and health performance of dairy cattle heifers.

Zaleska *et al.* (2015) conducted an experiment on impact of *Saccharomyces cerevisiae* supplementation on reproductive performance, milk yield in ewes and offspring growth, here the effect of supplementing sheep diets with *Saccharomyces cerevisiae* Inter Yeast dried brewer's yeast (Leiber GmbH, Bramsche, Germany) or with a Biolex® Beta-S (Leiber GmbH, Bramsche, Germany) extract containing over 70% _·β-1, 3/1, 6-D-glucan was investigated. Experiment 1 was carried out with 120 ewes and 190 lambs. The animals were divided into three groups: I – control; II – fed yeast; and III – fed Biolex. The supplements were administered during a 3-week preparation period for topping and a 70-day lamb-rearing period. The following reproductive parameters were analyzed: fertility, prolificacy, lamb rearing and breeding performance, milk yield and lamb growth rate. Experiment 2 was conducted with 120 ewes divided into two groups: I – control and II – fed yeast during a 3-week preparation period. Fertility and prolificacy were analyzed. Significant increases in prolificacy were recorded in sheep administered dried brewer's yeast: 28.51% in experiment 1 and 31.33% in experiment 2. Breeding performance was also higher by

35.00 %. Both yeast supplements had a stimulating impact on the milk yield of ewes and the growth rate of their offspring. Milk from the experimental ewes, especially in the group fed Biolex, had a substantially higher content of dry matter, mainly fat. The lambs in this group had the highest body weight at the age of 70 days. Finally they concluded that, the production of livestock per mother was highest in the group fed the supplement with *Saccharomyces cerevisiae*.

Hossain *et al.* (2014) conducted an experiment on supplement (*Saccharomyces cerevisiae*) on the performance and milk yield of cow. Ten multiparous cows were selected for the experiment. These cows were taken as control group before feeding probiotics and after feeding they were taken as treatment group. The cows were supplemented with 15 g live yeast culture per head per day for a one month trial period. In the conducted experiment it was seen that there was significant ($P<0.05$) improvement in milk yield after supplementing probiotics (0.3 liter/ day/ animal which is 8.80% in average daily milk yield) to the cross breed dairy cows. It was observed that there was no significant improvement in butter fat percentage of milk ($P>0.05$) and acidity (%) between treatment group and control group, but significant improvement ($P<0.05$) was found in protein content solids-not-fat content of milk, and performance.

Bitencourt *et al.* (2011) were conducted an experiment on dietary yeast supplementation to improve the digestive efficiency of ruminants, but responses depend on the yeast strain and the diet composition. Corn silage and citrus pulp are usual carbohydrate sources for dairy cows in southeast Brazil. This study evaluated the supplementation of dairy cows feeding on corn silage citrus pulp-based diets with *Saccharomyces cerevisiae*. Twenty multiparous, midlactation Holstein cows were

assigned to two treatments in crossover design. Treatments were: live yeast on oyster meal capable of supplying a daily minimum of 1 × 1010 CFU per cow or oyster meal top-dressed at 10 g to the morning meal. Diet contained (% of dry matter): 16.8% crude protein, 30.9% neutral detergent fiber, 43.9% corn silage, 2% tifton hay, 14.4% steam flaked corn, 16.9% citrus pulp and 21.7% soybean meal. Yeast supplementation increased daily yields of milk (29.4 vs. 28.5 kg, p = 0.11), protein (0.939 vs. 0.908 kg, p = 0.05), and lactose (1.294 vs. 1.241 kg, p = 0.06), but did not affect milk fat contents (p = 0.59). Daily dry matter intake was 21.4 with yeast and 20.7 kg for the control (p = 0.11). Total tract apparent digestibility of the neutral detergent fiber was 48.1% with yeast and 43.2% for the control (p = 0.08). Finally they reported that, there was a trend for increased intake of digestible organic matter with yeast supplementation (p = 0.07). The positive milk protein yield response to yeast supplementation may have resulted from the increased fiber digestibility.

Yalçın *et al.* (2011) studied abou the Nutritive Value of Live Yeast Culture (*Saccharomyces cerevisiae*) and its effect on milk yield, performance, milk composition and some blood parameters of dairy cows. Six multiparous Holstein cows were allocated to two groups of three cows and assigned randomly to one of two diets in a cross-over experiment. Daily 50 g *Saccharomyces cerevisiae* was top dressed at the p.m. feeding for the treatment group. *Saccharomyces cerevisiae* supplied a high protein and energy with high organic matter digestibility values (83.35%) determined by in vitro enzymatic analysis. Yeast culture supplementation significantly increased milk yield, tended to increase fat, protein and lactose of milk. Methylated fatty acid level of 18:3 (n-3) in milk fat was increased by yeast culture supplementation. The concentrations of methionine, phenylalanine, tyrosine,

tryptophan and taurine were significantly increased with dietary inclusion of yeast culture. Live yeast culture supplementation did not affect other performance characteristics, milk quality characteristics and blood parameters. As a conclusion they said that live yeast culture (*Saccharomyces cerevisiae*) had high nutritive value and positive effects on milk production, performance and some milk quality characteristics in lactating cows under field conditions.

Zain *et al.* (2011) conducted an experiment on the effect of yeast (*Saccharomyces cerevisiae*) on fermentability, microbial population and digestibility of low quality roughage in vitro. In the experiment they used completely randomized design, with 4 treatments and 4 replications. The experimental substrates composed of 50% ammoniated rice and 50% concentrate, and this substrate was used as a control substrate (A). The rice straw was previously treated with 4% urea. The crude protein of the substrate was 12%. S. cerevisiae was added in the diet at 0.25, 0.50 and 0.75% on dry matter in diet B, C and D respectively. In vitro fermentability and degradability of nutrients were determined following the first stage of the Tilley and Terry procedure (1969). Ruminal fluid was obtained from a cannulated steer. The parameters measured were dry matter digestibility, organic matter, cellulose, neutral detergent fiber (NDF), acid detergent fiber (ADF), pH, concentration of ammonia (NH3), volatile fatty acid (VFA) and rumen microbial population. The results indicated that the addition of S. cerevisiae significantly increased the nutrient digestibility, fermentability rations and rumen microbial population. Digestibility of dry matter increased from 53.00% to 61.00%, 65.00% and 66.00% and rumen microbial population increased from 0.29 x 109 cfu/ml rumen fluid to 4.99 x 109, 5.12 x 109 and 6.01 x 109 cfu/ml rumen fluid, respectively, in treatments A, B, C and

D. Supplementation of 0.50 and 0.75 % S. cerresiveae did not significantly affect digestibility. Finally they concluded that the best supplementation of S. cerevisiae is 0.5% in dry matter substrate.

Petr Doležal *et al.* (2010) were conducted an experiment about the effect of yeast culture (*Saccharomyces cerevisiae*) supplementation on ruminal fermentation in 20 Holstein dairy cows divided into control and experimental groups, each group of 10 cows. Here the animals received a diet based on maize silage (19 kg), alfalfa silage (15 kg), meadow hay (1.5 kg), extracted rapeseed meal (1 kg) and concentrate mixture (9.5 kg). The diets were fed as a total mixed ration. The supplement of yeast culture Levucell® SC 20 (*Saccharomyces cerevisiae* – CNCM I-1077; min. content 2 × 1010 CFU·g-1) was added to the concentrate mixture in the ration fed to the experimental group of animals. The addition of yeast culture significantly ($P < 0.01$) increased ruminal pH but had no positive effects on the increased production of volatile fatty acids. The supplementation of yeast culture significantly ($P<0.01$) increased numbers of protozoa in the rumen of dairy cows of the experimental group (361.3 ± 18.315) compared to the control group (308.3 ± 37.505). The addition of yeast culture significantly ($P < 0.01$) increased concentration of serum glucose, calcium, phosphorus, copper, zinc, magnesium and AST ($P < 0.05$). As compared to the control group (4.948 ± 0.0384 mmol·l-1), the level of urea in the blood serum was significantly decreased ($P < 0.01$) in the experimental group of cows. At the end they concluded that the supplementation of *Saccharomyces cerevisiae* culture at recommended doses enhances ruminal fermentation which may have a positive effect on health status and milk production of Holstein dairy cows.

Mikulec *et al.* (2010) conducted an experiment on Influence of live yeast cells (*Saccharomyces cerevisiae*) supplementation to the diet of fattening lambs on growth performance and rumen bacterial number, here they performed the on thirty-six East - Friesian lambs divided into a control group without live yeast cells (CD = control diet), an experimental group with 1 g/day of live yeast cells in the diet (YC1) and an experimental group with 0.5 g/day of live yeast cells in the diet (YC0.5). Diet was based on hay and concentrate containing: corn (66.3%), soybean meal (18.7%), bran (6%) and alfalfa meal (4%). No effects were recorded on weight, weight gain and feed conversion ratio. The number of anaerobic and aerobic rumen bacteria was not affected by the treatment. Results demonstrated that 0.5 g/day and 1 g/day of live yeast cells supplementation to finishing lambs fed hay and high energy concentrate does not improve growth performance.

Milewski (2009) conducted an experiment with 26 lactating Kamieniec breed ewes divided into two equal groups: I – control and II – experimental. Group II ewes were fed a diet supplemented with *Saccharomyces cerevisiae* dried yeast (Inter Yeast S), mixed with CJ concentrate, in the amount of 30 g/animal/d. Milk yield and the blood biochemical and haematological indices of ewes were determined on days 28 and 70 of lactation. Dietary supplementation with dried yeast caused a significant increase in milk yield (by 18.18% at the peak of lactation and by 15.53% towards the end of lactation). An increase in the counts of erythrocytes and leukocytes, haemoglobin concentration, and haematocrit values was observed in ewes fed a diet containing dried yeast. An increase in the concentrations of glucose and Na+ and Cl^{-} ions accompanied by a decrease in creatinine concentrations and a shift in the acidbase balance towards the alkaline side was demonstrated in the experimental ewes.

Changes in the haematological parameters of experimental ewes were indicative of blood-supply improvement and immunity enhancement. Which changes in biochemical indices suggested that, the administered yeast supplement had a stimulating effect on energy metabolism and a protective effect on renal function, and it contributed to preventing metabolic acidosis.

Dolezali *et al.* (2005) conducted an experiment investigated the effect of addition of yeast culture (*Saccharomyces cerevisiae*) on rumen fermentation by using thirty-six dairy cows of Holstein breed. Here the animals were divided into one control and five experimental groups. Each group involved 6 individuals. The animals received a diet consisting of good maize silage with a higher dry matter content (16 kg), clover-grass haylage (l6 kg), meadow hay (3 kg) and supplementary feed mixture (7.5 kg). The rations were fed to cows as total mixed ration (TMR). In experimental groups, the yeast culture was added into the feed mixture in amounts of 2, 4, 6, 8, 10 g per day and animal. Samples of rumen fluid were taken per orally 3–4 hours after feeding. The obtained results indicated that the addition of a *Saccharomyces cerevisiae* SC-47 culture in recommended doses showed a positive effect on ruminal digestion. As compared with control, the addition of all aforementioned amounts of the yeast culture into the feeding ration resulted in all cases in a statistically significant ($P<0.01$) decrease in pH and fluctuated near the lower limit of the reference values. As compared with control, the yeast culture supplementation showed a positive effect ($P<0.01$) on production of volatile fatty acids (VFA) (127.6 vs. 84.0 mmol/l). The utilisation of ammonia was higher ($P<0.01$) in experimental groups (8.12, resp. 8.68 mmol/l) than in controls (9.06 mmol/l). The difference in protozoa numbers in rumens of dairy cows in the control and experimental groups was statistically highly

significantly ($P<0.01$) different. There was a close relationship between the dose of yeast culture on the one hand and the VFA content and protozoa numbers on the other. The regression analysis of dependence of dependent variable (i.e. pH of rumen fluid) on the independent one (i.e. the dose of yeast culture) revealed only a slight degree of dependence ($r = 0.671$). Here results shows that *Saccharomyces cerevisiae* culture in recommended doses showed a positive effect on ruminal digestion.

Alshaikh *et al.* (2001) were conducted an experiment to examine the effect of dietary yeast supplementation on milk production, milk composition and ruminal fermentation by using one hundred-fifty lactating, multiparous cow at post-peak of lactation. They randomly divided the cows into three groups of fifty cows each: a control group fed on a basal diet without yeast supplementation and two groups fed on basal diets supplemented with one of two commercial sources of yeast cultures, given at the rates of 15 g/head/d (YC1) and 50 g/head/d (YC2), respectively, as per manufacturers' recommendation. Daily milk production was recorded for all cows, while milk samples were taken randomly from ten cows per group for two consecutive days at two-week intervals for chemical analysis of the milk. Rumen fluids were also analyzed for ammonia nitrogen and volatile fatty acids. There the results indicated that cows consuming diets supplemented with yeast culture tended to decrease their dry matter intake and to increase their milk yield. Cows fed YC2 supplemented diet produced more milk and 4% fat corrected milk than those fed either YC1-supplemented diet or the control. The highest milk fat percentage was obtained in cows fed YC2 supplemented diet while the highest percentages of protein, lactose, total solids and solids not fat were recorded in cows fed YC1. Finally

they concluded that rumen ammonia nitrogen concentration decreased significantly after yeast culture supplementation.

Acetohydroxamic acid (also known as AHA or Lithostat) is a drug that is a potent and irreversible inhibitor of bacterial and plant urease usually used for urinary tract infections. The molecule is similar to urea but is not hydrolysable by the urease enzyme. In 1983 the US Food and Drug Administration approved acetohydroxamic acid (AHA) as an orphan drug for "prevention of so-called struvite stones" under the newly enacted Orphan Drug Act of 1983 (An orphan drug is a pharmaceutical agent that has been developed specifically to treat a rare medical condition, the condition itself being referred to as an rare disease). AHA cannot be patented because it is a standard chemical compound.

The Formula of Acetohydroxamic acid: C2H5NO2

FDA Pharmacology Summary from FDA Pharm Classes showed that acetohydroxamic acid is a Urease Inhibitor. The mechanism of action of acetohydroxamic acid is as a Urease Inhibitor (Acetohydroxamic acid, a synthetic drug derived from hydroxylamine and ethyl acetate, is similar in structure to urea. In the urine, it acts as an antagonist of the bacterial enzyme urease.

Metabolic description from HMDB shows that Acetohydroxamic Acid has no direct antimicrobial action and does not acidify urine directly. It is used, in addition to antibiotics or medical procedures, to treat chronic urea-splitting urinary infections.

Sunhy Biology Company said in their literature that, Acetohydroxamic acid (URIT) increase urease activity in ruminant’s rumen non-competitively. Acetohydroxamic acid (URIT) slowing down the decomposing speed of urea in rumen, synchronize the

ammonia releasing and its utilization by ruminant microorganism, or keeping them relatively balance; preventing animal from ammonia poisoning. Acetohydroxamic acid (URIT) Improves utilization efficiency of exogenous and endogenous ammonia—N, increase the synthesized quantity of microorganism protein. It also save protein feedstuff, increases the digestive speed of crude feed in rumen, and improves growth performance of animals. It prevents ammonia odor in farm, prevents protein deficiency disease, increase immunity against disease and Acetohydroxamic acid (URIT) helps to fattening of cow. Acetohydroxamic acid (URIT) has fewer side effects in also overdose (2 or 3 times more than normal dose)

Wang *et al.* (1999) was conducted an experiment to investigate the effects of urea and acetohydroxamic acid (AHA) on in vitro ruminal urea-nitrogen (urea-N) metabolism and microbial community using total mixed ration as a substrate. Here treatments were arranged in a 2 × 2 factorial design with urea supplemented at 0 or 2% dry matter (DM), and AHA equivalent to 0 or 450 mg/kg DM. Ruminal fluids were collected from 3 Chinese Holstein dairy cows through permanent ruminal fistula, diluted with artificial saliva (1: 2, v/v), and incubated anaerobically at 39°C for 0, 1, 2, 4, 6, and 12 h. Each treatment was performed in 3 serum bottles and experiment was run 3 times. Supplementation of urea increased ($P < 0.01$) ruminal pH, ammonia-nitrogen (NH3-N) concentration and urease activity, while addition of AHA inhibited ($P<0.01$) their increments. Acetohydroxamic acid was still stable within 6 h of incubation. When AHA was added, urea-N concentration of fermentation fluid in the treatment with urea supplied was gradual decline ($P<0.05$). The peak of NH3-N concentration was not delayed by AHA addition, comparing with treatment with urea supplementation only. The bacterial PCR-DGGE profiles of

4 treatments were similar to each other before and after incubation. Urea stimulated ($P < 0.01$) the decrements of Ruminococcus albus, R. flavefaciens, Fibrobacter succinogene, and Butyrivibrio fibrisolvens populations, but had no effect on Prevotella population ($P = 0.18$). However, all those functional bacterial populations were not influenced by AHA addition. It was concluded that AHA could slow down the degradation of urea by the inhibition of urease activity, and the dose of 450 mg/kg DM could not alter ammonia formation pattern in this fermentation condition. In addition, AHA had no effect on ruminal microbiota, which could be altered by urea supplementation.

Wang *et al.* (1999) found that changes of the rumen microbial profiles as affected by urea and acetohydroxamic acid addition in vitro. In ruminants, urea was broken down rapidly to ammonia by rumen bacteria and urease inhibitors were used for increasing the efficiency of urea utilization by inhibiting ruminal urease. And, the effect of urea and urease inhibitors on the rumen microbes was not clear. This study investigated the effect of urea and AHA (acetohydroxamic acid) addition in the diets on rumen microbial diversity using dual-flow continuous culture systems. Eight fermenters were used in a period of 10 d (7 d for adaptation and 3 d for sampling) experiment and TMR (containing alfalfa hay 17.72%, corn silage 17.5%, steam corn 7.39%, soybean meal 2.64%) were placed into each fermenter twice a day. Based on this diet, the fermenters were assigned to a 2 × 2 factorial arrangement of treatments with urea supplemented at 0 or 0.5% dry matter intake (DMI), and AHA equivalent to 0 or 450 mg/kg DMI. While the urea and AHA were dissolve in the artificial saliva and infused into the vessels twice daily. On each sampling day, fermentation fluids were collected at 0 h, 2 h, 6 h and 10 h from each fermenter. Total DNA of rumen microbe

were extracted and subjected for DGGE and 16S rRNA gene sequencing. Distinct bacterial profiles were observed with urea addition and little differences were found with AHA addition. UPGMA analysis showed that samples with urea and AHA addition were clustered together. Group with urea addition showed a higher Shannon diversity compared with other groups ($P<0.01$). 16S rRNA gene sequencing analysis revealed that the dominant ruminal bacteria shared by all 4 groups belonged to phyla Firmicutes, Bacteroidetes and Proteobacteria. However, in urea adding groups, the bacteria Lachnospiraceae, Clostridiaceae, and Succinivibrionaceae were found in highest abundance compared with the other 2 groups ($P<0.01$). In contrast, the Paraprevotellaceae and Veillonellaceae bacteria were abundant in treatments without urea ($P<0.01$). Little difference of the bacteria abundance was found with AHA addition. In conclusion, adding urea to the diet could change the ruminal bacteria diversity while AHA addition had little effect on the rumen microbiota.

CHAPTER III

MATERIALS AND METHODS

3.1. Experimental site selection

Present study was conducted in a commercial bull farm in Masumpur, under 6 no Auliapur Union, Dinajpur Sadar, Dinajpur. The farm situated in side of the Ramsagor road, where necessary equipment is available from nearest market and also from Dinajpur town. In the farm there was an experienced manager and also have experienced labor. By considering these, this farm was selected for the experiment.

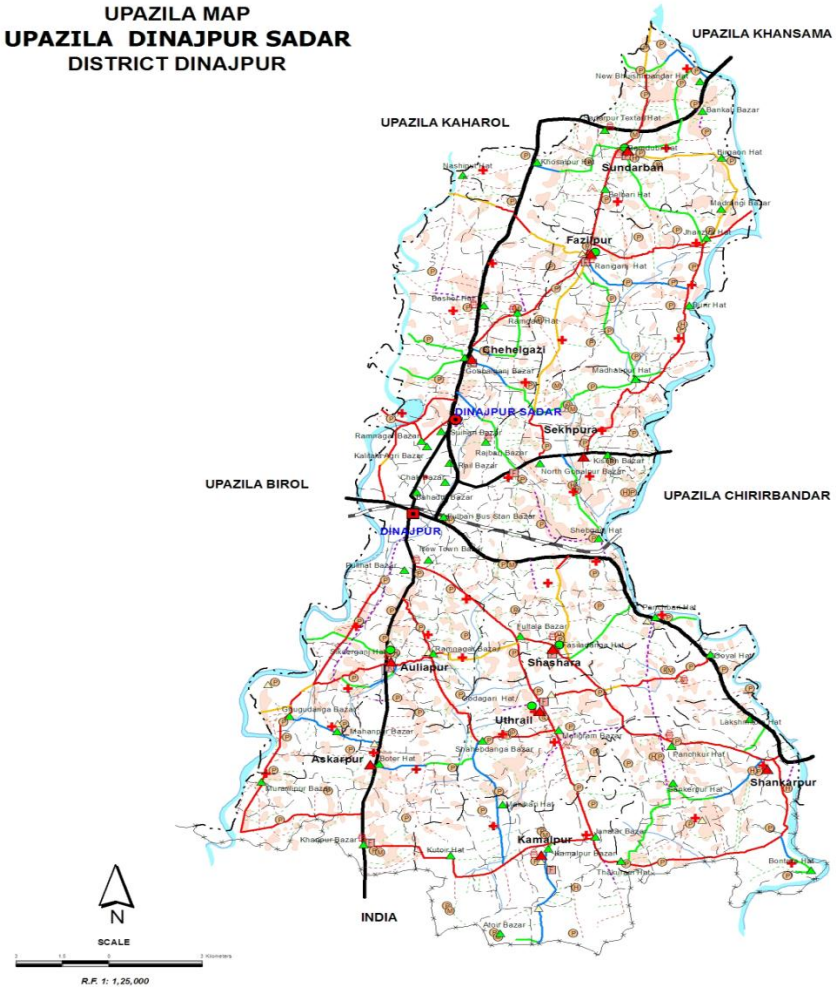

Figure 1: Dinajpur Upazilla map

3.2 Experimental Animal

Indigenous bulls were selected for this experiment, and for that 12 indigenous bull are brought for this experiment. The age of the animal was between 2.0 to 2.5 years. All of the experimental bulls were healthy, disease free and physiologically sound and they are adapted to the local environment.

Figure 2: Urit (Acetohydroxamic acid) and A-Max (Saccharomyces cerevisiae).

3.3 Experimental feeds

There were two feed supplement used for the research. These are Urit (Acetohydroxamic acid) and A-Max (Saccharomyces cerevisiae) (Fig: 3.2).

Urit (Acetohydroxamic acid) is originally manufactured by Shuny Biology, China, and in Bangladesh it is imported and marketed by "Century Agro Limited". The price of urit is BDT 250/- for 200gm. And for one bull its cost is only BDT 2.5/- per day per bull (in a dose of 2 g per day per bull).

A-Max (Saccharomyces cerevisiae) yeast culture is originally manufactured by Arm & Hammer Animal Nutrition, USA. In Bangladesh "Wilts Marketing Company Limited" import and marketed this. The retail price of A-max is BDT 320/-. And for one bull its cost is only BDT 5.76/- per day per bull (in a dose of 18 g per day per bull).

3.4 Experimental layout

The experiment was conducted with total 12 indigenous bull aged between 2.0 years to 2.5 years. These bulls were randomly divided into three (3) experimental groups, identified as T_0, T_1 and T_2. Here T_0 group is control group and these bulls are reared with regular rations and *ad libitum* rice straw and fresh water. T_1 group was supplemented with Urit (Acetohydroxamic acid, 2 g in feed/bull/day) with regular ration and *ad libitum* rice straw and fresh water. T_2 group was treated with A-Max (*Saccharomyces cerevisiae,* 18 g feed/bull/day) with regular ration and *ad libitum* rice straw and fresh water. Then the animals were kept in a shed fed them separately. Initial live weight was taken at the start of the experiment and then weekly upto 11 weeks (77 days) by using digital balance machine.

The experimental layout was as follows:

T_0 = Feed mixture (2 kg/bull/day) + *Ad libitum* rice Straw & water

T_1 = Feed mixture (2 kg/bull/day) + Urit (2 g/bull/day) + *Ad libitum* rice straw & water

T_2 = Feed mixture (2 kg/bull/day) + A-Max (18 g/bull/day) + *Ad libitum* rice Straw & water

3.5 Shed preparation for bull rearing

Before purchasing the bull the shed was washed and cleaned with fresh water, spray water and disinfectant. Then all necessary equipment was set properly for bull rearing.

3.6 Pre-experimental management of bull

Total 12 indigenous bulls brought for the experiment. Then the bulls were kept 7 days in the shed for observation. After this period the bull were introduced with

anthelmintic drug Tab. Endex (Triclabendazole INN & Levamisole BP) at the rate of one bolus for 75 kg body weight and after 7 days booster dose is given to those bulls. During the experiment the prevalence of FMD was higher, so FMD vaccine was introduced.

3.7 Preparation of ration

A ration was prepared for these bulls. The availability, the cost and nutritious value were considered for preparing this ration. 100 kg ration for the bull was prepeared as follows-

Table 1: Ration for bull

Sl. No.	Name of feed	Amount (Kg)	Unit Price(Tk.)	Price(Tk.)
1	Soybean Meal	20	34	680
2	Maize (grain)	15	20	300
3	Rice bran	14	16	224
4	Molasses	14	30	420
5	Rice straw	30	3	90
6	Gram husk	3	20	60
7	Urea	0.5	20	10
8	Mineral Premix	2	80	160
9	Sodi-Bi -Carb	0.5	100	50
10	Vitamin	0.5	250	125
11	Salt	0.5	25	12.5
Total		**100**		**2132**

For 100 kg feed preparation the cost is BDT 2132/-. And according to this the cost was 21.32 taka for per kg feed mixture.

3.8 General management practices

Always fresh, clean and cool drinking water was made available for all the beef bull, cleaning of the farm was done in every morning. Bulls of different groups were kept in different side of the shade. All the bulls were washed with water once daily except when the weather was too cold. The experimental supplements was combined with regular formulated ration and divided into two portions, supplied twice daily, once at 10 a.m and another at 3 p.m. Straw and water were supplied *ad libitum*.

3.9 Parameter Studied

The following parameters were studied during the experimental period:

I. Feed intake (kg)
II. Live weight (kg)
III. Live weight gain (kg)
IV. To analyze the cost benefit ratio of the beef bull production

3.10 Measurement of live weight

Initial live weight of each bull was measured with the help of digital balance on 0 day of experiment and subsequently at every 7 days interval the bull were weighed and recorded up to 11 weeks of experimental age (Fig: 3.3).

Figure 3: Weighing Machine and measuring of weight

3.11 Calculation

$$\textbf{Total weight gain (g)} = \text{Average final wt.} - \text{Average initial wt.}$$

$$\textbf{Average daily gain (g)} = \frac{\text{Final live weight} - \text{Initial live weight}}{\text{Experimental age (days)}}$$

$$\textbf{Total benefit} = \text{Total outcome} - \text{Total cost}$$

3.12 Data and Statistical Analysis

Data were analyzed using SPSS v.11 for Windows (SPSS Inc., Chicago, IL, USA). Statistically significant differences between group means were determined by analysis of variance (ANOVA). Mean values were considered significantly different at $P<0.05$. Data were expressed as mean ± SEM.

CHAPTER IV

RESULTS AND DISCUSSION

This chapter represents the result after completing the experiment and their discussion. Different parameters of the experiment are followings –

4.1 Live weight

Effect of *Saccharomyces cerevisiae* (A-max) and Acetohydroxamic acid (Urit) on live weight of bulls represented in Table 2 here initial weight taken before start the experiment and then every 7 days intervals the weight of these cattle was taken.

Table 2: Live weight of bulls fed *Saccharomyces cerevisiae* (A-maax) and Acetohydroxamic acid (Urit)

Live weight at different weeks	Experimental groups			Level of Significance
	T_0	T_1	T_2	
Initial wt	151.75 ± 9.31	153.50 ± 8.84	158.00 ± 13.16	NS
at 1st Week	155.75 ± 9.31	158.50 ± 9.08	163.25 ± 13.30	NS
Wt. at 2nd Week	159.88 ± 9.27	163.25 ± 9.00	168.50 ± 13.07	NS
Wt. at 3rd Week	164.13 ± 9.15	167.75 ± 9.14	173.50 ± 12.70	NS
Wt. at 4th Week	168.13 ± 9.15	172.75 ± 8.49	178.50 ± 13.04	NS
Wt. at 5th Week	172.25 ± 9.45	177.50 ± 8.55	183.50 ± 12.89	NS
Wt. at 6th Week	176.38 ± 9.76	180.75 ± 9.86	186.50 ± 12.16	NS
Wt. at 7th Week	180.63 ± 9.64	185.50 ± 9.97	191.50 ± 12.50	NS
Wt. at 8th Week	184.50 ±10.02	190.25 ± 10.00	196.75 ± 12.16	NS
Wt. at 9th Week	188.63 ± 10.33	195.25 ± 10.36	201.75 ± 12.15	NS
Wt. at 10th Week	192.50 ± 10.32	200.00 ± 10.19	206.75 ± 12.15	NS
Wt. at 11th Week / final weight	196.50 ± 9.96	204.75 ± 10.03	212.00 ± 12.51	NS

Wt= weight, NS = Non significant (P>0.05). Here, T_0, rearing with regular ration; T_1, treated with 2 g Acetohydroxamic acid (Urit) ; T_2, treated with 18 g *Saccharomyces cerevisiae* (A-max)

Result of the experiment showed that average live weight of these bull among the groups is not differed significantly (P>0.05). But from the results it shows that there is change in live weight gain, the initial live weight of these groups T_0 , T_1 and T2, respectively 151.75±9.31,153.50±8.84 and 158.00±13.16, final weight is 196.50±9.96, 204.75±10.03 and 212.00±12.51 the live weight gain is higher in group T_2, then in T_1, and comparatively less in T_0.

4.2 average weight gain

Effect of dietary *Saccharomyces cerevisiae* (A-max) and Acetohydroxamic acid (Urit) supplementation on average weight gain of indigenous bull is showed in Table 3.

This result shows that only in 7th week there is no significant (P>0.05) weight gain occurs among the group. But other than 7th week the weight gain changes among the group significantly (P>0.05).

Table 3: Average weekly weight gain

Weight gain	Experimental groups			**Level of Significance**
	T_0	T_1	T_2	
Wt gain at 1st Week	4.00 ± 0.00	5.00 ± 0.58	5.50 ± 0.29	*
Wt gain at 2nd Week	4.13 ± 0.13	4.75 ± 0.25	5.25 ± 0.25	*
Wt gain at 3rd Week	4.25 ± 0.25	4.50 ± 0.29	5.00 ± 0.41	*
Wt gain at 4th Week	4.00 ± 0.41	5.00 ± 0.91	5.00 ± 0.41	*
Wt gain at 5th Week	4.13 ± 0.13	4.75 ± 0.25	5.00 ± 0.41	*
Wt gain at 6th Week	4.13 ± 0.31	3.25 ± 1.70	3.00 ± 1.22	*
Wt gain at 7th Week	4.25 ± 0.25	4.75 ± 0.48	5.00 ± 0.41	NS
Wt gain at 8th Week	3.88 ± 0.43	4.75 ± 0.48	5.25 ± 0.48	*
Wt gain at 9th Week	4.13 ± 0.31	5.00 ± 0.41	5.00 ± 0.41	*
Wt gain at 10th Week	3.88 ± 0.43	4.75 ± 0.25	5.00 ± 0.41	*
Wt gain at 11th Week	4.00 ± 0.41	4.75 ± 0.25	5.25 ± 0.48	*

Wt= weight, NS = Non significant (P>0.05), * = Significant (P<0.05). Here, T_0, rearing with regular ration; T_1, treated with 2 g Acetohydroxamic acid (Urit) ; T_2, treated with 18 g *Saccharomyces cerevisiae* (A-max)

4.3 Feed intake

Average feed intake of indigenous bull is showed in Table 4 and the feed mixture is given to these bulls @ 2 kg per bull. *Ad libitum* rice straw and water were supplied. Here T_0 group is control group and these bulls are reared with regular rations and *ad libitum* rice straw and fresh water. T_1 group was supplemented with Urit (Acetohydroxamic acid, 2 g in feed/bull/day) with regular ration and *ad libitum* rice straw and fresh water. T_2 group was treated with A-Max (*Saccharomyces cerevisiae*, 18 g feed/bull/day) with regular ration and *ad libitum* rice straw and fresh water

Table 4: Feed intake in different groups

Parameter	Experimental groups			Level of significance
	T_0	T_1	T_2	
Feed intake (kg/bull)	154.30±3.02	154.60±5.11	154.20±3.89	NS
Straw (No of bundle)	309±6.14	308±7.21	310±5.95	NS
Urit (g)	-	154 g		-
A-max (g)	-	-	1386 g	-

NS= Non Significant ($P<0.05$); Here, T_0, rearing with regular ration; T_1, treated with 2 g Acetohydroxamic acid (Urit) ; T_2, treated with 18 g *Saccharomyces cerevisiae* (A-max),

4.4 Cost benefit analysis

For the costing the market price of different feed items is considered. One labor is sufficient for 15 beef cattle and salary of the labor is 7200 tk (seven thousand and two hundred taka only). So labor cost for one cow/day is 16 tk only.

According to Skorn Koonawootrittriron *et al.* (2010), Department of Animal Science, Kasetsart, University, Bangkok said that dressing percentage of beef bull is 58 ± 2 %.

And the current meat value is BDT 400/- (four hundred taka).

Table 5 showing the data about total costing and benefit for beef cattle production in aspect of different treatment groups.

Table 5: Data showing the costing and net benefit of beef cattle production

Variables	Dietary treatments		
	T_1	T_2	T_3
Feed intake (kg/bull)	154.30	154.60	154.20
Feed cost (tk)	3289.68	3296.07	3287.54
Straw cost (daily 12 tk/bull)	924.00	924.00	924.00
Labor cost (daily 16tk/bull)	1232.00	1232.00	1232.00
Urit cost (tk)	0.00	192.50	0.00
A-max cost (tk)	0.00	0.00	443.52
other cost (tk)	924.00	924.00	924.00
Total cost per bull (tk)	6523.98	6723.17	6965.26
Total weight gain per bull (kg)	44.75	51.25	54.00
Total meat obtain from per bull (0.58% of total B.W) (kg)	25.95	29.73	31.32
Meat price @tk 400/kg	10382.00	11890.00	12528.00
Total income (tk)	**3858.02**	**5166.83**	**5562.74**

Here, T_0, rearing with regular ration; T_1, treated with 2 g Acetohydroxamic acid (Urit) ; T_2, treated with 18 g *Saccharomyces cerevisiae* (A-max), tk=taka

From the experiment it shows that the weight gain is higher is group-T_2 (treated with 18 g *Saccharomyces cerevisiae*, A-max) and the total weight gain is 54 kg in 77 days and the total benefit is also higher in this group than other, so it indicates a higher growth rates. This result support the findings of Mikulec *et al.* (2010) who conducted an experiment on Influence of live yeast cells (*Saccharomyces cerevisiae*) supplementation to the diet of fattening lambs on growth performance and rumen bacterial number, and found that live yeast cells supplementation (Saccharomyces cerevisiae) to finishing lambs fed hay improve growth performance.

This result support to Ghazanfar *et al.* (2015) findings who told that, incorporation of Saccharomyces cerevisiae in the National Research Council (NRC) recommended diet improved growth and health performance of dairy bull heifers.

Dolezal *et al.* (2010) were conducted an experiment about the effect of yeast culture (*Saccharomyces cerevisiae*) supplementation on ruminal fermentation and results show that the supplementation of *Saccharomyces cerevisiae* culture at recommended doses enhances ruminal fermentation which may have a positive effect and health status of Holstein dairy cows.

Therefore, it is concluded from this experiment that cattle supplemented with *Saccharomyces cerevisiae* had higher body weight. These results may be due to increase feed consumption, improving gut environment of cattle and improve the feed consumption and feed efficiency of the cattle.

CHAPTER V

SUMMARY AND CONCLUSION

Bangladesh is a highly populated country and per capita animal protein intake is below the normal. The production of animal protein is not satisfactory. And to meet up the protein demand we have to increase livestock production and also we have to find a way to produce livestock with low cost where the profit margin is higher.

The current experiment was conducted with total 12 indigenous bull aged between 2.0 years to 2.5 years. These bulls were randomly divided into three (3) experimental groups, identified as T_0, T_1 and T_2. Here T_0 group was control group and these bulls were reared with regular rations and ad libitum rice straw and fresh water. T_1 group was fed ration supplemented with Urit (Acetohydroxamic acid, 2 g in feed/bull/day) with regular ration and ad libitum rice straw and fresh water. T_2 group was treated with A-Max (Saccharomyces cerevisiae, 18 g feed/bull/day) with regular ration and ad libitum rice straw and fresh water. The animals were kept in a shed and fed separately. Initial live weight was taken at the start of the experiment and then weekly up to 11 weeks (77 days) by using digital balance, Weekly average weight gain was T0, T1 and T2 was 3.73 ± 0.18, 4.27 ± 0.26, 4.52 ± 0.25 respectively. In this experiment, the live weight changes significantly and in the 11 weeks for on bull average weight gain of T_0, T_1 and T_2 respectively 44.75 kg, 51.25 kg and 54.00 kg. The net income (Tk) for a single bull in experiment time is T_0, T_1 and T_2 respectively BDT 3858.02/-, BDT 5166.83/-, BDT 5562.74/-.

So, it may be concluded that by using both Urit and A-max increase growth performance of bull. But supplementation of A-max in feed results more benefit than regular ration. This can meet our daily protein deficit as well as it can contribute our national economy. And in small scale farm and both large scale bull fattening farm introduction of both Urit and A-max increase growth rate of bull and which increase their income, can create employment and can increase national income.

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APPENDICES

Appendix-I

Feed intake record of bull

Date……..

Treatment Group	Animal No.	Amount of feed provided (kg)	Amount of Straw provided(kg)	Amount of Urit provided (g)	Amount of A-max provided(g)
T_0					
T_1					
T_2					

Appendix-II

Live weight and weight gain record

Group name …..					
Date	**Animal No.**	**Live weight**	**Average live weight**	**Weight gain**	**Average weight gain**