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Effect of *Saccharomyces cerevisiae* on the growth performance of *Labeo rohita*

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ABSTRACT

Aquaculture is one of the basic and fundamental economical leading industry in Asia. The use of probiotics in aquaculture improves efficiency and growth of fish and feed conversion ratio (FCR). Probiotics may also improve fish culture by triggering appetite and improving fish nutrition by which improving the production quality of vitamins. This method (probiotics) also improves the quality of fish nutrition by the breakdown of components which are indigestible and also by detoxification of injurious compounds present in diet. In probiotics method yeast (*Saccharomyces cerevisiae*) have positive impact of fish performance during fish culturing, especially under stressed conditions. Yeast plays leading improvement in growth and FCR of fish. So, the yeast probiotic method was used to monitor the growth responses of *Labeo rohita* at different levels yeast (*Saccharomyces cerevisiae*) probiotic supplemented feed. Fish probiotic yeast supplemented three treatment groups were made (T_1: $2.0x10^{10}$CFU probiotic, T_2 :$1.0x10^{10}$CFU probiotic while T_3 was 2% of their body weight. The growth parameters were recorded for treated fish after fortnightly netting. The results of net weight gain in treatment groups T_1 (20.64g) was significantly higher as compared to T_2 (18.42g) and T_3 (15.82g) groups. Similar results were seen in the average fish fork length (T_1:46, T_2:40 and T_3:28 mm) and total length (T_1:55, T_2:45 and T_3:30 mm).
Keywords: Probiotic, *Saccharomyces cerevisiae,* Wet weight gain, *Labeo rohita*, Fork length, Total length

INTRODUCTION

Fish has a lot of potential as a source of food to reduce the risk of starvation due to its important protein ingredients. It is more effective to reduce starvation in the country like Pakistan. Fish is highly quality protein source and totally a balanced diet for human of essential amino acids when compared to meat, eggs and milk (Hossain, 1996). The probiotics utilization in fish culture is to control diseases and improve food quality. It also improves growth rate of fish, fish health, improve eco-friendly aquaculture and also it got attention to control antibiotic resistant bacteria (Wang et al*.,* 2008).

In aquaculture, garlic (*Alium sativum*) supplemented feed showed significant results in improving feed conversion ratio (FCR), growth rate and also increase immunity in Nile tilapia (*Oreochromis niloticus*). It was concluded that garlic supplemented feed may be used to enhance growth performance and used as immunity stimulant in Nile tilapia (Naqi et al., 2019). This research promoted the effects of health, growth by alternative additives in farm raised animals using probiotics (Lodemann et al., 2007). Probiotics practice was very well recognized for animals and human dietary purpose (Rinkinen et al*.*, 2003) Now the practice is started in fish aquaculture (Irianto & Austin, 2002).

Probiotics is the use of living micro-organisms for the benefits of host health when administrated in appropriate amounts (FAO & WHO, 2001). Another way by which probiotics is defined among aquaculture is that “the use of living micro-organisms cultures which supplemented to environment (water) or feed to improve better results from the host specie” (Ringo et al., 2010). These also defined as live micro-organisms

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containing bio-proteins that are used to control composition for the growth, micro-flora in animals and colonization and also increase immunity and stimulate digestive process (Dhanaraj et al., 2010). The probiotics control intestinal micro-biota and also control harmful bacteria and also increase defense mechanisms (Giorgio et al*.,* 2010).

Probiotics is used to improve FCR and growth of fish either it will be supplied with vitamins or nutrients or directly supplied by feed (Ringo & Gatesoupe, 1998). Significant results are clearly shown that probiotics may enhance the rate of growth in fish (Bogut et al*.*, 1998) and this may also improve FCR of fish by improving or enhancing the growth rate of the fish (Young-Hyo *et al*., 2001). While culturing fish in stress conditions for its better growth and FCR yeast is best as probiotics for fish aquaculture (Olvera et al., 2001). Many of recent researches shown results that *S. cerevisiae* is good when it is dietary administrated. (Harikrishnan et al., 2011).

Yeast is much more commonly used in aquaculture either it is directly used as feed or processed and used as ingredients of feed (Stones & Mills, 2004). When yeast is used as probiotics feed for fish at its early developmental stages of growth. It definitely enhances its growth rate. Many of the species of yeast are identified for such beneficial purpose in aquaculture but *S. cerevisiae* is documented as best in all ways either alone or with bacteria (Gatesoupe, 2007). Yeast either used as live or as feed supplementation in both ways it improves protein digestibility, feed efficiency and better growth rate. Yeast also colonizes the cells of intestine of the fish after its addition in diet (Wache, et al., 2006). *S. cerevisiae* is considered as best for relative growth rate and weight gain in fingerlings of common carp (Abdulrahman & Muhammad, 2012).

Indian major carps, *Labeo rohita*, *Cirrhinus mrigala and Catla catla* and have their high commercial values in market due to their consumer demand due to their good flesh and taste as diet source. *Labeo rohita* results are satisfactory high for feed conversion efficiency, growth rate and feed conversion ratio when treated against gram positive strains as probiotics (Gohila et al*.,* 2013). When *B. subtilis* is used in feed for *Labeo rohita* shown better results for weight gain and maximum survival rate (Kumar et al*.,* 2006). The *Pseudomonas pseudoalcaligenes*as is used as probiotic feed for *Labeo rohita*, shows higher growth performance relational to control group (Chaudhary & Qazi, 2007). After deficiency of gram positive strains as probiotics feed for *Labeo rohita,* shows better growth results (Damodaran et al., 2013). The current study is therefore designed to evaluate the effects of yeast supplementation on growth of *Labeo rohita.*

MATERIALS AND METHODS

The healthy and fresh fingerlings of fish *Labeo rohita* were collected from Fish Seed Hatchery, Satyana Road, Faisalabad and after their collection the fingerlings were brought and kept at Fisheries Research Farms, Department of Zoology, Wildlife and Fisheries, University of Agriculture, Faisalabad. Then these were transferred to 3 stocking earthen ponds of 15×8×2m (L×W×D) dimensions for each pond. Before stocking, all the ponds were limed with CaO and sundried to kill all the pathogens. In these earthen ponds inlets and outlets were properly maintained to control exit and entry of any organism and were properly screened with iron wire mesh about the size of 1cm. Then poultry manure addition was completed to prepare water for culturing of fish and prevent water seepage as the poultry manure forms a thick layer at the base of the pond. After this job these ponds were filled with underground water through turbine up to level of 1.5 m throughout 6 months (experimental research duration). This process of filling of ponds was done with tube well water and was maintained.

Then morphometric values were measured for *Labeo rohita* fingerlings that were recorded as for total length, wet weight gain and fork length. After such type of measurements 40 fingerlings in each earthen pond were stocked. These morphometric values were consistently recorded fortnightly through the experimental period in the form of total length (mm), fork length (mm) and wet weight gain (g) to evaluate growth performance of experimental fish. These measurements were done by the given formulas in literature of Aliyu-Paiku et al. (2010). After the completion of data work fish were released back in their experimental ponds.

The two supplementary iso-caloric feeds have 2500 kcal/kg energy in 25% protein but having different probiotic levesl (*S. cerevisiae)* viz. 1.00×10^{10}CFUg^{-1} and 2.00×10^{10}CFUg^{-1} respectively were made and fed to fish at the rate of 2 % of the fish wet body weight (Table I).

Table I: Chemical composition of experimental diets

Ingredients	T_1	T_2	T_3
	Probiotic Level I 2.0×10^{10}CFUg^{-1}	Probiotic Level II 1.0×10^{10}CFUg^{-1}	Control Feed (No Additive)
Wheat flour	18%	18%	18%
Starch	2%	2%	2%
Canola meal	14%	14%	14%
Sunflower meal	12%	12%	12%
Corn gluten (30% protein)	19%	19%	19%
Fish meal	15%	15%	15%
Dicalcium phosphate (DCP)	1%	1%	1%
Soya oil	1%	1%	1%
Premix	1.9%	1.95%	2%
Probiotic (*Saccharomyces cerevisae*)	0.1%	0.05%	0%
Total	100%	100%	100%

Then water limnology of ponds was done by collecting water samples and taken out to laboratory but the physical parameters of water were analyzed at ponds site which were light penetration and water temperature. On the other way chemical analysis for chlorides, magnesium, calcium and total hardness along with total dissolved solids (TDS), electrical conductivity (EC), Dissoved oxygen (DO) and PH in laboratory regularly on weekly basis by given protocols as described in A.P.H.A. 1998.

RESULTS

Fish growth

Labeo rohita growth performance was determined or monitored in term of (increase in total length); (increase in fork length) and Wet Weight Gain (g). Two different levels of probiotics (T_1 $2.0x10^{10}$CFU and T_2 $1.0x10^{10}$CFU*) was fed to Labeo rohita* along with a control.

Wet weight gain (g)

Before stocking the fingerlings of *Labeo rohita*, their Wet Weight Gain was 2.30±0.30, 2.80±0.44 and 2.50±0.40g in respectively T_1, T_2 and T_3 (control group) and at the end of the trial average Wet Weight Gain (g) in T_1 ($2.0x10^{10}$CFU), T_2 ($1.0x10^{10}$CFU) and T_3 (control group) was 205.75±1.94, 185.44±0.95 and 156.65±1.52g respectively and also maximum Wet Weight Gain of *Labeo rohita* was 20.64g (T_1), 18.42g (T_2) and 15.82g (T_3)g (Fig 1 and 2).

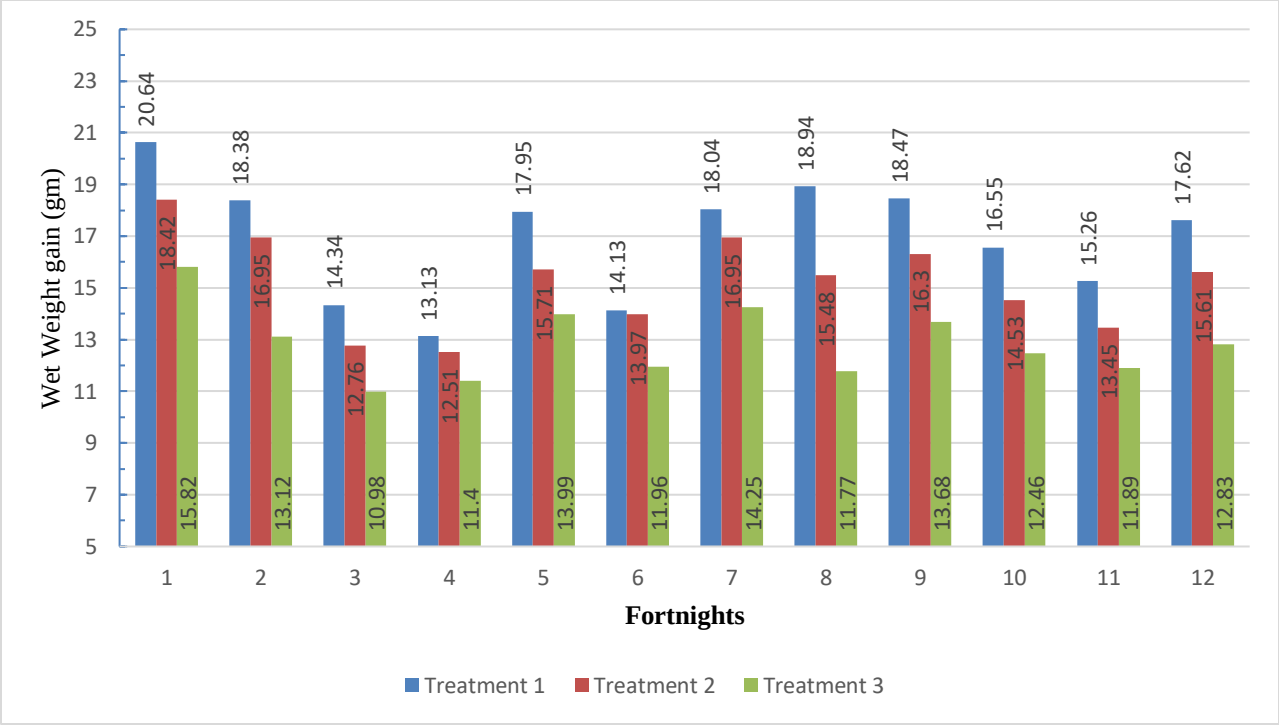

Fig 1: Wet weight gain by *Labeo rohita* in three different treatments of probiotic

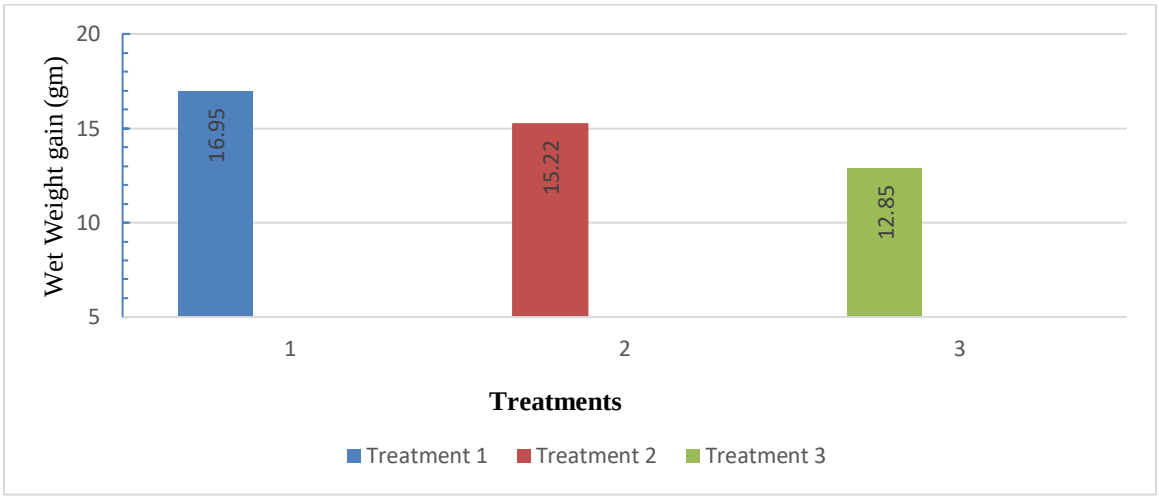

Fig 2: Comparison of total average increased wet weights (g) of *Labeo rohita* in three treatments during all fortnights.

Increase in Fork Length (mm)

Fork Length was measured in T_1, T_2 and T_3 (control group) respectively was 50±0.54, 55±0.30 and 54±0.48mm of *Labeo rohita* before stocking of fish, whereas the Final Fork Length was measured at the end of experiment 228±0.71, 204±0.66 and 170±0.64mm in T_1 ($2.0x10^{10}$CFU), T_2 ($1.0x10^{10}$CFU) and T_3 (control) respectively. The maximum Fork Length of *L. rohita* was shown in T_1, T_2 and T_3 results respectively 46, 40 and 28mm during first fortnight (Fig 3 and 4).

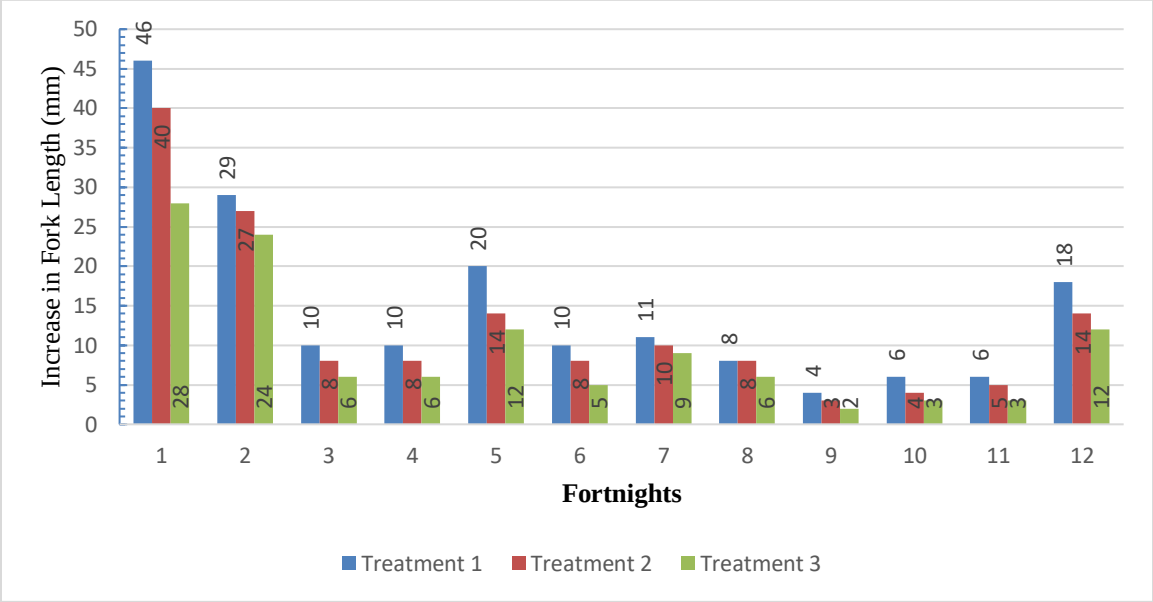

Fig 3: Increase in Fork length by *Labeo rohita* in different treatments

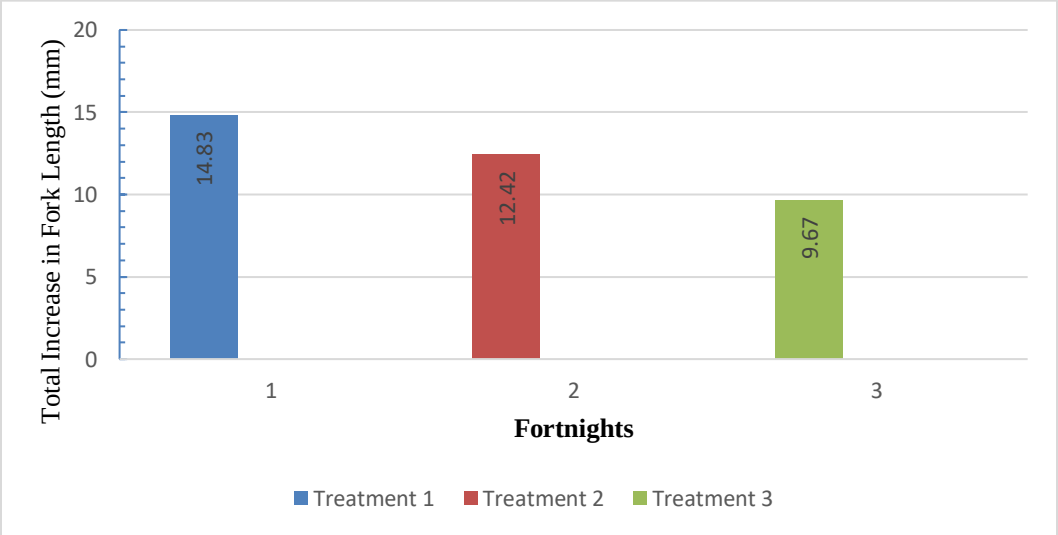

Fig 4: Comparison of total avg. increase in Fork length by *Labeo rohita* in three treatments during six months of trial.

Increase in Total length (mm)

Prior stocking, the Total Length (mm) of the fish were (60±0.65 in T_1) (65±0.53 in T_2) and (65±0.56 in T_3). At the end of the trial, The Total Length of *Labeo rohita* were increased in T_1 (256±0.51) in T_2 (220±0.63) and in control (180±0.47). The maximum Total Length increase was shown in T_1 (55mm), T_2 (45mm) and T_3 (30mm) in *L. rohita* during first fortnight (Figure 5 and 6).

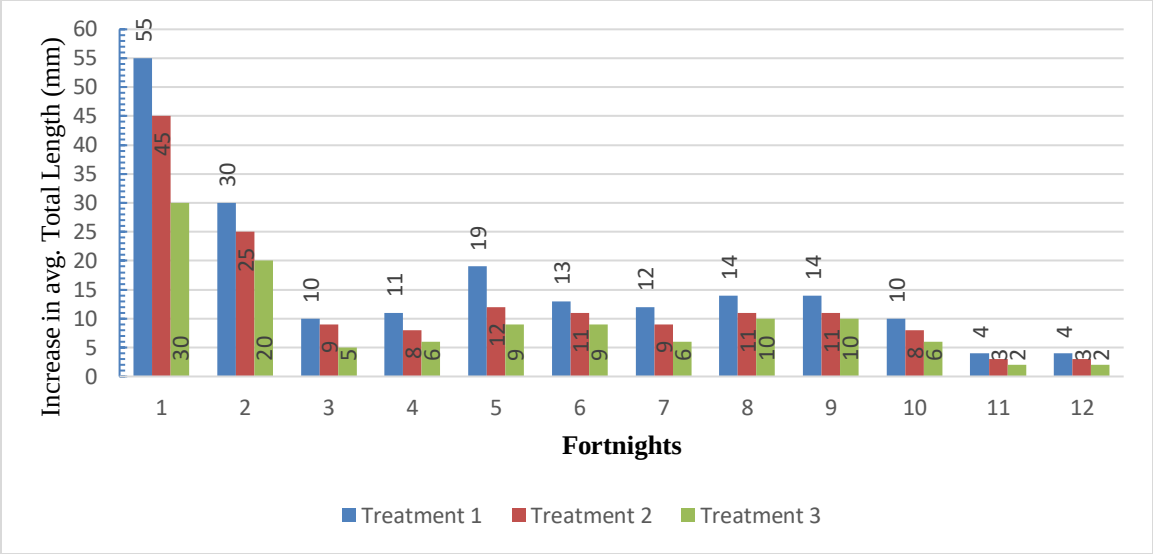

Fig 5: Increase in total length of *Labeo rohita* in different treatments

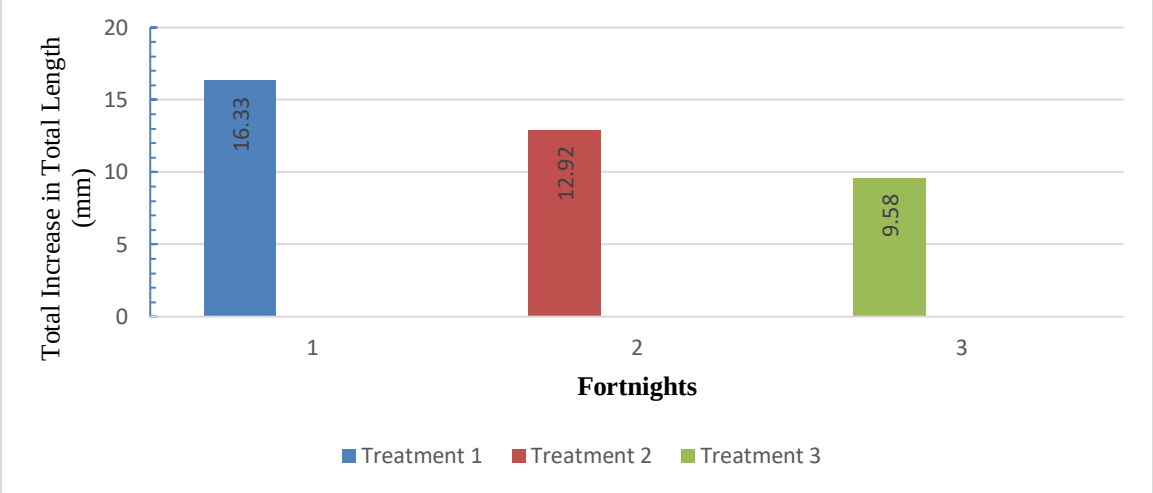

Fig 6: Comparison of total avg. increase in Total length by *Labeo rohita* in three treatments during six months of trial.

DISCUSSION

The present study was designed to evaluate the effects of yeast (*Saccharomyces cerevisiae*) as a probiotic on the weight gain of *Labeo rohita*. The results showed significant effects of yeast supplemented diets on growth performance (in terms of Total Length, Fork Length and specific growth rate) of *Labeo rohita*. The values of physical parameters were kept in range optimum for the growth of *Labeo rohita* throughout the trial (Abdelhamid et al., 2009).

The growth effects on *Labeo rohita* fingerlings were recorded significantly higher in T_1, T_2 and control diet T_3. These results clearly demonstrate the potential of *S. cerevisiae* in T_1 and T_2 experimental groups of Rohu. Many of scientists have demonstrated the effects of probiotic feed in aquaculture (Gomez-Gil et al., 2000; Robertson et

al., 2000).

By improving nutritional digestibility with probiotics, the feed utilization and fish growth may also be improved. In this regard, Tovar et al. (2002) and Wache et al. (2006) obtained better results of protein and diet digestibility also show better results in feed efficiency and growth by using yeast as probiotic feed supplementation. These results were also confirmed by Bomba et al. (2002), reported the effects of probiotics feed improve digestive ability of animals and increase microflora. El-Haroun *et al*. (2006) reported the effects of microbial probiotics in feed which is good dietary supplementation of essential nutrients to increase activity in digestive tract. Microbial cells as probiotics bacteria and yeast also enhance growth performance.

Results of present research work also supported by Gatesoupe (2007), that yeast (*S. cerevisiae)* as probiotic supplemented feed enhanced survival rate and growth rate of fish at its early developmental stages. In the similar results Chaudhary and Qazi (2007) found that yeast supplemented feed improve and enhance the growth rate of fingerlings of Rohu (*Labeo rohita*). Wache et al. (2006) also reported the results about yeast supplemented feed which enhance feed efficiency and growth by improving protein and diet digestibility. Gohila et al. (2013) also confirmed in his results that probiotic strains increase protein efficiency, feed conversion efficiency and feed conversion ratio in *Labeo rohita.* Kumar et al. (2006) reported survival and growth rate in *L. rohita* is increased by probiotics.

CONCLUSION

Regarding the growth impacts by probiotic supplemented feed was seen higher and more significant levels of experimental groups of *Labeo rohita* with experimental feeds (T_1 and T_2) comparing with group (T_3) of control diet. These results showed clearly demonstration of probiotics (*S. cerevisiae*). These results highlight the beneficial and important role of probiotics in aquaculture Industry. The improvement shown in FCR and growth value of fish is possibly due to improved nutritional digestibility.

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