

**STUDIES ON FEEDING OF PROBIOTIC CULTURED  
WHEY ON GROWTH PERFORMANCE OF  
BROILERS**

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**B.Sc. (Agriculture)**

**MASTER OF SCIENCE  
IN  
AGRICULTURE  
ANIMAL HUSBANDRY AND DAIRY SCIENCE  
(ANIMAL HUSBANDRY)**



**DEPARTMENT OF ANIMAL HUSBANDRY AND DAIRY SCIENCE  
COLLEGE OF AGRICULTURE, LATUR  
VASANTRAO NAIK MARATHWADA KRISHI VIDYAPEETH  
PARBHANI - 431402 (M.S.) INDIA**

**2021**

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WHEY ON GROWTH PERFORMANCE OF  
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**BY**

**PATIL PRAJAKTA DATTAJIRAO**

**B.Sc. (Agriculture)**

**A thesis submitted to  
Vasant Rao Naik Marathwada Krishi Vidyapeeth, Parbhani  
in partial fulfillment of the requirement for the degree of**

**MASTER OF SCIENCE  
IN  
AGRICULTURE  
ANIMAL HUSBANDRY AND DAIRY SCIENCE  
(ANIMAL HUSBANDRY)**



**DEPARTMENT OF ANIMAL HUSBANDRY AND DAIRY SCIENCE,  
COLLEGE OF AGRICULTURE, LATUR  
VASANTRAO NAIK MARATHWADA KRISHI VIDYAPEETH  
PARBHANI - 431402 (M.S.) INDIA**

**2021**

## DECLARATION BY THE CANDIDATE

I hereby declare that the thesis entitled, “**Studies on Feeding of Probiotic Cultured Whey on Growth Performance of Broilers**” submitted by me is based on the actual work carried out by me under the guidance and supervision of **Prabhakar Vishnu Padghan**. The extent of information derived from the existing literature have been duly cited and referenced. The existing research work or its any part is not submitted anywhere else for the award of any degree or diploma.

I also hereby declare that no sentence, equation, diagram, table, paragraph or section has been copied verbatim from previous work unless it is cited and duly referenced. There is no plagiarism; the work presented is original and own work of the researcher. No ideas, process, results or words of others have been presented as researcher’s own work.

Place : Latur  
Date : ~~15/08~~ 2021


Patil . P . D  
Signature of the Candidate  
(**Patil Prajakta Dattajirao**)  
Reg. No: 2019A/19ML

## CERTIFICATE - I

This is to certify that the thesis entitled, “**Studies on Feeding of Probiotic Cultured Whey on Growth Performance of Broilers**” submitted by **Patil Prajakta Dattajirao (Reg. No: 2019A /19ML)** in partial fulfillment of the requirements for the award of the degree of **MASTER OF SCIENCE (Agriculture)** in the subject of **Animal Husbandry and Dairy Science (Animal Husbandry)** submitted to the Vasantnao Naik Marathwada Krishi Vidyapeeth, Parbhani is a record of bonafide research work carried out by her under my guidance and supervision. The thesis or its any part has not previously formed the basis for the award of any degree, diploma or other similar title.

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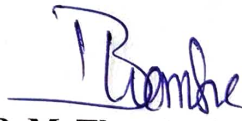
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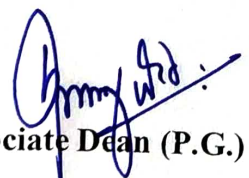
  
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**Patil P.D**  
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## ABBREVIATIONS USED

Short form	Full form	Short form	Full form
\$	- Canadian dollar	LE	- Livre Egyptian
%	- Percent	MA	- Market age
/	- Per	mg	- Milligram
@	- At the rate	min	- Minutes
<sup>o</sup> C	- Degree Celsius	ml	- Mililitre
AOAC	- Association of official Analytical chemical	N	- Significant
Avg	- Average	NRC	- Nutrient required for chicken
BDT	- Bangladesh Taka	NS	- Non significant
BIS	- Bureau of Indian standards	pH	- Potential of hydrogen
BWG	- Body weight gain	Rs.	- Rupees
CD	- Critical difference	SE±	- Standard error
cfu	- Colony forming unit	Sr. No	- Serial number
CRD	- Complete randomized design	tk	- Toner kit
Dist	- District	Tq	- Taluka
DM	- Dry matter	viz.,	- Namely
E:P	- (Energy) calorie: protein	VNMKV	- Vasantao Naik Marathwada Krishi Vidyapeeth
<i>et al.</i>	- Et alia (and others)	ZnB	- Zinc-bacitracin
FCR	- Feed conversion ratio		
Fig.	- Figure		
g	- Gram		
GM	- General mean		
GMC	- Ground maize cob		
i.e.	- That is		
IICP	- Illinoids ideal chick protein		
k	- Thousand		
kcal	- Kilo calorie		
kg	- Kilogram		
l	- Litre		

# **THESIS ABSTRACT**

## THESIS ABSTRACT

1. Title of the thesis : “Studies on feeding of probiotic cultured whey on growth performance of broilers”
  2. Name of the candidate : Patil Prajakta Dattajirao
  3. Name of research guide : Padghan Prabhakar Vishnu
  4. Department : Animal Husbandry and Dairy Science  
(Animal Husbandry)
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India.
  6. Degree to be awarded : Master of Science in Agriculture.
- 

## ABSTRACT

The present investigation was carried out on “Studies on feeding of probiotic cultured whey on growth performance of broilers”. The research was conducted at Mulani Poultry Farm, Gadegaon Tq. Barshi, Dist. Solapur. During the year 2020-2021. The experimental trial of six weeks was undertaken for fourty-two, day old, broiler chicks divided in four treatments with 40 chicks in each treatment with four replications of ten chicks. The control group (T<sub>0</sub>) was fed without probiotic cultured whey and T<sub>1</sub>, T<sub>2</sub>, and T<sub>3</sub> groups were provided with 10 per cent, 20 per cent, and 30 per cent probiotic cultured whey, respectively in drinking water. It was observed that the average cumulative body weights of broiler birds in treatment group T<sub>1</sub> (2583.72) was significantly (P<0.05) higher as compared to T<sub>0</sub> (2381.68 g), T<sub>2</sub> (2540.00 g) and T<sub>3</sub> (2445.01 g). At the end of sixth week significantly highest gain in weight was observed in T<sub>1</sub> (2556.51 g) as compared to T<sub>0</sub> (2334.86 g) and does not differ significantly with T<sub>2</sub> (2493.34 g) and lowest in T<sub>3</sub> (2334.85 g). The highest percent of gain was in first week and lowest in sixth week. Total feed intake indicate that T<sub>3</sub> (4741.36 g) had significantly (P<0.05) higher feed consumption than T<sub>0</sub> (4332.76), T<sub>1</sub> (4466.92) and T<sub>2</sub> (4360.1 g). However, T<sub>0</sub> (4332.76 g), T<sub>1</sub> (4466.92 g)

and T<sub>2</sub> (4360.1 g) does not differ significantly from each other. Overall FCR at the end of experimental period indicated that treatment T<sub>1</sub> (1.71) and T<sub>2</sub> (1.71) showed significantly better performance compare to T<sub>0</sub> (1.81) and T<sub>3</sub> (1.99). At the end of sixth week total water intake was 6971.25, 6800.62, 6586.02 and 6311.53 ml per bird in treatment T<sub>0</sub>, T<sub>1</sub>, T<sub>2</sub> and T<sub>3</sub>, respectively. It was seen that total water intake in T<sub>0</sub> (6971.25) was highest and T<sub>3</sub> (6311.53) was lowest and all treatment differ significantly from each other. Standard plate count after adding probiotic cultured whey in drinking water was  $2.20 \times 10^6$ ,  $2.45 \times 10^6$  and  $2.60 \times 10^6$  cfu/ml in treatment T<sub>1</sub>, T<sub>2</sub> and T<sub>3</sub>. The coliform count after adding probiotic cultured whey in drinking water was 1.40, 1.20 and 1.35 cfu/ml at  $10^2$ . Yeast and mould count after adding probiotic cultured whey in drinking water was 0.37, 0.39 and 0.39 cfu/ml at  $10^2$  for treatment T<sub>1</sub>, T<sub>2</sub> and T<sub>3</sub>, respectively. The net profit per bird was highest in T<sub>1</sub> (Rs.75.7) followed by T<sub>2</sub> (Rs.58.323), T<sub>0</sub> (Rs.57.84) and lowest in T<sub>3</sub> (Rs.28.99). The addition of 10 per cent probiotic cultured whey in broiler drink is beneficial by improving growth performance, FCR and Net profit.

**(Keyword- Probiotic, whey, broiler, growth performance, cost of rearing)**

**CHAPTER-I**  
**INTRODUCTION**

## CHAPTER- I

### INTRODUCTION

The main indian poultry market consisting of broilers and eggs reached a value of Rs.1.988 billion in 2020. The consumption of poultry meat in india was found to be over 3.9 million metric tonnes in 2020 (Anonymous, 2021). More than 50 billion chickens are raised annually as a source of food, for both their meat and their eggs. Poultry egg and meat are important sources of high quality proteins, minerals and vitamins to balance human diet. Around 5000 million chickens are being raised every year as a source of food. Indian poultry industry is 5000 years old; recently it began to witness remarkable growth from backyard to poultry industry (Mohd, 2015). There are about 1500 hatcheries operating in country. Indian poultry represents a major success. Poultry industry contributes about Rs 125 lakh crore. Accounting for about 1 per cent of national GDP and about 14 per cent of livestock GDP (Singh 2019).

Poultry is one of the fastest growing segments of Agriculture and Animal Husbandry sector. Feed is one of the largest items of expenditure in poultry and it alone accounts 70 per cent of total production (Thirumalaisamy *et al.* 2016). The constant increase in cost of poultry feed ingredients and compounded feed is making less profit to poultry farmers. To minimize the cost of feeding several feed additives have been extensively used for enhancing poultry production in recent years. Many feed additives like growth promoters including synthetic hormone and antibiotic have been used for increasing poultry production but due to development of antibiotic resistant bacterial strains and residual effects of these feed additives in eggs and meat, they lead to various health hazards to consumers (Bidarkar *et al.* 2014). Poultry gives income throughout the year. It helps for quick turn over of capital and also work for employer. The production of poultry farming is very cheap and easily affordable with no any disadvantages chicken tends to be easily digested. It contains no fiber, making it a good choice for people with digestive issue such as baked or grilled. Among all livestock in agriculture poultry plays significant role, it is most suitable active employment opportunities. Chickens are being raised every year as a source of food. Among all edible meat, broiler meat has the least fat content. It can also be cooked in its own fat and does not require any from outside. Poultry meat

contains more protein and essential amino acid than others meats and is low in its cholesterol content in comparison to other meats. The scientist and researcher working in poultry sector tried and trying to find out the alternative for antibiotics and chemicals used for poultry production as hormones, growth promoter, supplements and additives. The different herbals and beneficial microbes especially prebiotics and probiotics are observed to be beneficial and found alternative for antibiotics and chemicals (Rahimi and khaksefidi, 2006; Alam and Ferdaushi, 2018 and Kaushal *et al.* 2019). Thus the best of all above to the use of probiotics as feed additives for better and safe production in livestock in general and specific in poultry (Bidarkar *et al.* 2014). Recently it is believed that probiotics have beneficial effects to improve the productive performance of poultry. In india quantity and quality of meat production is of paramount importance in broiler production. To avoid health hazards of antimicrobials to human as well as poultry, in recent years, a probiotics as feed additives for better and safe production poultry was employed (Jadhav *et al.* 2015). Poultry probiotics are live micro-organism causing no pathological disorders and promoting enteric microbiota balance (Ohimain and Ofango, 2012). Probiotics refer to a group of non-pathogenic organisms that when administered in sufficient amount, are known to have beneficial effects on health of host (Mountzouris *et al.* 2010). The species that are used in probiotic preparations are *Lactobacillus bulgaricus*, *L.acidophilus*, *L.casei*, *L.helveticus*, *L.salvarius*, *L.plantarum*, *L.faecalis*, *Streptococcus thermophiles*, *Enterococcus faecalis*, *Enterobactris faecalis*, *Bifidobacteria species*, *Saccharomyces crevisiae* and *Toulopsis Sphaerica*, *Lactobacilli* and *Streptococci* are most commonly used treatments of bacteria in production of probiotics (Jadhav *et al.* 2015). The addition of either pure *Lactobacillus* cultures or mixtures of *Lactobacilli* and other bacteria to broiler diets has produced variable results found on improvement in body weight gain (BWG) and feed conversion ratio (FCR) of broilers feed a mixture of different *Lactobacillus* strains from 1 to 42 days of age (Kaldvathy *et al.* 2003). *Lactobacillus* strains have beneficial effects by a variety of complementary mechanisms including an ability to modulate host immune function, high adhesion capacity, and high antimicrobial capacity against pathogens and high resistance against gastric acidity (Chen *et al.* 2018, Zhui *et al.* 2018 and Omar 2014).

Whey is the greenish translucent liquid obtained from milk after

precipitation of casein. Whey is considered as an ideal media for probiotic cultivation and an immune system enhancer, it's major protein fractions are alpha - lacto globulin and beta - lacto globulin, the yellow colour of whey is due to presence of B- group vitamin and especially riboflavin may be used as nutrient source. In spite of its balanced nutrients liquid whey is disposed as a waste product. Liquid whey has a high biological oxygen demand, so it's disposal in river kill's living organism. Environmental pollution is also concern in many countries (Thivend *et al.* 1977). There is an interest in recent years to utilize the locally available agro- industrial and dairy waste materials, with rich nutrient as alternative source of carbon and other mineral etc. for production of probiotic. This will not only result in reduction of cost of production of probiotic but also helps in providing a solution to the disposal of huge quantities of such byproducts of dairy industry contributing to environmental pollution (Nasim *et al.* 2004 and Soccol *et al.* 2010). After considering this one of the option that has attracted much attention is use of whey in combination of probiotic culture as a poultry drinks may helpful to sort out this problem and help for poultry industry. By keeping this view, the present project was designed with following objectives:

1. To optimize the level of probiotic cultured *paneer* whey in broiler birds drink
2. To study the growth performance of broiler birds
3. To study the feed conversion ratio in broiler birds
4. To evaluate cost on broiler rearing

**CHAPTER-II**  
**REVIEW OF LITERATURE**

## CHAPTER-II

### REVIEW OF LITERATURE

The review of literature of present investigation is presented by considering the objectives of study particularly effect of different types of feed, probiotics and prebiotic on growth performance of poultry birds, feed intake and water intake by poultry birds and feeding cost for broiler rearing to compare and discuss with present study.

#### **1.Effect of different types of feed on growth performance of poultry birds:**

Warren and Emmert (2000), studied the efficacy of phase feeding in supporting growth performance of broiler chicks. Nutrient required for chicken (NRC) or illinois ideal chick protein (IICP) requirements were fed from 0 to 21 days and from 40 to 61 days and phase feeding was tested. Result showed that weight gain from 0 to 21 days for nutrient required for chicken (NRC) feeding was 566 g, for illinois ideal chick protein (IICP) feeding was 556 g and for phase feeding was 566 g and weight gain from 40 to 61 days of age, for NRC feeding 514 g. It showed that there were no differences in weight gain.

Donkoh *et al.* (2003), reported the trial of feeding diets containing GMC (Ground maize cob) of 25, 50 and 75 g/kg, respectively. Weight gain of control group was 1.81 kg, weight gain when level of ground maize cob at 25 g/kg was 1.89 kg, at 50 g/kg was 1.79 kg and at 75 g/kg was 1.75 kg. Result showed that birds fed with diet containing highest amounts of GMC (Ground maize cob) (50 and 75 g/kg) had slightly lower weight gain than fed with control and 25 g GMC (Ground maize cob) per kg.

Davis *et al.* (2003), studied pearl millets as alternatives feed ingredients in broiler diet. The final live weight of broilers male for control groups was  $2,320 \pm 45$  g and for birds fed with millets was  $2,409 \pm 32$  g the final live weight of broilers female for control group was  $1,932 \pm 35$  g and for birds fed with millets was  $2,048 \pm 24$  g. The result showed that the broiler males fed with millets have higher weight than others.

Korver *et al.* (2004), studied the effect of triticale and wheat on broiler performance. Body weight at 42 day was 2,096 g when fed with wheat and was 1,972

g when fed with triticale basal diet. Body weight of strain ross 308 × ross 308 was 2,058 g, hubbard HiY × hubbard HiY was 2,076 g and ross 308 × hubbard HiY was 1,967 g. Birds on triticale treatment weighed 6 per cent less than those on wheat treatment. Average daily body weight gain during week 2, week 3, and over course of experiment was greater for the wheat fed birds than for triticale fed birds. It showed that, complete replacement of wheat in broiler diets with triticale resulted in decreased body weight gain to market weight.

Ravindran *et al.* (2006), studied the effect of whole wheat feeding on performance of broiler chickens the weight gain in first week in birds fed with ground wheat was 101 g/bird and fed with whole wheat was 88 g/bird. In 2<sup>nd</sup> week the body weight of birds due to influence of ground wheat was 339 g/birds and whole wheat was 306 g/bird. In 3<sup>rd</sup> week body weight due to ground wheat was 786 g/bird whole wheat was 738 g/bird. In 4<sup>th</sup> week body weight due to influence of ground wheat was 1343 g/bird and due to whole wheat was 1283 g/bird. In 5<sup>th</sup> week body weight of bird due to influence of ground wheat was 1991 g/bird. And whole wheat was 1856 g/bird. This showed that there is reduction in weight with feeding of whole wheat.

Nyamambi *et al.* (2007), studied the effect of feeding sorghum condensed tannins on intestinal growth, function and histology was investigated in eight weeks broiler growth trial. Four sorghum varieties SV2, Brown Tsweta, DC and Chirimaugute are fed to broiler. Live weight of broiler birds at 42 days when fed with maize was 1419 g, SV2 was 1550 g, Brown Tsweta was 1487 g, Chirimaugute was 1457 g, DC 50 g was 1474 g and Dc 100 was 1373 g. Live weight of broilers at 56 days fed with maize was 2463 g, Chirimaugute was 2443 g, SV2 was 2561 g, Brown Tsweta was 2475 g, DC 50 was 2475 g and DC 100 was 2329 g. Result showed that Dc 100 fed birds had lower live weights than SV2, Brown Tsweta, Chirimaugate and DC 50 but not than maize.

Ponte *et al.* (2008), evaluated the effect of restricting the intake of a cereal- based feed on poultry performance. The body weight of broiler having no access to pasture at 36 days, 42 days, 56 days and 64 days with 100 per cent of referenced feed intake were 971 g, 1193 g, 1509 g, 1808 g and 2046 g, respectively. With 75 per cent of referenced feed intake were 985 g, 1167 g, 1348 g, 1536 g and 1767 g, respectively and with 50 per cent of feed reference feed intake were 976 g,

1048 g, 1132 g, 1234 g and 1410 g, respectively. The body weight of broiler with access to pasture at 36-day, 42-day, 50 day, 56-day, 64 day with 100 per cent of referenced feed intake were 962 g, 1194 g, 1531 g, 1843 g and 2103 g, respectively and with 75 per cent of referenced feed intake were 937 g, 1123 g, 1316 g, 1544 g and 1800 g, respectively and with 50 per cent of referenced feed intake were 964 g, 1068 g, 1162 g, 1293 g and 1498 g, respectively. This showed that birds in treatment 75 and 50 have lower weight gain and body weight compared with birds from non-restriction groups. Final body weight was significantly decreased in birds in cereal-based feed restricted group.

Clark *et al.* (2009), studied the effect of feeding cracked corn and concentrate protein pellets on broiler growth performance. Effect of feeding coarsely cracked corn and concentrate pellets in comparison to a complete pelleted diet on broiler performance from 0 to 41 days were studied. Total body weight at 0 per cent, 25 per cent, 50 per cent, 75 per cent, and 100 per cent cracked corn inclusion level were 2740 g, 2637 g, 2386 g, 2192 g and 2084 g, respectively. From visual observation, feed selectivity could be a reason for growth response. Result showed that the group of birds with 0 per cent inclusion level of cracked corn had better body weight than other.

Dozier *et al.* (2010), studied the effect of feed form on growth performance of broiler chicken. Broilers fed four treatments were provided from 18 to 42 days of age. 1) High quality pellets. 2) Low quality pellets. 3) A proportion of formulated corn added post-pellet and 4) Mash (corn was ground via roller mill). Broiler fed pelleted diets grew faster ( $P \leq 0.001$ ) and consumed more ( $P \leq 0.001$ ) feed from 15 to 28 days, 15 to 42 day of age that mash fed broilers. Feeding higher quality pellets to broiler increased growth rate during the grower, finisher and cumulative period over birds fed diets having lower quality pellets. Body weight gain was similar for broilers fed diets presented as high-quality pellets or rolled corn post-pellet throughout experimentation.

Allout *et al.* (2012), studied the utilization of fenugreek as growth promoter for broiler chickens. The live body weight of birds fed with and without fenugreek were  $389 \pm 13.56$  g and  $357 \pm 16.21$  g, respectively. This shows that broiler chicks fed diet supplemented with fenugreek seeds at 3 g/kg of feed have highest body weight. Adding fenugreek to broiler diet resulted in an increased body weight.

Chehragi *et al.* (2013), determined the effect of different feed form on performance in broiler chickens. The weight gain of broilers at 6<sup>th</sup> week for mash was  $1984.5 \pm 122.166$  g, for crumble  $2237.75 \pm 193.80$  g, for pellet  $2190 \pm 31.26$  g. The result showed that weight gain of birds fed with mash have poor performance and crumbled diet gain more weight.

Singh *et al.* (2013), studied on impact of feed on growth and development of different broiler strain. The average body weight gain of B<sub>1</sub>, B<sub>2</sub> and B<sub>3</sub> groups of F1 treatment (control + broiler mash 100 per cent) group were  $1.02 \pm 0.002$ ,  $1.03 \pm 0.02$  and  $1.03 \pm 0.03$  kg/ bird. In F1 maximum body weight gain was in B<sub>2</sub> group followed by B<sub>1</sub> with average of 1.02 kg/birds. The body weight gain in F2 treatment (soybeans 30 per cent + maize 70 per cent) was  $1.13 \pm 0.02$  kg/bird  $1.09 \pm 0.05$  kg/bird. The body weight gain in F3 treatment (broiler mash 30 per cent + Maize 70 per cent) were  $1.05 \pm 0.06$  kg,  $1.04 \pm 0.04$  kg,  $1.05 \pm 0.02$  kg, respectively. The maximum body weight gain was observed in B<sub>3</sub> followed by B<sub>1</sub> group. Average body Weight was 1.04 kg/bird. This showed that birds fed with mash had lower body weight gain.

Singh *et al.* (2014), studied the effect of feeding coarsely ground corn on performance of broiler birds. The weight gain with no inclusion of coarse corn was 1595 g and that of inclusion of 150 g/kg, 300 g/kg, 450 g/kg, and 600 g/kg coarse corn had 1648 g, 1707 g, 1787 g and 1733 g weight gain, respectively. There was increase in weight gain as inclusion level of coarse corn increased.

Mohamed *et al.* (2015), studied the effect of replacing Maize with sorghum on growth of broiler chickens experiment consisted of 28 days starter phase and 21 days finisher phase. The treatment T<sub>1</sub> was fed with maize based, (control) T<sub>2</sub> is fed with 15 per cent sorghum, T<sub>3</sub> is fed with 30 per cent sorghum and T<sub>4</sub> is fed with 45 per cent sorghum. During 1 to 28 days, the daily weight gain for T<sub>1</sub> was 28.39 g/day, For T<sub>2</sub> was 28.3 g/day, for T<sub>3</sub> it was 29.59 g/day and for T<sub>4</sub> it was 31.5 g/ day and during 29 to 49 days the daily weight gain for T<sub>1</sub> was 28.3 g/day, for T<sub>2</sub> it is 28.3 g/day, for T<sub>3</sub> it is 29.5 g/day and for T<sub>4</sub> it was 31.5 g/day and during 29 to 49 days the daily weight gain for T<sub>1</sub> it was 77.00 g/day, for T<sub>2</sub> it was 80.4 g/day, for T<sub>3</sub> it was 82.4 g/day, for T<sub>4</sub> it was 84.2 g/day. There was no significant differences ( $p > 0.05$ ) was observed in daily weight gain and final weight gain. The result showed that replacement of maize with sorghum up to 45 per cent were not have any adverse

effect on performance of broiler chickens and T<sub>4</sub> (45 per cent inclusion) resulted in better body weight gain. Average daily gain was obtained between control and experiment diets with all three feed ingredient during the grower phase.

Batonon-Alavo *et al.* (2015), studied the inclusion of sorghum, millet and cottonseed meal-based diets. Sorghum-based diets and cottonseed meal-based diet significantly increased. Average daily feed intake compared with control diet with about 3.80 per cent and 3.31 per cent respectively. No effect of feed ingredient was observed on growth rate since similar relative to control diet in each experiment showed that millet-based diets tended to reduce average daily gain. Average daily gain was lower in sorghum-based diet which was 5.36 per cent compared to control, whereas a trend was observed for average daily feed intake. Birds fed cottonseed meal based diets increased average daily feed intake by 2.57 per cent while reducing average daily gain by 3.95 per cent compared with control.

Mingbin *et al.* (2015), studied the effect of feed form and feed particle size on growth performance of broilers. The body weight of broilers in whole period for different feed particle size and feed form was observed. The body weight for crumble pellet feed for fine 2550 g, for medium 2520 g, and for coarse 2505 g. Body weight of broilers fed with mash for fine 2298 g, for medium 2396 g and for coarse was 2415g. The main effect for fine was 2424 g, for medium was 2458 g, for coarse was 2460 g. The result showed that particle size had no significant effect on broiler performance and birds fed with crumble pellet diets had higher body weight than these fed with mash diet.

Nanto *et al.* (2016), studied the effect of feeding diets combining whole grain paddy rice and high levels of fat on broiler chicken growth. The chickens fed with whole grain paddy rice based diets containing 10 per cent soyabean oil and 10 per cent corn oil exhibit unsteady gain with tendency to fall. The body weight gain of birds fed with whole grain paddy rice based diet with 10 per cent soyabean oil and 10 per cent corn oil and dehulled rice based diet containing 10 per cent soyabean oil diet was significantly lower than that of birds fed with dehulled rice based diet containing 5 per cent soyabean oil diet (control) ( $P < 0.05$ ), while weight gain of birds fed with whole grain paddy rice containing 10 per cent rendering oil and when grain paddy rice based diet containing 10 per cent soyabean oil + vitamin B12 + methionine + ethoxyquin was comparable to that of control group. Result showed that feeding rice

diets containing high levels of soyabean have negative effect.

Emadinia *et al.* (2017), studied the effect of whole wheat and wet feeding on growth performance of broiler chicken. In dry feeding method body weight of broiler was 2251 g and in wet feeding method body weight of broiler was 2318.20 g and also in whole wheat form body weight was 2186 g and that was 2384.1 g in ground wheat form. The result showed that wet feeding had no significant effect on body weight, but slight enhancement was observed in wet feeding and ground wheat form compared to dry feeding and whole wheat form respectively.

Gujjarwar, (2018), studied the per cent chemical composition of broiler ration. She showed that the chemical composition of pre-starter as 23.35, 3.92, 4.95, 6.2, 1.57 and 61.58, per cent crude protein, crude fiber, ether extract, total ash, acid insoluble ash and nitrogen free extract, respectively. While the starter ration was containing 21.64, 3.96, 5.08, 6.1, 1.60 and 63.25 per cent crude protein, crude fiber, ether extract, total ash, acid insoluble ash and nitrogen free extract, respectively. The content of nutrient in finisher ration were 20.20, 3.99, 5.12, 5.98, 1.62 and 64.71 per cent crude protein, crude fiber, ether extract, total ash, acid insoluble ash and nitrogen free extract, respectively. Metabolizable energy containing in pre-starter, starter and finisher ration as 2982.5, 3065.7 and 3198.8 kcal/kg, respectively. Whereas E:P ratio content in pre-starter, starter and finisher ration as 127.73:1, 141.66:1 and 158.35:1, respectively.

Hatim *et al.* (2019), investigated the effect of total substitution of corn by millet in broiler diets on physiological and productive characteristics. The result of body weight was studied in which body weight at 0, 1, 5, 20, 25, and 30 days in treatment group was  $48 \pm 4$ ,  $56 \pm 5$ ,  $120.4 \pm 4$ ,  $230 \pm 10$ ,  $466.18 \pm 6$ ,  $789.6 \pm 10$ ,  $1363.8 \pm 20$  and  $1669 \pm 25$  g per bird, respectively and in control group it was  $48 \pm 5$ ,  $55 \pm 4$ ,  $90.66 \pm 6$ ,  $210 \pm 7$ ,  $410.41 \pm 8$ ,  $696 \pm 10$ ,  $1292 \pm 11$  and  $1469.44 \pm 20$  g per bird, respectively. This showed that there is elevation in body weight of treated group started at day 5, at day 25 and 30 the difference between experiment groups which were increased which become more significant.

Parade (2019), studied the percent chemical composition of broiler ration. He showed that the chemical composition of pre-starter as 23.35, 3.92, 4.95, 6.2, 1.57 and 61.58, per cent crude protein, crude fiber, ether extract, total ash, acid

insoluble ash and nitrogen free extract, respectively. While the starter ration was containing 21.64, 3.96, 5.08, 6.1, 1.60 and 63.25 per cent crude protein, crude fiber, ether extract, total ash, acid insoluble ash and nitrogen free extract, respectively. The content of nutrient in finisher ration were 20.20, 3.99, 5.12, 5.93, 1.62 and 64.76 per cent crude protein, crude fiber, ether extract, total ash, acid insoluble ash and nitrogen free extract, respectively. Metabolizable energy containing in pre-starter, starter and finisher ration as 2982.5, 3065.7 and 3198.8 kcal/kg, respectively. Whereas E:P ratio content in pre-starter, starter and finisher ration as 127.73:1, 141.66:1 and 158.35:1, respectively.

Parade (2019), experimental study was conducted to evaluate the effect of lemongrass leaf meal as a natural feed additives on growth performance of broilers. The control group T<sub>1</sub> was feed with standard broilers ration and T<sub>2</sub>, T<sub>3</sub>, and T<sub>4</sub> groups were provided same broiler ration supplementation with 0.5 per cent, 1 per cent & 1.5 per cent lemongrass leaf meal. The result showed that birds fed with 1.5 per cent lemongrass leaf meal have more body weight than other birds.

Meshram (2019), experimental study was conducted to evaluate the effect of drumstick leaf meal on growth performance of broilers. The control group T<sub>1</sub> is feed with standard broilers ration and T<sub>2</sub>, T<sub>3</sub>, and T<sub>4</sub> groups were provided same broiler ration supplementation with 0.5 per cent, 1 per cent & 1.5 per cent drumstick leaf meal. The result showed that birds feed with 0.5 per cent drumstick leaf meal have more body weight than other birds.

Liu *et al.* (2020), studied the effect of stale maize on growth performance in broiler. The birds were fed with basal diet and diets with 100 per cent control maize replaced by stale maize. During day 0 to 21 average daily gains was 35.49 g in control and 35.69 g in birds fed with stale maize was 86.7 g in control diet and 85 g in birds fed with stale maize. From day 0 to 42 average daily gains in control diet was 61 g and in birds fed with stale maize was 60.3 g. During day 0 to 21, feeding stale maize diet reduced average daily feed intake while did not affect average daily gain ( $P>0.05$ ). During day 22 to 42 Average daily feed intake was decreased ( $P<0.05$ ) by stale maize treatment, while average daily gain did not differ ( $P>0.05$ ). In whole experiment, broiler fed stale maize diets had lower average daily feed intake ( $P<0.05$ ), but the dietary treatment did not affect the final body weight and average daily gain ( $P>0.05$ ).

Idan *et al.* (2020), evaluated the effect of feeding starter crumble from overall performance of broiler. The effect of feed form on growth of broiler birds was taken in first 22 days and overall, 42 days experimental period. The dietary treatment was made up of 1) 21 days mash; 2) 7 days crumbles followed by 14 day mash 3) 14 days crumble followed by 7 days mash and 4) 21 days crumbles. The feed form affected body weight, average daily gain of broiler. During the day 0-7 and 0-14 days, birds fed crumbles had increased ( $P < 0.001$ ) body weight, average daily gain compared with mash diet fed broiler. Highest body weight was observed in birds, fed 21 days crumble (3141 g) in starter phase had increase overall body weight compared with those fed main mash diet, (2924 g) at 42 day. Again, overall average daily gain, 7 days crumble (1099 g), 14 days crumble (111 g) and 21 days crumble (109 g) were increased for birds fed crumbles compared with those fed mash diet, 21 days mash (69 g) and (106 g), respectively. The result showed that feeding broiler chicks crumbled diets at starter phase increases feed intake, which improve growth performance.

Patil (2020), experimental study was conducted to evaluate the effect of tulsi leaf powder as a natural feed additives on growth performance of broilers. The control group T<sub>1</sub> is feed with standard broilers ration and T<sub>2</sub>, T<sub>3</sub>, and T<sub>4</sub> groups were provided same broiler ration supplementation with 0.5 per cent, 1 per cent & 1.5 per cent tulsi leaf powder. The result showed that birds feed with 1.5 per cent tulsi leaf powder has more body weight (2670.50 g) than other birds.

Patil (2020), studied the per cent chemical composition of broiler ration. He showed that the chemical composition of pre-starter as 23.20, 3.85, 4.89, 6.03, 1.45 and 62.24, per cent crude protein, crude fiber, ether extract, total ash, acid insoluble ash and nitrogen free extract, respectively. While the starter ration was containing 21.50, 3.90, 4.98, 6.0, 151 and 64.37 per cent crude protein, crude fiber, ether extract, total ash, acid insoluble ash and nitrogen free extract, respectively. The content of nutrient in finisher ration were 20.40, 3.94, 5.04, 5.80, 1.58 and 65.18 per cent crude protein, crude fiber, ether extract, total ash, acid insoluble ash and nitrogen free extract, respectively. Metabolizable energy containing in pre-starter, starter and finisher ration as 2975.3, 3065.7, 3198.8 kcal/kg, respectively. Whereas E:P ratio content in pre-starter, starter and finisher ration as 126.64:1, 143.12:1 and 159.04:1, respectively.

## 2. Effect of probiotics and prebiotic on growth performance of poultry birds

Jin *et al.* (1998), studied growth performance of broilers feed diets containing *Lactobacillus* culture. The body weight after 42 days of birds fed with basal diet is 914.59 g, body weight of birds basal diet fed with 0.5 per cent, 0.10 per cent and 0.15 per cent were 1983 g, 2077 g and 1,925.3 g, respectively. It shows that treatment with 0.1 per cent *Lactobacillus* culture had greater body weight ( $P < 0.005$ ) than other.

Ivankovic *et al.* (1999), studied the effect of probiotic vebac on growth of broilers. Average weights of chickens at 6<sup>th</sup> week of group without probiotic in drinking water were 1956 g and group with vebac added in drinking water was 2168 g. The result showed that chicken with vebac added in drinking water had higher average live weights than chickens from group without probiotic in drinking water.

Hossain (2004), studied the effect of yoghurt and protexin boost on gut microflora and broiler performance. The treatment T<sub>1</sub> is control and T<sub>2</sub>, T<sub>3</sub> and T<sub>4</sub> received 1 g, 2 g, and 3 g sour yoghurt, respectively per liter of drinking water. The body weight gain at 35 days of age for T<sub>1</sub> was 1307.37, T<sub>2</sub> was 1327.07, T<sub>3</sub> was 1259.83, T<sub>4</sub> was 1423.82 and T<sub>5</sub> was 1526.66 g per birds, this showed no significant effect of probiotic on weight gain of broiler.

Anjum *et al.* (2005), studied the effect of dietary supplementation of multi-strain probiotic on broiler growth performance. Chicks were divided into three experimental groups, A fed with diet supplemented without protexin (control) and B and C were fed diets containing protexin 100 and 110 g/tonne in starter and 50 and 55 g/tonne in finisher diet. Body weight gain in overall period of group A was  $1904 \pm 09$  g and group C was  $2000 \pm 18$  g. The result showed that body weight gain was found to be higher in protexin- supplemented.

Panda *et al.* (2005), studied the influence of supplementation of *Lactobacillus sporogenes* on the performance of broilers the chick were fed with either control diet and diet supplemented with 100 mg probiotic per kg diet or 150 mg probiotic per kg diet. The body weight gain in probiotic supplemented broilers was 1508.09 g and control group broiler was 1398.09 g. This showed that body weight gain in probiotic group higher compared to control group.

Aftahi *et al.* (2006), studied the effect of yoghurt and protexin boost on

broiler performance. The body weight gain of T<sub>1</sub> treatment (control) group was 1307.37 g, T<sub>2</sub> treatment (3 g sour yoghurt per litre of drinking water) was 1327.07 g, T<sub>3</sub> treatment (4 g sour yoghurt per litre of drinking water) was 1259.83 g, T<sub>4</sub> treatment (5 g sour yoghurt per litre of drinking water) was 1423.82 g and T<sub>5</sub> treatment (1 g protexin boost per 10 liter of drinking water) was 1526.66 g. This showed that body weight gain was improved in T<sub>4</sub> and T<sub>5</sub> treatment groups during 1 to 21 days of age. During 22 to 35 days of age highest weight gain was in T<sub>5</sub> followed by T<sub>4</sub>, T<sub>2</sub>, T<sub>1</sub>, and T<sub>3</sub>. This showed that there was better body weight gain of probiotic groups compared with control group.

Timmerma *et al.* (2006), studies growth performance of broilers given drinking water in field trials. The final body weight of birds was 2357 g in control groups and 2342 g in trials administrated with chicken specific probiotics. The total body weight of flock was 5448 kg in control and 5506 kg in group with administration of chicken specific probiotic. And in controlled trials the final body weight of birds were 1978 g in control group and 2003 g in trial administrated with chicken specific probiotic. The total body weight of flock was 305.8 kg in control and 404.6 kg in group with administration of chicken specific probiotic. The result shows that average daily gain during growth phase (14 to 30 days) and body weight at 30 days were significantly higher in chicken specific probiotic treated group.

Rahimi and Khaksefidi (2006), evaluated the effect of dietary supplementation of antibiotic and probiotic on performance of birds under heat stress condition the body weight gain for 0-3 weeks in control group was  $568.75 \pm 19.86$  g, in group fed with antibiotic had  $621.50 \pm 4.55$  g, in group fed with 0.05 per cent probiotic was  $585 \pm 19.52$  g and 0.1 per cent probiotic was  $575.25 \pm 28.09$  g. The body weight gain for 4 to 6 weeks in control groups had  $987.5 \pm 35.03$  g and fed with antibiotic had  $1112 \pm 52.04$  g, fed with 0.05 per cent probiotic had  $1015 \pm 59.91$  g and 0.1 per cent probiotic had  $1050.75 \pm 41.67$  g. Result showed that the addition of antibiotic to diet significantly improved body weight gain.

Sultan *et al.* (2006), studied the comparative effect of yoghurt as probiotic on performance of broiler chicks. Mean weight gain in starter phase when protexin 1 g/l of water gain in starter phase (group A) was 592.5 g. When yoghurt 5 m/l of water used (group B) was 633.8 g and in control (group C) 610 g observed. Group B was higher than A and C. Highest gain in body weight by incorporating

probiotics at 5 or 10 m/l drinking water in broilers at starter phase was observed . Mean weight gain in finisher phase when protexin 1 g/l of water used (group A) was 1282 g, when yoghurt 5 m/l of water used (Group B) was 1580 g and in control group (C) 1281 g observed. Mean weight gain was significantly higher for group B ( $P<0.05$ ), this showed that there is significant increase in final body weight and body weight gain.

Ghiyasi *et al.* (2007), evaluated the effect of prebiotic (fermacta) in low protein diet on performance of broiler chicks. Effect of protein and prebiotic levels on body weight gain of broiler chicks was recorded. Diets with high protein without prebiotic have body weight gain of 197 g, at 1-10 days ,1005 g at 10-28 days, 1323 g at days 28- 42 and 2525 g after 42 days. Diet having high protein with prebiotic had 199 g at 1 to 10 days, 961 g at 10-28 days, 1319 g at 28-42 days after 42 days it was 2479 g. Diet having low protein without prebiotic had 181 g at 1-10 days ,865 g from 10-28 days, 1250 g from 28 to 42 days and 2296 g after 42 days. Diets with low protein with prebiotic had 185 g from 1 to 10 days 911 g from 10-28 days, 1235 g from 28 to 42 days and after 42 days body weight gain was 2331 g. Result showed that commercial diet with and without probiotic caused heavier body weights than 2 low protein diet addition of prebiotic to low protein diet improved body weight in starter, grower and total periods of experiments.

Ashayerizadeh *et al.* (2009), studied the effect of dietary supplementation of antibiotic, probiotics, and prebiotics on growth performance of broiler chickens. The body weight gain at 42 days in control diet was  $1999.6 \pm 30.44$  g, the birds fed with flavomycin had  $2127.4 \pm 15.42$  g and fed with primalac had  $2070.1 \pm 33.44$  g. The birds fed with biolex-MB had body weight  $2077.9 \pm 37.97$  g and fed with symbiotic had  $2145.4 \pm 29.41$  g body weight gain at 42 days. Supplementation with flavomycin, primalac, biolex-MB and the primalac-biolex-MB mixture were increased weight to 130.8, 73.5, 81.3 and 148.8 g, respectively. The weight gain was increased for birds fed primalac and biolex-MB by 7.4 per cent compared to control diet.

Eckert *et al.* (2010), studied influence of probiotic administration on feed or water on growth parameters of broilers body weight of broilers at 48 days of control group was  $2.84 \pm 0.03$  kg, the group of birds fed with probiotic application to feed was  $2.84 \pm 0.04$  kg, a group with probiotic applied continuously through drinking

water was  $2.89 \pm 0.03$  kg, and group with intermittent application of probiotic with phyto-genic product was  $2.83 \pm 0.03$  kg. The result showed that group with probiotic applied continuously through drinking water was more body weight than other therefore it may be the best route of administration for probiotic.

Torshizi *et al.* (2010), studied that effect of administrating probiotic in water or as feed supplement on broiler performance. The body weight gain from 1 to 42 days for control group was 52.15 g/bird/day. For group of probiotic supplementation with drinking water was 55.46 g/bird/day and in group at probiotic supplemented with feed was 53.39 g/bird/day. Result showed that the probiotic supplemented with drinking water increased body weight gain of broilers than control group.

Toghyani *et al.* (2011), investigated the impact of probiotic and prebiotic as growth promoter compared to antibiotics on performance of broiler chicks. Body weight of controlled birds after 42 days was 2110.18 g, body weight of group fed with antibiotic had 2091.03 g, and probiotic had 2138.30 g body weight. Diet supplemented chicks with probiotic and prebiotic increased body weight at 42 days of age compared to control.

Omara (2012), studies nutritive value of skimmed milk and whey, added as natural probiotics in broiler diets. The body weight at grower period (1-4 weeks) in control diet was 753.33 g, the weight when avi-bac is used at 0.1 per cent is 853.33 g and 0.5 per cent and 1 per cent skimmed milk are 853.33 g and 846.67 g and weight when 0.5 per cent and 1 per cent whey used were 853.33 g and 866.67 g, respectively. The body weight in finisher period (5-6 weeks) in control diet was 1620 g, the weight when 0.1 percent avi-bac used was 1743.33 g. The weight when 0.5 and 1 per cent skimmed milk added were 1750 g and 1790 g and the weight when 0.5 per cent and 1 per cent whey used were 1756.67 g and 1860 g, respectively. The result shows that body weight of birds at the beginning did not vary in groups ( $p > 0.05$ ) compared with control, probiotic supplementation that is avi-bac or skimmed milk or whey improve body weight and weight gain during grower, finisher and over all period. The group received 1 per cent whey recorded best body weight and body weight gain in grower, finisher and overall period there was no significant difference in body weight and body weight gain at the end of each period among treatment (T<sub>2</sub>, T<sub>3</sub>, T<sub>4</sub> and T<sub>5</sub>) which fed on diets supplemented with probiotics.

Liu *et al.* (2012), reported growth performance of broiler chickens supplemented with *Bacillus licheniformis* in drinking water. The daily weight gain of cocks from 0 to 6 weeks for control group was  $65.91 \pm 0.8$  g for group supplemented with 1 ml *Bacillus licheniformis* was  $70.21 \pm 0.9$  g and for group supplemented with 2 ml *Bacillus licheniformis* was  $70.58 \pm 9$ g. The daily weight gain of hens from 0 to 6 weeks for control group was  $54.38 \pm 0.79$  g, for group supplemented with 1 ml *Bacillus licheniformis* was  $55.74 \pm 0.79$  g and for group supplemented with 2 ml *Bacillus licheniformis* was  $59.99 \pm 0.79$  g. The result showed that cocks fed on 2 ml *bacillus licheniformis* had higher average daily weight gain and also hens fed on 2 ml *Bacillus licheniformis* had a greater average daily weight gain than control hens over 0 to 6 weeks.

Gutierrez *et al.* (2013), evaluated the effect of floramax on growth performance of broiler chicken. Total of 200 day-of-hatch broiler chickens were divided into 2 treatment groups and fed for 30 days. The body weight of control group was  $1.30 \pm 52.26$  kg and body weight of group fed with floramax B-11 was  $1.37 \pm 63.82$  kg. A significant increase ( $p < 0.05$ ) in body weight was observed on probiotic fed birds groups compared to control group.

Hrncar *et al.* (2014), studied the effect of probiotic addition in drinking water on body weight and body measurements of broiler chickens. Body weight broilers chicken of control group was  $2070.65 \pm 180$  g, *Lactobacillus fermentum* was  $2294.59 \pm 196.34$  g and *Enterococcus faecium* was  $2263.16 \pm 188.67$  g. This result showed that addition of *L. fermentum* and *Enterococcus faecium* in drinking water statistically significantly increased as compared to control.

Saiyed *et al.* (2015), studied inclusion of probiotic, prebiotic and its combination in broiler diets. Average body weight gain after 6 weeks treatment T<sub>1</sub> (control) was  $1913.14 \pm 31.87$  g, in treatment T<sub>2</sub> (probiotic @ 100 g/ton feed) was  $2009.69 \pm 36.74$  g, in treatment T<sub>3</sub> (prebiotic @ 500 g/ton feed) was  $2053.93 \pm 14.25$  g in treatment T<sub>4</sub> (prebiotic + probiotic @ 100 g/ton and 500 g/ton) was  $2029.44 \pm 18.1$  g in treatment T<sub>5</sub> (probiotic + prebiotic @ 50 g/ton and 250 g/ton feed) was  $2043.49 \pm 58.34$  g. Result showed that group fed with prebiotic have higher average body weight gain followed by T<sub>5</sub>, T<sub>4</sub>, T<sub>2</sub> and T<sub>1</sub> groups.

Patel *et al.* (2015), studied the effect of probiotic supplementation on

growth performance of broiler body weight gain in T<sub>1</sub> (basal diet without probiotic) was 1700.11 ± 16.77 g in T<sub>2</sub> (T<sub>1</sub> + probiotic 50 g/ton) was 1724.12 ± 18.22 g in T<sub>3</sub> (T<sub>1</sub> + 100 g/ton probiotic) was 1790.82 ± 17.49 g. Average daily body weight gain for T<sub>1</sub> was 39.48 ± 0.15g, for T<sub>2</sub> was 39.99 ± 0.10 g and for T<sub>3</sub> was 41.63 ± 0.25 g respectively. The daily body weight gain was higher in T<sub>3</sub> treatment group than T<sub>2</sub> and T<sub>1</sub>. The body weight gain was improved in T<sub>3</sub> compared to T<sub>2</sub> and T<sub>1</sub> in starter, finisher and overall phase.

Olnood *et al.* (2015), studied the effect of four *Lactobacillus* strains on growth performance of broiler chickens. The body weight gain after 42 days of birds fed with basal diet was 2334 g. Birds basal diet fed with antibiotic, zinc-bacitracin (ZnB, 50g/kg) was 2412 g. Birds fed with isolate treatments with probiotic no 461 unidentified *lactobacillus* species was 2357 g, birds fed with isolate treatment with probiotic no.697 *L. salivarius* was 275 g, birds fed with isolate treatment with probiotic no.709 *L.crispatus* was 2389 g and isolate treatment with probiotic no.1286 *L. johnsonii* was 2358 g, result showed that there were no significant effect on body weight gain when probiotics were added into feed there was numerically higher body weight gain compared to negative control group.

Togyani *et al.* (2015), evaluated effect of kefir as a potential probiotic on growth performance. Body weight of control group was 2440.9 g, probiotic supplemented group was 2487.7 g, supplemented with 2 per cent milk kefir in drinking water 2509.6 g and supplemented with 2 per cent molasses kefir 2327.4 g. Result showed that broiler supplemented with milk kefir had higher body weight compared with control, supplemented with probiotic or molasses kefir.

Fallah (2016), studied the performance of broiler chickens fed different levels of dried whey and protexin probiotic. Final body weight of broiler of control group was 2240 ± 126.83 g. group of broilers fed with protexin had 2340 ± 125.85 g. and fed with dried whey powder + protexin was 2370 ± 18.25 g. Body weight of broiler fed with dried whey powder and protexin had increased body weight compared to control chicks.

Sarangi *et al.* (2016), fed 360 one day old vencobb broilers with diets consisting of control and basal diets supplemented with prebiotics and probiotics. The treatment consisting of three replicates and each replicate having 30 birds for six

weeks treatments were T<sub>0</sub> (control), T<sub>1</sub> (400 g/ton of starter as well as finisher ration), T<sub>2</sub> (100 g/ton of starter ration and 50 g/ton of starter as well as finisher) and T<sub>3</sub> (symbiotic) 500 g/ton of starter as well as finisher ration. The body weight at 42 day was 1730.04±1.027 g for T<sub>0</sub>, 1711.76 ± 24.81g for T<sub>1</sub>, 1726.30 ± 25.46 g for T<sub>2</sub> and 1761.88 ± 20.84 g for T<sub>3</sub>. The result showed lower body weight broiler fed diets supplemented with probiotics and prebiotics than those fed control diets.

Abdel-hafees, (2017), studied the effect probiotic, prebiotic and symbiotic with and without feed restriction on performance of broiler chickens. The weight gain after overall period in control diet was 2125.04 ± 34.65 g, diet with probiotic was 2728.07 ± 27.94 g, diet with prebiotic was 2860.54 ± 26.21g diet with symbiotic was 2860.54 ± 26.21 g. Result showed that initial body weight of chicks did not differ (P>0.05) between dietary treatment birds fed with control. Effect of prebiotic at sixth week with an increase of 6 per cent and at second week in synbiotic group with an increase of 8 per cent this indicated that prebiotic was lowest in effect while symbiotic was highest.

Borghain *et al.* (2017), studied effect of feeding garlic as prebiotic on performance of broiler chicken. Final body weight gain in control group was 1904.86 ± 27.05 g in T<sub>1</sub> (basal diet 0.5 per cent garlic powder) was 1986.11 ± 30.85 g in T<sub>2</sub> (basal diet 1 per cent garlic powder) was 2175 ± 31.90 g in T<sub>3</sub> (basal diet + 1.5 per cent garlic powder) was 2008.30 ± 34.13 g. During first and second week of age body weight did not differ significantly. On third week body weight of T<sub>2</sub> group achieved higher body weight compared to control during fourth, fifth and sixth week of age, body weight differ significantly. T<sub>2</sub> group achieved highest body weight fourth, fifth, and sixth week respectively. Hence the result showed that supplementation of garlic powder, improved final body weight of broiler.

Kalia *et al.* (2017), evaluated growth performance of broiler strains at high altitude and evaluation of probiotic effect on their survivability body weight gain from 7 to 35 days of age of vencobb was 254.39 ± 3.81 g/birds, RIR cross breed 288.22 ± 3.55 g/bids and hubbard 250.47 ± 3.63 g/birds. Result showed that RIR cross- breed has higher body weight than other.

Alam and Ferdaushi (2018), studied the use of probiotics instead of antibiotics in broiler production. Broilers of group T<sub>1</sub> were fed the starter and finisher

diets (control group). The broilers of groups T<sub>2</sub> was fed the control starter and finisher diets supplemented with antibiotic and groups T<sub>3</sub> fed with Guardizen-M and T<sub>4</sub> fed with Protexin and T<sub>5</sub> fed with Poultry star solution in drinking water. The body weight improvement in T<sub>1</sub> group was 40.9 g, T<sub>2</sub> was 41.1 g, T<sub>3</sub> was 41.3 g, T<sub>4</sub> was 41.8 g and T<sub>5</sub> was 41.6 g. Average weight of T<sub>1</sub> was 1501.9 g, T<sub>2</sub> was 1550.2 g, and in T<sub>3</sub> it was 1610.39 g and T<sub>4</sub> was 1590.8 g and in T<sub>5</sub> was 1605.6 g. This proven that higher amount of body weight gain was observed in probiotics groups.

Apata, (2018), studied growth performance nutrient digestibility and immune response of broiler chicks fed diets supplemented with a culture of *Lactobacillus bulgaricus*. Birds fed with 20, 40, 60 and 80 mg/kg *Lactobacillus bulgaricus* addition to broiler chick diets significantly improved growth performance.

Al-khalaifa *et al.* (2019), studies the effect of dietary probiotics and prebiotics on the performance of broiler chickens. They were allotted to 5 experimental treatments. The probiotics were *Bacillus coagulance* and *Lactobacillus* and prebiotics included fructo-oligosaccharides and mannan-oligosaccharides. The body weight at 1st week, 2<sup>nd</sup> week, 3<sup>rd</sup> week, 4<sup>th</sup> week, and 5<sup>th</sup> week in control group was 45.04 g, 125.9 g, 304 g, 644 g, 1091.2 g, and 1672 g, respectively and in birds feed with *Bacillus coagulance* it was 45.4 g, 128.64 g, 296.00 g, 626.40 g, 1084.0 g and 168.8 g, respectively and in birds feed with *Lactobacillus* body weight recorded was 44.24 g, 122.92 g, 290.0 g, 611.2 g, 1085.6 g and 1646.40 g respectively. In prebiotic feed, when the fructo-oligoaccharides feed body weight was 44.4 g, 128.8 g, 307.20 g, 619.2 g, 1078.4 g and 1664.8 g and in birds feed with mannan-oligosaccharides the body weight was 44.96 g, 126.52 g, 1307.00 g, 612.80 g, 1084.80 g, 1584.8 g, respectively. Difference between treatment groups are statically different (P<0.05). The result showed that there is lower body weight in broilers fed diets supplemented with probiotics than those fed control diet.

Kaushal *et al.* (2019), studied growth pattern of broiler fed on dietary enzymes and probiotic over a period of six weeks. The result showed that body weight gain was improved in T<sub>4</sub> treatment (5 g sour yoghurt per litre of drinking water) and T<sub>5</sub> treatment (1 g protexin boost per litre of drinking water) group which was 1423.82 g and 1526.66 g during 1 to 21 days of age. During 22 to 35 days of age highest weight gain in T<sub>5</sub> followed by T<sub>4</sub>, T<sub>2</sub>, T<sub>1</sub>, and T<sub>3</sub> this showed that there was better body weight gain of probiotic groups compared with control group.

Ray *et al.* (2019), studied the performance of broiler using three different probiotic indicates the final weight of broiler chickens of control diet was 1846 g, broiler fed with Probiotic-1 (*Lactobacillus spp.*, *Bacillus spp.*, and *Saccharomyces*) was  $1988 \pm 28.14$  g broiler fed with Probiotic-2 (*Bacillus subulans*, *Bacillus sogulans*) was  $2055 \pm 53.98$  g and broiler fed with Probiotic-3 (*Bacillus subilluis*) was  $2057 \pm 94.18$  g. This showed that there was no significant improvement in body weight gain and no improvement on performance was observed.

### **3 Feed intake and water intake**

Parker *et al.* (1972), studied the effect of ambient temperature upon body temperature, feed consumption and water consumption. Average water consumption under four different temperature for 28 days were recorded at 28<sup>th</sup> day water consumption at 10<sup>o</sup>C was 354 ml/day at 21.1<sup>o</sup>C was 605 ml/day. At 32.2<sup>o</sup>C was 1025 ml/day and at 37.8<sup>o</sup>C was 1257 ml/day trial showed that on 37.8<sup>o</sup>C treatment increased water consumption. Water consumption remained fairly stable in treatment period of 21.1<sup>o</sup>C.

Brake *et al.* (1992), reported that the daily feed and water consumption of broiler chicks from 0 to 21 days of age. They concluded that feed and water intake of broiler chicks can be predicted accurately during first three weeks of age, if diet and conditions are comparable to those used in this study result will be more consistent between laboratories if standard amount of starter diet is fed to chicks.

Shoeib *et al.* (1997), studied the response of broiler chicks to probiotic (pronifer) supplementation. Group I received basal diet and group II received pronifer at the rate of 1 kg/ton diet, while group III and IV assigned to dietary regimens composed of 95 per cent basal diet plus 5 per cent wheat bran and pronifer was added at rate 1 kg/ton and 2 kg/ton diet. The result showed that low feed intake in the chicks fed on probiotic as compared to control group.

Shivani *et al.* (2000), studied the effect of different strains of microbes isolated from leopard excreta on performance of chicks of different strains. The experimental plan consisted of three treatment i.e. T1: control, T2: *L. bulgarious*, L4 (palampur) + *S. lactis* S1 (mysore) + *S. cerevisiae* Y3 (palampur) ; T3: *L. acidophilus* (leopard excreta), + *S. faecalis* + *S. carlsbergensis* (leopard excreta). The feed conversion ratio for T1 was 1.95, T2 was 2.06 and T3 was 1.86, this shows that feed

conversion ratio differ non-significantly in all groups.

Warren and Emmert. (2000), studied the efficiency of phase feeding in supporting growth performance of broiler chicks. Nutrient required for chicken or illinois ideal chicks protein (IICP) from 40 to 60 days and feed intake was tested. Result showed that feed consumption for nutrient required for chicken (NRC) feeding was 3733 g, illinois ideal chicks protein (IICP) feeding was 3852 g and phase feeding was 3774 g. This result showed that no difference in feed intake was observed but birds fed illinois ideal chicks protein (IICP) diet were decreased.

Aftahi *et al.* (2006), the effect of yoghurt and protexin boost on broiler performance. The treatment T<sub>1</sub> is control T<sub>2</sub>, T<sub>3</sub> and T<sub>4</sub> received 3 g, 4 g and 5 g yoghurt per lit of drinking water and T<sub>5</sub> received 1g protexin boost per 10 lit of drinking water. The feed consumption from 1 to 35 days of age of T<sub>1</sub> was 2253 g, T<sub>2</sub> was 2265 g, T<sub>3</sub> was 2239.33 g, T<sub>4</sub> was 2316.16 g and T<sub>5</sub> was 2320.66 g. Result showed that, group T<sub>5</sub> and T<sub>4</sub> consumed highest amount of feed than other. Feed consumed by T<sub>1</sub>, T<sub>2</sub> and T<sub>3</sub> had no significant difference among birds.

Kermanshahi and Rostami (2006), evaluate the effect of adding levels of dried whey powder in diet of broiler, at level of 0, 2, 4 and 8 per cent the feed intake of control 1310.4 g, 2 per cent was 1458.9 g, 4 per cent was 1308.7 per cent and 8 per cent was 1313.4 g. The result showed that broilers fed with 2 per cent whey in diet, had higher feed intake than the control group.

Sultan *et al.* (2006), studied the comparative effect of yoghurt as probiotic on the performance of broiler chicks. The one hundred and twenty chicks were divided into 3 groups for treatment of yoghurt at rate of 5ml<sup>-1</sup> and protexin 1gl<sup>-1</sup> of water and control group. Mean feed intake of chicks in starter phase for protexin was 1104.5 g, yoghurt was 1076.25 g and control 1115.75 g and in finisher phase for protexin was 3281.075 g, yoghurt was 3236.37 g and control was 3227.25 g. Result showed that there was no significant different in starter and finisher phase.

Timmerma *et al.* (2006), studies growth performance of broilers given drinking water supplemented with probiotic. In field trials feed intake of birds was 4460 g in control group and 4300 g in trial administrated with multispecies probiotics, and in controlled trials feed intake was 3153 g in control group and 3246 g in trial administrated with chicken specific probiotic. Result showed that feed consumption

was decreased in controlled trial in control group and is higher in field trial in control group.

Gao *et al.* (2009), studied the effect of *Saccharomyces cerevisiae* fermentation product on immune functions of broilers challenged with broiler allotted to six groups with a 2×3 factorial arrangement of treatments supplemented (at 0 per cent, 0.25 per cent and 0.50 per cent) with *Saccharomyces cerevisiae* fermentation product. The feed intake for 0 per cent was 82.3 g per bird, for 0.25 per cent 86.2 g per bird and 0.5 per cent was 85.8g per bird. Result showed that supplemented *Saccharomyces cerevisiae* fermentation product increases feed intake of broiler during 1 to 42 days.

Torshizi *et al.* (2010), studied the effect of administrating probiotics in water or as feed supplement on broiler performance. The water intake from 1 to 42 days for control group was 177.21 ml/day/bird. For group of probiotic supplementation with drinking water was 185.17 ml/bird/day and in group of probiotic supplemented with feed was 187.01 ml/bird/day. Result showed that the water intake was increased in group of probiotic supplementation with feed.

Toghyani *et al.* (2011), investigated the effect of prebiotic and probiotic as antibiotic growth promotor substitution on productive and carcass traits of broiler chicks. Daily fed intake of controlled birds was 90.88 g/day and of fed with probiotic was 94.55 g/day and of antibiotic was 93.08 g/day and probiotic group was 95.58 g/day. Result showed that feed efficiency of group with supplemented diets improved in comparison to control birds.

Patel *et al.* (2015), studied the effect of probiotic supplementation on growth performance, feed conversion ratio of broilers. The feed intake of T<sub>1</sub> (basal diet without probiotic) was 3140.91 ± 29.97 g/bird in T<sub>2</sub> (T<sub>1</sub> + probiotic 50g/ton) was 3134.76 ± 15.244 g/bird and In T<sub>3</sub> (T<sub>1</sub> + 100g/tonne probiotic) was 3165.42 ± 23.12 g/bird. The result showed that there is non-significant effect of probiotics supplementation on feed intake.

Olnood *et al.* (2015), studied effect of novel probiotic on growth performance of broiler chickens. Feed intake from 1 to 42 days in basal diet was 4038 g/bird. Birds fed with basal diet with antibiotic, zinc-bacitracin was 4125 g/bird. A bird fed with isolate treatment with probiotic no. 461 unidentified *Lactobacillus*

species was 4007 g/bird. Birds fed with isolate treatment with probiotic no. 697 *L. salivarius* was 4061 g/bird. Bird fed with isolate treatment with probiotic no.709 *L. crispatus* was 4109 g/birds. Fed with isolate treatment with probiotic no. 1286 *L. Johnsonni* was 4079g/bird. Result showed that there is no significant effect among group.

Togyani *et al.* (2015), evaluated kefir as potential probiotic on growth performance of broiler chicks the treatment T<sub>1</sub> is control, T<sub>2</sub> group fed with 2 per cent milk kefir in drinking water T<sub>3</sub> fed with 2 per cent molasses kefir in drinking water and T<sub>4</sub> fed with diet supplemented with commercial probiotic. The daily feed intake from day 1 to 42 day for control group was 98.6 g/day, for T<sub>4</sub> was 101.8 g/day, for T<sub>3</sub> was 101.0 g/day and for T<sub>2</sub> was 95.7 g/day. The result showed that group of birds fed with diet supplemented with commercial probiotic had more daily feed intake than other.

Fallah (2016), studied the performance of broiler chickens fed different levels of dried whey and protexin probiotic. Feed intake of broiler of control group was 4220 ± 352.75 g. Group of broilers fed with protexin had 4360 ± 353.49 g and fed with dried whey powder was 4280 ± 348.29 g and fed with dried whey powder and protexin was 4380 ± 358.56 g. Result showed that there are significant differences in feed intake among control and dried whey powder + protexin treatment.

Bai *et al.* (2017), studied the supplemental effect of probiotic *Bacillus subtilis* fmbJ on growth performance of broiler chickens. Control group is fed without *Bacillus subtilis*-fmbJ and antibiotic. The 1<sup>st</sup> group fed with 2×10<sup>10</sup> cfu/kg *Bacillus subtilis* fmbJ. 2<sup>nd</sup> group fed with *Bacillus subtilis* at 3×10<sup>10</sup> cfu/kg and 3<sup>rd</sup> group fed with 41×0<sup>10</sup> cfu/kg *Bacillus subtilis*-fmbj. The feed intake of control group was 93.78 ± 3.51 g/bird, 2<sup>nd</sup> group was 91.90 ± 3.07 g and 3<sup>rd</sup> group was 92.67 ± 3.83 g. The result showed that there was increase in feed intake in group fed with probiotic.

Borgohain *et al.* (2017), studied the effect of feeding garlic as prebiotic on performance of broiler chicken. The treatment T<sub>0</sub> was control T<sub>1</sub>, T<sub>2</sub> and T<sub>3</sub> were supplemented with 0.5 per cent, 1.0 per cent and 1.5 per cent garlic powder. The feed intake of T<sub>0</sub> group was 3390.90 g, T<sub>1</sub> was 3580.7 g, T<sub>2</sub> was 3633.23 g and T<sub>3</sub> was 3512.17 g. This shows that supplementation of garlic powder improved feed intake as compared to control group. The overall feed conversion ratio for T<sub>0</sub> was 1.78, T<sub>1</sub> was

1.8, T<sub>2</sub> was 1.67 and T<sub>3</sub> was 1.74. This showed the feed conversion ratio was affected significantly in broiler fed with garlic as prebiotic.

Kalia *et al.* (2017), studied growth performance of different broiler strains at high altitude and evaluation of probiotic effect on their survivability feed intake from 7 to 35 days of age of vencobb was  $1003.45 \pm 6.90$  g/bird. RIR cross breed was  $1037.34 \pm 6.43$  g/bird and Hubbard was  $1091.33 \pm 6.13$  g/bird. Result showed that feed intake was higher in hubbard strain.

Kalia *et al.* (2017), studied growth performance of different broiler strain with evaluation of probiotic effect on survivability water intake from 7 to 35 days of age of birds were observed. The water intake of vencobb was  $1785.06 \pm 6.53$  ml/bird. RIR cross breed was  $1780.03 \pm 6.35$  ml/bird and hubbrad was  $1810.84 \pm 6.11$  ml/bird. The result showed that water intake was higher in hubbard followed by vencobb and RIR cross-breed respectively.

Alam and Ferdaushi (2018), studied the use of probiotics instead of antibiotics in broiler of group T<sub>1</sub> were fed the starter and finisher diets (control group). The broiler of group T<sub>2</sub> was fed the control starter and finisher diets supplemented with antibiotic and group T<sub>3</sub>- guardizan-M, T<sub>4</sub>- protexin and T<sub>5</sub>- poultry star so in drinking water. The feed intake in T<sub>1</sub> group was 84.9 g/day, T<sub>2</sub> was 85.3 g/day, T<sub>3</sub> was 86.6 g/day and T<sub>4</sub> was 86.1 g/day and T<sub>5</sub> was 86 g/day. These proven that improvement in feed consumption are due to increased efficiency of digestion due to probiotic bacteria.

Gujjarwar (2018), experimental study was conducted to evaluate the effect of ginger as a natural feed additives on growth performance of broilers. The control group T<sub>1</sub> is feed with standard broilers ration and T<sub>2</sub>, T<sub>3</sub>, and T<sub>4</sub> groups were provided same broiler ration supplementation with 0.5 per cent, 0.75 per cent & 1 per cent ginger powder. The result showed that birds feed fed with 0.75 per cent ginger powder consume lowest feed consumption (4613.14 g) and control group consume more feed (5114.78 g) than other groups.

Ray *et al.* (2019), studied the performance of broiler using three different probiotic in diets the feed intake of broiler chickens of control diet was  $3350 \pm 18.00$  g, broiler fed with PB-1 (*Lactobacillus spp.*, *Bacillus spp.* and *Saccharomyces*) was  $3423 \pm 28.66$  g, broiler fed with (*Bacillus subulans*, *Bacillus*

*sogulans*) was  $3475 \pm 18.00$  g and broiler fed with (*Bacillus subtilis*) was  $3553.4 \pm 53.57$  g. This showed that feeding *Bacillus Subtilis* containing probiotics showed increases in feed intake.

Parade (2019), experimental study was conducted to evaluate the effect of lemongrass leaf meal as a natural feed additives on growth performance of broilers. The control group T<sub>1</sub> is feed with standard broilers ration and T<sub>2</sub>, T<sub>3</sub>, and T<sub>4</sub> groups were provided same broiler ration supplementation with 0.5 per cent, 1 per cent & 1.5 per cent lemongrass leaf meal. The result showed that birds feed with 1.5 per cent lemongrass leaf meal have low feed consumption and birds feed with standard broiler ration consumed more feed than other birds.

Parade (2019), experimental study was conducted to evaluate the effect of lemongrass leaf meal as a natural feed additives on growth performance of broilers. The control group T<sub>1</sub> is feed with standard broilers ration and T<sub>2</sub>, T<sub>3</sub>, and T<sub>4</sub> groups were provided same broiler ration supplementation with 0.5 per cent, 1 per cent & 1.5 per cent lemongrass leaf meal. The total water intake of broiler of treatment T<sub>1</sub>, T<sub>2</sub>, T<sub>3</sub> and T<sub>4</sub> were 6910.55, 7250.16, 7089 and 7566.79 ml per bird. Result showed that birds fed with 1.5 per cent lemon grass leaf meal have more water intake than another birds.

Meshram (2019), experimental study was conducted to evaluate the effect of drumstick leaf meal as a natural feed additives on growth performance of broilers. The control group T<sub>1</sub> is feed with standard broilers ration and T<sub>2</sub>, T<sub>3</sub>, and T<sub>4</sub> groups were provided same broiler ration supplementation with 0.5 per cent, 1 per cent & 1.5 per cent drumstick leaf meal. The result showed that birds feed with 0.5 per cent leaf meal have lowest feed consumption and group of birds fed with standard broilers ration without supplementation of leaf meal have highest feed consumption that is 4.715 kg per bird than other groups.

Patil (2020), studied the effect of tulsi leaf powder on growth performance of broilers. The control group T<sub>1</sub> and T<sub>2</sub>, T<sub>3</sub>, and T<sub>4</sub> groups were fed with broiler ration supplementation with 0.5 per cent, 1 per cent & 1.5 per cent tulsi leaf powder. The result showed that birds feed with 1.5 per cent tulsi leaf powder consume lowest feed (4283.13 g) and control group consume more feed (4335.50 g) than other groups.

Patil (2020), studied the effect of tulsi leaf powder on growth performance of broilers. The control group T<sub>1</sub> and T<sub>2</sub>, T<sub>3</sub>, and T<sub>4</sub> groups were feed with broiler ration supplementation with 0.5 per cent, 1 per cent & 1.5 per cent tulsi leaf powder. The total water intake of broiler of treatment T<sub>0</sub>, T<sub>1</sub>, T<sub>2</sub> and T<sub>3</sub> were 6908.18, 7064.01, 7252.85 and 7397.63 ml per bird. The result showed that birds fed with 1.5 per cent tulsi leaf powder have more water intake than other.

#### **4. Feeding cost for broiler**

Korver *et al.* (2004), studied performance characteristics and economic comparison of broiler chickens fed wheat and triticale based diet. Feed cost of wheat 0.577 \$/kg of live weight and triticale was 0.617 \$/kg of live weight triticale become economically suitable as a straight wheat replacement in broiler chickens diet when price was less than or equal to 95 per cent of price was less than or equal \$ 18/ton (canadian) wheat and triticale have similar nutrients composition and diet specifications were very similar using triticale as straight replacement for wheat.

Aftahi *et al.* (2006), studied the effect of yoghurt and protexin boost on broiler performance cost of feed for control group (T<sub>1</sub>) was 45.91 tk(tonerkit)/chicks, for T<sub>2</sub> (3g sour yoghurt) was 46.55 tk/chick, for T<sub>3</sub> (4g sour yoghurt ) was 47.28 tk/chick, for T<sub>4</sub> (5g sour yoghurt was 17.40 tk/chick. and for T<sub>5</sub> (1g protexin boost). The profit of broiler was highest in T<sub>4</sub> treatment groups (16 tk/chick) shows that more profit was received for broiler fed probiotics.

Ravindran *et al.* (2006), studied the effect of whole wheat feeding on performance of broiler chickens whole wheat inclusion @ 100 g/kg and 200 g/kg and 22-35 days. There was lowering in weight gain and feed intake of broiler but improvement in feed to gain ratios by 5 points. Inclusion of whole advantage via improved feed efficiency and lowered processing costs.

Sultan *et al.* (2006), studied the effect of yoghurt as probiotic on performance of broiler chicks mean cost of feed consume chick when protexin 1 g/l of water used was Rs.70.05 and gross return was Rs.93.74 when yoghurt 5 m/l of water used was Rs. 55.76 and gross return was Rs. 110.75 and in control diet cost of feed per chicks was Rs. 56.45 and gross return was Rs. 94.53 this showed that cost was higher for protexin used group. The gross return for yoghurt used group was higher, the cost benefit and income per bird was highest in groups alternatively given

antibiotic and probiotic at weekly interval.

Schmidt (2008), studied that effect of broiler market age on performance parameters and economics. Birds were grouped into 5 market ages and different parameters like production cost, production efficiency index, farmer's gross margin etc. were measured. Market age significantly influenced all evaluated parameters except for final cost/kg broiler and effect of farm and market age interaction was not significant. The mean market age of groups MA1, MA2, MA3, MA4 and MA5 were 42.29, 43.58, 44.68, 45.60 and 47.84 days respectively. The result obtained in present study and a facility to house 16000 birds, the farmer would have Rs. 400 reduction in her/his gross margin per flock when MA1 is compared to MA5. The negative effect of market age on live performance did not significantly influence production cost per kg of broiler this lower impact on production cost was due to variation from 16.86 per cent (MA5) in farmers participation in composition of final cost.

Samarakoon *et al.* (2012), studied the strategies to improve the cost effectiveness of broiler production. He studies the cost effectiveness of sex-separated feeding of broiler. The unit profitability (Rs/m<sup>2</sup>/day) at 35 days in male was  $54.8 \pm 1.9$  and in female  $46.3 \pm 1.3$  at 36 days in male was  $57.2 \pm 2.1$  and in female  $47.5 \pm 1.7$  at 37 days in male  $57.2 \pm 1.7$  and in female  $47.9 \pm 1.4$  at 38 days in male was  $58.9 \pm 2.1$  and in female  $48.8 \pm 1.4$  at 39 days in male was  $59.6 \pm 2.1$  and in female was  $49.5 \pm 1.2$  at 40 days in male was  $61.7 \pm 1.9$  and female  $51.1 \pm 1.4$  at 41 days in male was  $61.0 \pm 2.2$  and female  $51.5 \pm 1.3$  and at 42 days in male was  $60.01 \pm$  and female  $52 \pm 1.3$ . Thus, shows that males' unit profitability had increased from day 35 up to 40 and reduced thereafter and achieve highest profit at day 40 from day 40 to 42 the unit profit value had decreased. In female unit profit value increased from day 35 to 42 and showed highest value at day 42 which was  $52 \pm 1.3$ .

Omara (2012), investigated the effect of adding either commercial or natural probiotics to broilers diets on growth performance. The effect of dietary treatment on economic efficiency includes feed cost of 8.85 Livre Egyptian/kg in birds fed with Basel diet. Birds fed with avi-bac of 0.1 per cent are 9.12 LE feed cost for birds with 0.5 per cent and 1 per cent skimmed milk were 9.25 LE and 9.38 LE respectively and feed cost for birds fed with 0.5 per cent and 1 per cent whey were 9.08 LE and 9.52 LE respectively. The result showed that broiler birds fed with

probiotics average values of total cost/kg body weight decreased. The data showed that adding skimmed milk whey to broiler chick diet improved average values of economics efficiency compared to either control diet or avi-bac supplemented diet.

Gutierrez *et al.* (2013), studied the effect of lactic acid bacteria based probiotic, floramax-B11 on economy of broiler chickens. From economics analysis chicken treated with floramax, increase body weight of 100 g in trial 1 or 110 g in trial 2, when converted to a cost benefit ratio suggested that for every one USD spends with probiotic there cost benefit ratio was 1:22:57 or 1:26:97 respectively.

Omar (2014), studied economic evaluation of probiotic using in different broiler breeds. The variable cost includes feed cost, labor cost, total veterinary management cost. Total variable cost for ross breed for probiotic treated group was  $11.12 \pm 0.10$  Livre Egyptian/bird and for control group was  $11.65 \pm 0.06$  LE/bird having net profit  $2.01 \pm 0.003$  LE/bird for treated and  $1.71 \pm 0.01$  LE/bird for control. Total variable cost for cobb breed for probiotic treated group was  $11.60 \pm 0.10$  LE/bird and for control group was  $11.39 \pm 0.11$  LE/bird having net profit  $1.42 \pm 0.08$  LE/bird for treated and  $1.42 \pm 0.07$  LE/bird for control and total variable cost for hubbard breed for probiotic treated group was  $11.29 \pm 0.003$  LE/bird having net profit  $1.95 \pm 0.03$  LE/bird for treated and  $1.34 \pm 0.05$  LE/bird for control group. Result showed significant differences for net profit. Ross breed treated with probiotic have largest net profit and hubbard breed of control group had lowest net profit.

Saiyed *et al.* (2015), studied the inclusion of probiotic and its combination in broiler diet and their effect on economics of commercial broilers. Cost of feed in broiler starter for T<sub>1</sub> (control), T<sub>2</sub> (probiotic @ 100 g/ton) of feed T<sub>3</sub> (prebiotic @ 500 g/ton) of feed T<sub>4</sub> (probiotic + prebiotic @ 100 g/ton and 500 g/ton of feed) and T<sub>5</sub> (probiotic + Prebiotic @ 50 g/ton and 250 g/ton of feed) was 22.32 Rs/kg, 22.49 Rs/kg, 22.56 Rs/kg, 22.39 Rs/kg, 22.56 Rs/kg and 22.44 Rs/kg. Cost of feed in broiler finisher for T<sub>1</sub>, T<sub>2</sub>, T<sub>3</sub>, T<sub>4</sub> and T<sub>5</sub> was 22.02, 22.19, 22.09, 22.26 and 22.14 Rs/kg. Feed cost per bird return over feed cost T<sub>1</sub> was  $85.50 \pm 1.34$  Rs/bird and  $55.82 \pm 1.13$  Rs/bird for T<sub>2</sub> was  $83.63 \pm 2.38$  Rs/bird and  $64.64 \pm 0.72$  Rs/bird, for T<sub>3</sub> was  $84.32 \pm 0.60$  Rs/bird and  $67.12 \pm 1.57$  Rs/bird. For T<sub>4</sub> was  $78.85 \pm 1.14$  Rs/bird and  $70.82 \pm 2.38$  Rs/bird. For T<sub>5</sub> was  $78.47 \pm 1.18$  Rs/bird and  $72.28 \pm 1.43$  Rs/bird. Feed cost during whole experiment periods was lower in T<sub>4</sub> and T<sub>5</sub> group than others return over feed cost of control group was lower than all treatment group. Highest

return over feed cost was in T<sub>5</sub> (29.48 per cent) as compared to control (T<sub>1</sub>) suggest that incorporation of symbiotic yield more return and can afford its 50 per cent level for better economy.

Patel *et al.* (2015), studied the effect of probiotics supplementation on economics of broiler. Cost of feeding for T<sub>1</sub> treated group (control) was Rs.84.05 ± 0.80 for T<sub>2</sub> (T<sub>1</sub> + probiotic 50 g/tonn feed) was Rs.84.25 ± 0.41. For T<sub>3</sub> (T<sub>1</sub>+100 g/ton probiotic) was Rs.85.43 ± 0.62. Return over feed cost for T<sub>1</sub>, T<sub>2</sub> and T<sub>3</sub> was Rs.26.45 ± 1.05, Rs.27.82 ± 0.61 and Rs.30.99 ± 0.39. The lowest feed cost was observed in control group (T<sub>1</sub>) followed by T<sub>2</sub> and highest in T<sub>3</sub> as compared to T<sub>2</sub> and T<sub>1</sub>. Result showed that use of probiotics in broiler chicks was financially profitable.

Shinde (2015), studied the effect of spirulina supplementation on growth of broilers. The net profit of broilers fed with ration supplemented with 0.04 per cent spirulina (T<sub>1</sub>) was Rs.23.71, broilers fed with ration supplemented with 0.06 per cent spirulina (T<sub>2</sub>) was Rs.32.08 and broiler fed with ration 0.08 per cent spirulina was Rs.23.52, and control (T<sub>0</sub>) group was Rs.22.4. The result showed that net profit was highest in broilers fed with 0.06 per cent Spirulina than 0.04 and 0.08 per cent spirulina and control group.

Karangiya *et al.* (2016), studied the effect of dietary supplementation of garlic, ginger and their combination in economy in commercial broiler. The feed cost of broiler starter in control (T<sub>1</sub>) diet birds was 25.56 Rs/kg, for birds fed with 1 per cent garlic (T<sub>2</sub>) was 27.06 Rs/kg, for birds fed with 1 per cent ginger (T<sub>3</sub>) was 29.56 Rs/kg and for birds fed with 1 per cent garlic and ginger (T<sub>4</sub>) was 31.06 Rs/kg. The cost of broiler finisher in control diet birds was 25.22 Rs/kg, for birds fed with 1 per cent garlic was 26.72 Rs/kg, for birds fed with 1 per cent ginger was 29.22 Rs/kg and for birds fed with 1 per cent ginger and garlic was 30.72 Rs/bird. Feed cost for T<sub>1</sub>, T<sub>2</sub>, T<sub>3</sub>, and T<sub>4</sub> was 83.80 ± 1.44 Rs/bird, 87.36 ± 1.28 Rs/bird, 99.03 ± 0.88 Rs/bird and 104.8 ± 1.16 Rs/bird. Return over feed cost for T<sub>1</sub>, T<sub>2</sub>, T<sub>3</sub>, T<sub>4</sub> was 23.45 ± 1.23 Rs/bird, 22.48 ± 1.18 Rs/bird, 15.36 ± 0.82 Rs/bird and 1.80 ± 0.08 Rs/bird. Due to highest cost of ginger, return over feed cost diminishing over two groups. It indicates that ginger did not show any negative or positive effect in Return over feed cost.

Abdel hafeez *et al.* (2017), studied the effect of probiotic and symbiotic with and without fed restriction on performance and cost of rearing of

broiler chickens. The cost of feed for the control diet was 3.92 LE, 3.5 LE, 7.26 Livre Egyptian per kg or Egyptians pond at starter, grower and finisher period respectively. While cost of feed in diets containing additives was slightly higher than control. The additive improved feed cost of production starter mainly in probiotic and symbiotic groups where each kg gain cost 4.62 LE in both treatments compared with 5.49 LE control. At grower period the kg gain produced by same additives cost 6.03 and 5.83 LE compared with 6.53 LE for control at finisher each kg gain in probiotic, prebiotic, symbiotic cost 7.04 LE, 8.09 LE, 6.93 LE respectively compared with 9.0 LE in control. In total period three additives had the least costs but the prebiotic and symbiotic had lowest cost 5.99 and 5.85 LE, respectively.

Borghain *et al.* (2017), studied the effect of feeding garlic as probiotic on performance of broiler chicken gross profit per broiler for control group (T<sub>0</sub>) was Rs.45.73. For group fed with 0.5 per cent garlic powder (T<sub>1</sub>) was Rs.41.01. For group fed with 0.1 per cent garlic powder (T<sub>2</sub>) was Rs.51.19 and for group fed with 1.5 per cent garlic powder (T<sub>3</sub>) was Rs.32.93. The result showed that group fed with 1 per cent garlic powder was best in respect of higher gross profit per bird.

Kalia *et al.* (2017), studied the growth performance of different broilers strains at high altitude and evaluation of probiotic effect on their survivability. The net profit of group fed with broiler ration with 9 g probiotic/kg probiotic was Rs.216.65 per group and group fed with broiler ration with 18 g probiotic/kg ration was Rs.293.29 per group. Result showed that broiler group with 18 g probiotic/kg ration has more net profit than control and 9 g/kg probiotic in ration.

Ray *et al.* (2019), studied cost effectiveness of broiler using three probiotic cost of feed in control group was  $129 \pm 1.69$  Bangladesh taka (BDT)/bird, for birds fed with probiotic-1 (*Lactobacillus* spp., *Bacillus* spp, and *Saccharomyces*) was  $131.90 \pm 1.11$  BDT/bird and cost of probiotics was  $2 \pm 0.02$  BDT /bird. For birds fed with probiotic-2 (*Bacillus subulans*, *Bacillus soagulans*) was  $133.9 \pm 0.69$  BDT/bird and cost of probiotics was  $1.57 \pm 0.01$  BDT/bird. For birds fed with probiotic-3 (*Bacillus subtilis*)  $136.20 \pm 2.07$  BDT/bird and cost of probiotic was  $1.13 \pm 0.0158$  BDT/bird. Profit for control was  $7.40 \pm 3.94$  BDT/bird, for probiotic-1, probiotic-2 and probiotic-3 was  $39.60 \pm 3.20$ ,  $46.10 \pm 6.74$  and  $44.50 \pm 9.53$  BDT/bird. Result showed that *Bacillus subuland* and *Bacillus soagulans* was most cost effective.

Kaushal *et al.* (2019) studied the performance and economics of broiler chickens fed dietary enzyme and probiotics. The cost of feed eaten for T<sub>1</sub> (control) was 1.92 United States Dollar (USD)/bird, for T<sub>2</sub> (Basal feed + 0.25 g/kg enzyme) was 1.91 USD/bird, for T<sub>3</sub> (basal diet + 0.5 g/kg enzyme) was 1.87 USD/bird, for T<sub>4</sub> (basal diet +0.75 g/kg enzyme) was 1.87 USD/ bird, for T<sub>5</sub> ( basal diet +0.25 g /kg probiotics) was 1.90 USD/bird, for T<sub>6</sub> (basal diet + 0.25 g/kg enzyme + 0.25 g/kg probiotics) was 1.83 USD/bird , for T<sub>7</sub> (Basal diet + 0.5 g/kg enzyme +0.25 g/kg) was 1.79 USD/bird, for T<sub>8</sub> ( basal feed + 0.75 g/kg enzyme + 0.25 g/kg probiotics) was 1.79 USD/bird. The additional profit per bird in T<sub>2</sub>, T<sub>3</sub>, T<sub>4</sub>, T<sub>5</sub>, T<sub>6</sub>, T<sub>7</sub> and T<sub>8</sub> was 0.047, 0.18, 0.19, 0.043, 0.32, 0.46 and 0.47 USD/bird, which was maximum in T<sub>8</sub> and minimum in T<sub>2</sub> groups. This showed that supplementation of enzyme and probiotics decreased feed cost and increased income over feed cost in all group.

Parade (2019), experimental study was conducted to evaluate the effect of lemongrass leaf meal on growth performance of broilers. Net profit per bird was highest in group fed with 1.5 per cent lemongrass leaf meal (Rs 43.52) than fed with 0.5 per cent (Rs 43.61), 1 per cent (Rs 39.35) and lowest (Rs 37.47) in control group.

Meshram (2019), experimental study was conducted to evaluate the effect of drumstick leaf meal on growth performance of broilers. The profit per bird was highest in group fed with 0.5 per cent drumstick grass leaf meal (Rs 34.67) and lowest in control group (Rs 21.33) than fed with 1 per cent (Rs 26.21) and 1.5 per cent (Rs.23.78) groups.

Patil (2020), studied the effect of tulsi leaf powder on growth performance of broilers. The control group T<sub>1</sub> and T<sub>2</sub>, T<sub>3</sub> and T<sub>4</sub> groups were feed with broiler ration supplementation with 0.5 per cent, 1 per cent & 1.5 per cent tulsi leaf powder. The net profit per bird was highest in group feed with 1.5 per cent tulsi leaf powder (Rs 54.87) and lowest in control group (Rs 48.46) than fed with 0.5 per cent (Rs 51.65) and 1 per cent (Rs 53.29) groups.

**CHAPTER-III**  
**MATERIALS AND METHODS**

## CHAPTER-III

### MATERIAL AND METHODS

The experiment was undertaken to “Studies on feeding of probiotic cultured whey on growth performance of broilers”. The feeding and other field trials of experiment was conducted at Mulani Poultry Farm Gadegaon Tq. Barshi, Dist. Solapur and lab work was carried out in the Department of Animal Husbandry and Dairy Science, College of Agriculture, Latur, VNMKV, Parbhani, Maharashtra.

#### 3.1 Selection of experimental chicks

One hundred and sixty, day old, commercial broiler chicks (vencobb-400) were selected from host poultry farms (Mulani Poultry Farm). Experimental chicks vaccinated with Marek’s disease vaccine on the first day of life (at hatchery). Further vaccination was carried out as follows.

7<sup>th</sup> day -Lasota vaccine by intraocular route.

14<sup>th</sup> day- Gumboro vaccine by intraocular route.

21<sup>th</sup> day- Booster dose of Lasota vaccine through drinking water.

The wing banded experimental chicks were individually weighed and then randomly distributed into four treatments each treatment consist 40 chicks and every treatment had four replication each replication consists 10 chicks as shown in given below Table 3.1.

**Table 3.1: Average body weight of day old chicks**

Sr. no.	Dietary treatment	No of birds per treatments	Average body weight (g)
1	T <sub>0</sub> (Control)	40	46.82
2	T <sub>1</sub>	40	46.81
3	T <sub>2</sub>	40	46.67
4	T <sub>3</sub>	40	46.83
	SE $\pm$ = 0.08		CD @ 5% = 0.26

### 3.2 Housing and management

All the experimental chicks were reared for 42 days on deep litter system in a well-ventilated shed. Proper brooding of chicks was done by providing sufficient heat and light by using electric bulbs in each treatment for first 3 weeks of age. The standard temperature of brooding was kept at 32-35<sup>0</sup>C for first week. A brooding temperature was maintained in such a way that weekly reduction by 3<sup>0</sup>C till brooder temperature reached to 27<sup>0</sup>C in third week of age. Afterword sufficient artificial light was provided during night hours throughout the experimental period.

Fresh, clean and cool drinking water was provided to birds ad libitum. Water was mixed with probiotic cultured whey as per treatment. All the precautionary measures against diseases were taken throughout the experimental period of six weeks. The treatment combination for feeding probiotic cultured whey through drinking water were finalized as follows.

### 3.3 Treatment Combination:

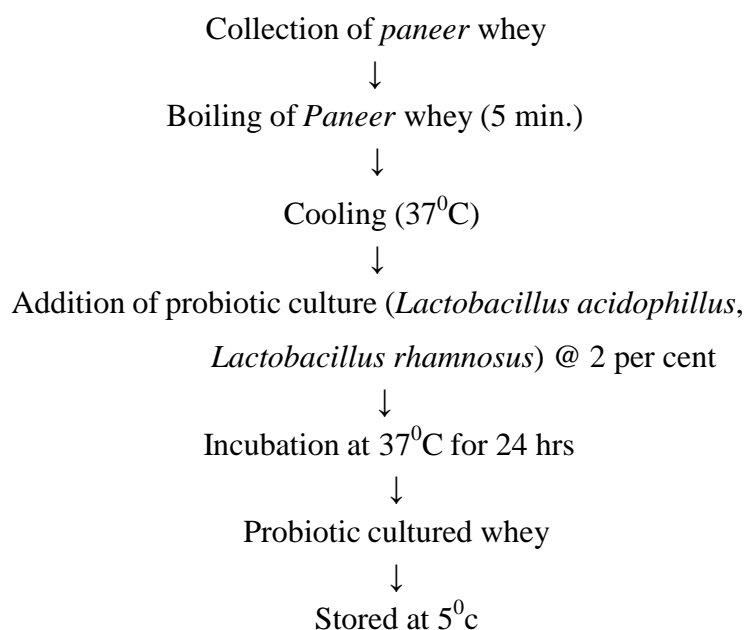
T<sub>0</sub> - Normal water (Control)

T<sub>1</sub>- Normal water + 10 per cent probiotic culture whey

T<sub>2</sub>- Normal water + 20 per cent probiotic culture whey

T<sub>3</sub>- Normal water + 30 per cent probiotic culture whey

### 3.4 Procedure for Preparation of Probiotic cultured Whey:





**Plate 3.1: Vaccinating broiler birds**

## **Procedure**

Paneer whey was collected from Department of Animal Husbandry and Dairy Science College of Agriculture, Latur. This paneer whey was boiled for 5 minutes for sterilization and kept for cooling upto 37<sup>0</sup>C at this temperature probiotic culture (*Lactobacillus acidophilus*, *Lactobacillus rhamnosus*) added at the rate of 2 per cent then it kept for incubation at 37<sup>0</sup>C for 24 hrs. Prepared probiotic culture stored at 5<sup>0</sup>C.

For every 3 days fresh probiotic culture whey was prepared as shown in flow diagram and used.

### **3.5 Diets and feeding regime:**

All the broiler chicks were fed with crumbled maize grains for first 2 days of age followed by the experimental ration which was bought from market which was consist of prestarter (0-2 weeks) with 23-24 per cent and 2750-2800 K cal energy, starter (from 2-6 weeks) with 21-22 per cent crude protein and 2850-2900 K.cal energy and finisher (from 6-9 weeks) with 18-19 per cent crude protein and 2950-3000 K.cal energy. The feed consumed by birds was recorded daily.

### **3.6 Watering**

Daily watering was done as per treatment combination of fresh water and Probiotic cultured whey and record of drank water was kept daily.

### **3.7 Observations recorded**

#### **3.7.1 Weekly gain in Body weight**

Randomly body weight of 10 birds from each treatment was recorded accurately at weekly interval. Weekly body weight was recorded accurately in morning hours by withdrawing feeding troughs. Weekly weight gain in each treatment was calculated considering body weight recorded during weekly interval.

#### **3.7.2 Feed intake and water intake**

Daily feed consumption was recorded in the course of the whole experiment for each treatment by subtracting left over feed from offered feed to know the actual quantity of feed consumed by birds in a particular group and similar procedure was adopted for drinking water.

### **3.7.3 Cost of Broiler rearing**

The data regarding average body weight, average feed consumption, feed per kg live weight and cost of feed per kg body weight gain and net profit per bird were recorded.

### **3.7.4 Microbial count of probiotic whey drink**

Total plate count, coliform count and yeast and mould count of probiotic whey drink were determined.

#### **3.7.4.1 Preparation of sterile dilution blank:**

Sterile dilution blank (0.85%) was prepared by dissolving 8.5 g of NaCl in 1 l of distilled water. The pH was adjusted to  $7.0 \pm 2$ , followed by autoclaving 9 ml aliquots at  $121^{\circ}\text{C}$  for 15 min.

#### **3.7.4.2 Preparation of sample dilution:**

Exactly 1 ml of Probiotic whey drink sample was taken and transferred to a sterile 9 ml dilution blank. The content of the tube was mixed well. This representing the first dilution (1:10), subsequently dilutions were prepared by transferring 1 ml in 9 ml sterile dilution blanks.

#### **3.7.4.3 Standard Plate Count**

Enumeration of standard plate count of probiotic whey drink was done as per IS 5402: (2012) using plate count agar pH ( $7.0 \pm 0.2$ ). The prepared plates were incubated at  $30 \pm 2^{\circ}\text{C}$  for  $72 \pm 3$  hrs. At the end of incubation period, colonies were counted using colony counter and results was expressed as cfu of total viable count.

#### **3.7.4.4 Coliform count:**

Enumeration of coliform count of probiotic whey drink was determined by using pour plate method described by Hought (1992) by employing Violet Red Bile Agar (pH  $7.4 \pm 0.1$ ). The prepared plates were incubated at  $37^{\circ}\text{C}$  for 48 hours colonies with dark red coloration were counted and they were expressed as  $\log_{10}$  cfu per ml of sample.

#### **3.7.4.5 Yeast and mould count:**

Probiotic whey drink was ascertained for yeast and mould counts as per suggested by Marshall (1993) using Potato Dextrose Agar and pH of media



**Plate a. Probiotic cultured whey**



**Plate b. Pre-Starter**



**Plate c. Starter**



**Plate d. Finisher**

**Plate 3.2: Feeding material used in experiment**

adjusted to  $3.5 \pm 0.1$  using tartaric acid solution. The prepared plates were incubated at  $30^{\circ}\text{C}$  for 3-5 days and counts were expressed as  $\log_{10}$  cfu per ml of sample.

### 3.8 Parameters of feedlot

#### 3.8.1 Weight gain (g)

The birds were weighed per week to determine the average live weight gain per chick in each treatment groups. Weight gain was calculated as the difference between two successive weekly body weights as follows.

$$\text{Body weight Gain} = \text{current week weight} - \text{Previous week weight}$$

#### 3.8.2 Feed intake per bird (g).

The feed was weighed per week to determine the average feed intake per chicks for the different treatment groups. Feed intake was calculated by left over feed and divided by numbers of birds in each group per day and totalized to be per week.

$$\text{Feed intake per bird (g)} = \text{Offered food} - \text{left over food}$$

#### 3.8.3 Water intake

The water intake was recorded daily by subtracting remaining water from total water offered.

$$\text{Water intake} = \text{Total water given} - \text{remaining water}$$

#### 3.8.4 Feed conversion ratio

It was recorded in each week of experiment and calculated by dividing feed consumed by body weight gain during week.

$$\text{FCR} = \frac{\text{Cumulative feed consumed (g)}}{\text{Cumulative body weight gain (g)}}$$

(Note: The value excludes the initial weight of chicks).

### 3.9 Chemical analysis

The chemical analysis of the experimental broiler ration was carried out as per A.O.A.C. (1995) for all the proximate principles.

#### 3.9.1 Dry matter (DM)

A 5 g of prepared sample was ground in pestle and mortar and weighed accurately in tarred moisture dish made up of porcelain silica. It was dried previously in hot air oven and dish was placed in air oven maintained at  $105 \pm 20^{\circ}\text{C}$  in the hot air oven for 30 minutes. The drying and weighing was carried out till the difference in the mass between two successive weighing were less than one mg The (DM) dry matter of feed was estimated as

$$\text{DM (\%)} = 100 \times \frac{(M_2 - M)}{(M_1 - M)}$$

Where,

M - Weight of empty dish

M<sub>1</sub> - Weight of sample with dish before drying

M<sub>2</sub> - Weight of dish with dried sample.

#### 3.9.2 Total ash

The dried material in the dish obtained from estimation of dry matter was ignited with the flame of suitable burner for about 2 hours. Afterwards, this was ignited by keeping in muffle furnace at  $600 \pm 200^{\circ}\text{C}$  until the ash resulted. This was cooled in desiccator and weighed. The procedure was repeated till the difference in weight between two successive weighing was less than 1 mg.

$$\text{Total ash (on dry basis) percent by mass} = 100 \times \frac{(M_2 - M)}{(M_1 - M)}$$

Where,

M - Weight of empty dish

M<sub>1</sub> - Weight of dish with ash

M<sub>2</sub> - Weight of sample with dish before ash

#### 3.9.3 Crude fiber

Moisture free and fat extracted samples of feeds were boiled with 1.25 per cent sulphuric acid for 30 minutes and washed with hot neutral water to make it



**Plate a. Day old chicks**



**Plate b. 2 Weeks old chicken**



**Plate c. 3 Weeks old chicken**



**Plate d. 4 Weeks old chicken**



**Plate e. 5 Weeks old chicken**



**Plate d. 6 Weeks old chicken**

**Plate 3.3: Week wise growth stages of broiler**

acid free. This was followed by boiling with 1.25 per cent sodium hydroxide solution for 30 minutes and washed with hot neutral water. Residue sample with crucible was dried, weighed and ignited in muffle furnace to obtain its ash contents. Crude fiber was calculated by deducting ash from the weight of dried residue.

#### **3.9.4 Nitrogen and crude protein**

The crude protein was estimated by multiplying the percentage of nitrogen by a factor 6.25. Depending upon the protein content, 2-5 g of oven dried sample was transferred to the Kjeldahl's flask. About 10 g of potassium sulphate and 0.5 g of copper sulphate were added to the flask. Concentrated  $H_2SO_4$  was added at the rate of 10 ml/ g of the sample. Flask was heated first gently and thereafter, vigorously and the mixture was digested till the mixture turns clear. Then NaOH solution was added in distillation flask. Distillation was continued till whole of the ammonia was released and was received over standard  $H_2SO_4$  which was then back titrated with standard NaOH in order to determine the amount of standard acid used to neutralize the ammonia evolved from the digested material.

#### **3.9.5 Ether extract**

The ether extract was determined by the Soxhlet's ether extraction apparatus in which the oven dried ground material was put in filter paper thimble and continuous extraction was made by petroleum ether having boiling point 40-60 °C.

#### **3.9.6 Energy**

The metabolizable energy (ME) content of feed was calculated as per the standard book values.

#### **Statistical Analysis**

The data obtained on cumulative gain in body weight, feed consumption and feed conversion ratio and water intake were subjected to analysis of variance of Complete Randomized Design CRD (Snedecor and Cochran, 1982).

**CHAPTER-IV**  
**RESULTS AND DISCUSSION**

## CHAPTER- IV

### RESULT AND DISCUSSION

The present research work has been carried out to find the effect of feeding probiotic cultured whey as a drink on growth performance of 'Vencob' broiler chicks. The whey supplemented with probiotic culture was fed at the level of 10 per cent, 20 per cent and 30 per cent to 'Vencob' broiler chicks through drinking water and one control treatment also conducted simultaneously, not supplemented with probiotic cultured whey to observe the effect of probiotic cultured whey. The different observation on multiple parameters of growth performance i.e. weekly body weight, feed intake, water intake and microbial count to insure the microbial count of whey were evaluated. The data obtained was tabulated and statistically analyzed by using the Completely Randomized Design (CRD) as per the method of Snedecor and Cochran, (1982) and the result obtained were discussed according to objectives of research with appropriate headings as below.

#### 4.1 Chemical composition of experimental broiler ration

#### 4.2 Growth performance of broiler chicks fed on probiotic cultured whey

##### 4.2.1 Cumulative body weight of experimental broiler birds

##### 4.2.2 Gain in body weight of experimental broiler birds

##### 4.2.3 Percent weekly gain in body weight of experimental broiler birds

#### 4.3 Feed intake of broiler birds fed on probiotic cultured whey

#### 4.4 Feed conversion ratio of broiler birds fed on probiotic cultured whey

#### 4.5 Water intake of broiler birds fed on probiotic cultured whey

#### 4.6 Microbial count of probiotic cultured whey added water

##### 4.6.1 Standard plate count of probiotic cultured whey added water

##### 4.6.2 Coliform count of probiotic cultured whey added water

##### 4.6.3 Yeast and Mould count of probiotic cultured whey added water

#### 4.7 Economics of broiler Rearing

#### **4.1 Chemical composition of experimental broiler ration**

The average chemical composition of experimental broiler ration i.e. pre-starter, starter and finisher of company 'Simran' used for feeding of the broiler chicken during experimental period is presented in Table 4.1

From Table 4.1 it was observed that the metabolizable energy contained in pre-starter, starter and finisher ration were 2982.42, 3065.7 and 3198.8 kcal/kg, respectively. Whereas, calorie protein ratio (E:P ratio) content in pre-starter, starter and finisher ration was 127.72:1, 141.66:1 and 158.34:1, respectively. From Table 4.1 it is observed that the chemical composition of pre-starter was 23.34, 3.93, 4.96, 6.2, 1.56 and 61.58 per cent crude protein, crude fiber, ether extract, total ash, acid insoluble ash and nitrogen free extract, respectively. While the starter ration content were 21.65, 3.95, 5.08, 6.3, 1.61 and 63.21 per cent crude protein, crude fiber, ether extract, total ash, acid insoluble ash and nitrogen free extract, respectively. The content of finisher ration were 20.19, 3.99, 5.11, 5.91, 1.63 and 64.75 per cent crude protein, crude fiber, ether extract, total ash, acid insoluble ash and nitrogen free extract, respectively.

**Table 4.1: Per cent chemical composition of experimental broiler ration on dry matter basis**

Sr No	Nutrients	Per cent in ration		
		Pre-starter	Starter	Finisher
1	Crude protein	23.34	21.65	20.19
2	Crude fiber	3.93	3.95	3.99
3	Ether extract	4.96	5.08	5.11
4	Total ash	6.2	6.3	5.91
5	Acid insoluble ash	1.56	1.61	1.63
6	Nitrogen free extract	61.58	63.21	64.75
7	Metabolisable energy	2982.42	3065.65	3198.76
8	E/P ratio	127.72:1	141.66:1	158.34:1

From Table 4.1 it is noticed that the values of experimental broiler ration contained adequate nutrients for growth of broilers and fulfilled the requirement of broiler as per the BIS (1992) with an appropriate calorie : protein ratio (E:P ratio). The component of experimental feed also observed similar to the feed used by Gujjarwar (2018), Parade (2019) and Patil (2020) in their respective research trial which were conducted on broiler and find out the effect of different feed

ingredients namely, ginger powder, lemongrass leaf meal and tulsi leaf powder, respectively.

#### **4.2 Growth performance of Broiler birds fed on probiotic cultured whey**

The experimental broiler were feed with normal diets and all other management kept as normal only the water offered to broiler was mixed with probiotic cultured whey and the observation pertaining to growth were recorded particularly body weight, daily feed consumption and water intake. The data analysis and tabulated according to the objectives and presented in the forth coming tables.

##### **4.2.1 Cumulative body weight of broiler birds fed on probiotic cultured whey**

The data on cumulative body weight of experimental broilers at weekly interval upto sixth week was recorded and subjected to CRD. The results are presented in Table 4.2 and the pattern of cumulative body weight is depicted in Fig 1.

As shown in Table 4.2, the initial body weight of broiler birds of treatments T<sub>0</sub>, T<sub>1</sub>, T<sub>2</sub> and T<sub>3</sub> were 46.82, 46.81, 46.67 and 46.83 g/bird, respectively. The non significance difference were maintained at the time of grouping of birds for treatments and hence all treatments were at par with each other initially. The average cumulative body weight of birds in first week was 158.95 g, 197.37 g, 180.94 g and 164.66 g in treatment of T<sub>0</sub>, T<sub>1</sub>, T<sub>2</sub> and T<sub>3</sub>, respectively. In second week the average cumulative body weight for birds in treatment of T<sub>0</sub>, T<sub>1</sub>, T<sub>2</sub> and T<sub>3</sub>, were 355.71 g, 396.95 g, 363.58 g and 358.76 g, respectively. During third week average cumulative body weight were 710.9 g, 750.5 g, 745.22 g, and 723.5 g for birds in treatment of T<sub>0</sub>, T<sub>1</sub>, T<sub>2</sub> and T<sub>3</sub>, respectively. The average weekly cumulative body weight of birds in fourth week were 1110.02 g, 1309.89 g, 1222.25 g and 1180.05 g for birds in treatment of T<sub>0</sub>, T<sub>1</sub>, T<sub>2</sub> and T<sub>3</sub>, respectively. In fifth week the average cumulative body weight for birds were 1950.01, 2061.33, 1971.88 and 1907.27 g per bird. In Sixth week the average cumulative body weight for birds were 2381.68, 2583.72, 2540 and 2445.01 g per bird in treatment of T<sub>0</sub>, T<sub>1</sub>, T<sub>2</sub> and T<sub>3</sub>, respectively.

The statistical analysis on the weekly body weight of broiler birds in four different treatments during each week revealed non-significant difference during initial, first and second week. But differences observed from third week onwards. At the end sixth week it was seen from Table 4.2 cumulative body weight of birds in treatment T<sub>1</sub> and T<sub>2</sub> was significantly superior ( $P < 0.05$ ) as compared to T<sub>0</sub> control

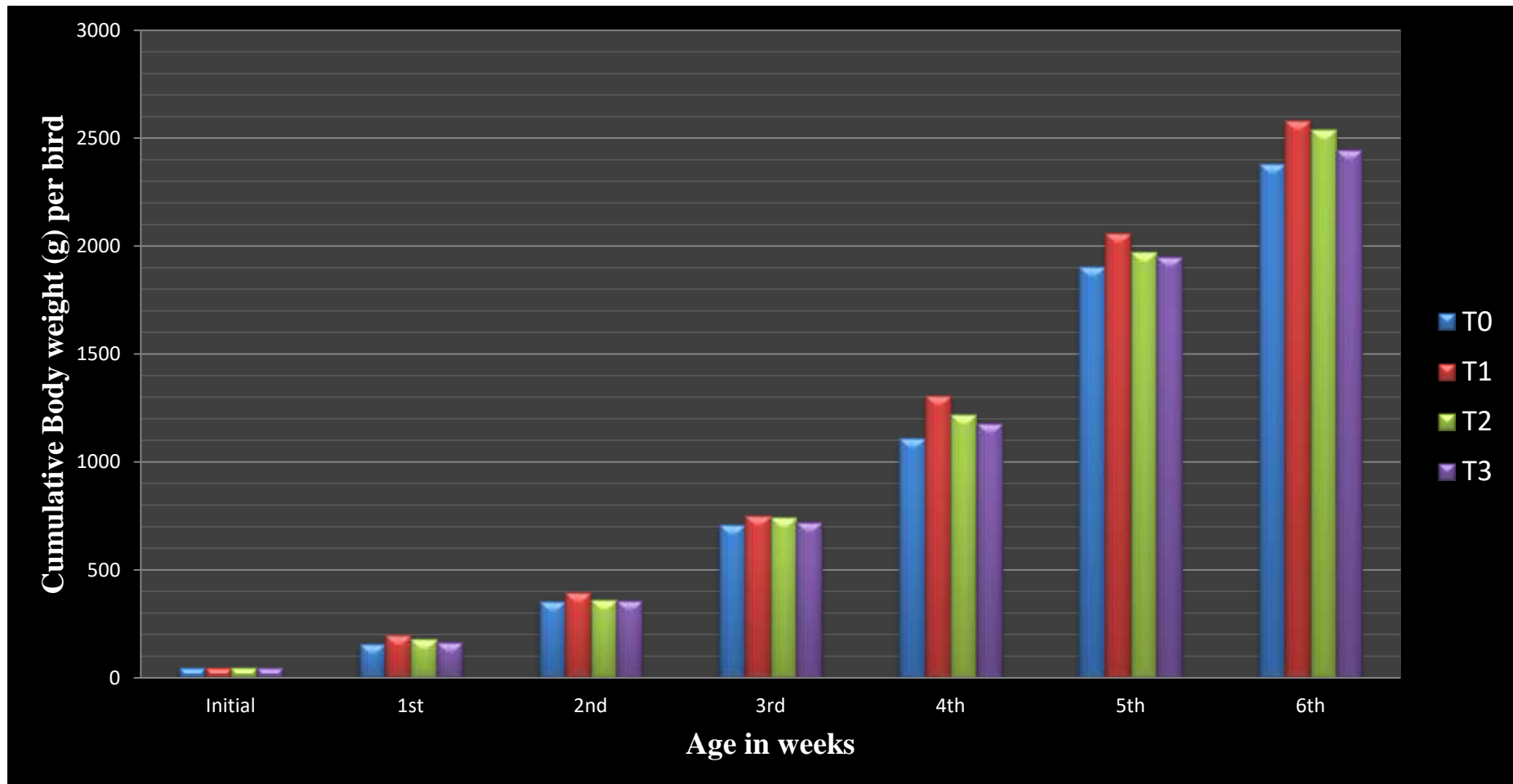
group and T<sub>3</sub> group. The treatment T<sub>0</sub> is control group (2381.68 g) which was significantly lower as compared to all i.e. T<sub>1</sub> (2583.72 g), T<sub>2</sub> (2540 g) and T<sub>3</sub> (2445.01 g). It is clear cut observed from table that the average cumulative body weight gain in other groups of bird fed with probiotic cultured whey was statistically different from control group, indicate that probiotic cultured whey definitely contributed in broiler growth.

**Table 4.2: Average weekly cumulative body weight (g) per bird**

Treatment	Weight of Broiler Birds at Weekend (Weighted days from 1 <sup>st</sup> day)						
	Initial (1 <sup>st</sup> )	1 <sup>st</sup> (8 <sup>th</sup> )	2 <sup>nd</sup> (15 <sup>th</sup> )	3 <sup>rd</sup> (22 <sup>th</sup> )	4 <sup>th</sup> (29 <sup>th</sup> )	5 <sup>th</sup> (36 <sup>th</sup> )	6 <sup>th</sup> (43 <sup>th</sup> )
T <sub>0</sub>	46.82	158.95	355.71	710.9 <sup>a</sup>	1110.02 <sup>a</sup>	1907.27 <sup>a</sup>	2381.68 <sup>a</sup>
T <sub>1</sub>	46.81	197.37	396.95	750.5 <sup>b</sup>	1309.89 <sup>b</sup>	2061.33 <sup>b</sup>	2583.72 <sup>b</sup>
T <sub>2</sub>	46.67	180.94	363.58	745.22 <sup>bc</sup>	1222.25 <sup>bc</sup>	1971.88 <sup>bc</sup>	2540.00 <sup>b</sup>
T <sub>3</sub>	46.83	164.66	358.76	723.5 <sup>c</sup>	1180.05 <sup>bc</sup>	1950.01 <sup>c</sup>	2445.01 <sup>c</sup>
SE±	0.08	9.53	10.67	7.36	21.29	10.86	19.31
CD at 5%	NS	NS	NS	22.69	65.62	33.48	59.50
GM	46.78	175.48	368.75	732.53	1205.55	1972.62	2487.59

(Means connected with similar superscript do not differ significantly from each other)

The experimental groups, fed with whey drinks was observed for weekly body weight gain maximum time at par, except T<sub>3</sub> in 5<sup>th</sup> week. It is observed from Table no. 4.2 that highest cumulative body weight was obtained in T<sub>1</sub> treatment of broilers by feeding of 10 per cent probiotic cultured whey which was 2583.72 g per bird. Followed by T<sub>2</sub> treatment of broiler by feeding of 20 per cent probiotic cultured whey which was 2540 g per bird followed by T<sub>3</sub> treatment of broilers by feeding of 30 per cent probiotic cultured whey which was 2445.01 and lowest cumulative body weight was in control (T<sub>0</sub>) group which was 2381.68 g per bird at the end of sixth week. But when the final weight of each treatment were compared it was noticed that T<sub>1</sub> treatment had maximum weight (2583.72 g), indicate that 10 per cent probiotic whey was optimum for encouraging weight gain in broiler as compared to 20 and 30



**Fig 4.1: Average weekly cumulative body weight (g) per bird**

per cent. This may be due to the extra dose of probiotic whey in case of treatments T<sub>2</sub> and T<sub>3</sub> fed with 20 and 30 per cent probiotic whey.

This result is similar to Ivankovic *et al.* (1999) who reported that the body weight of broiler group without probiotic in drinking water was 1956 g and group with probiotic added in drinking water had higher average live weight than chickens from group without probiotic in drinking water. And also supported by Apata, (2018) who confirmed that dietary supplementation with *Lactobacillus* cultures improved the performance of chickens; Toghyani *et al.* (2011), who observed the body weight of broiler feeding with antibiotic, probiotic and without any additive which was 2091.03 g, 2138.30 g and 2110.18 g. This showed that the diet supplemented with probiotic and prebiotic increased body weight at 42 days of age compared to control chicks and antibiotic group.

The result of present study is also similar with Hrncar *et al.* (2014), who reported body weight of broiler chickens for control group was 2070.65 ± 180 g, *Lactobacillus fermentum* was 2294.59±196.34g and *Enterococcus faecium* was 2263.16 ± 188.67 g. That is addition of *L. fermentum* and *Enterococcus faecium* in drinking water statically significantly increased as compared to control.

Togyani *et al.* (2015) who reported the body weight of broiler supplemented with milk kefir had higher body weight compared with control, supplemented with probiotic or molasses kefir.

Fallah, (2016), who reported body weight of broiler of control group was 2240 ± 126.83 g, group of broilers fed with protexin had 2340 ± 125.85 g and fed with dried whey powder with protexin had 2370 ± 18.25 g. Body weight of broiler fed with dried whey powder and protexin had increased body weight compared to control group.

Borghain *et al.* (2017), who reported the final body weight of birds fed with garlic powder as prebiotic was significantly higher as compared to other group.

But Sarangi *et al.* (2016), found different finding than present that the day old vencobb broilers with diets supplemented with probiotics and prebiotics. The body weight of broilers was lower in treatment group supplemented with probiotics and prebiotics than those fed control diets. It might be due to the other factors i.e.

selection of pre and probiotic materials, environmental effect and management of birds.

#### 4.2.2 Gain in body weight of broiler birds fed on Probiotic Cultured Whey

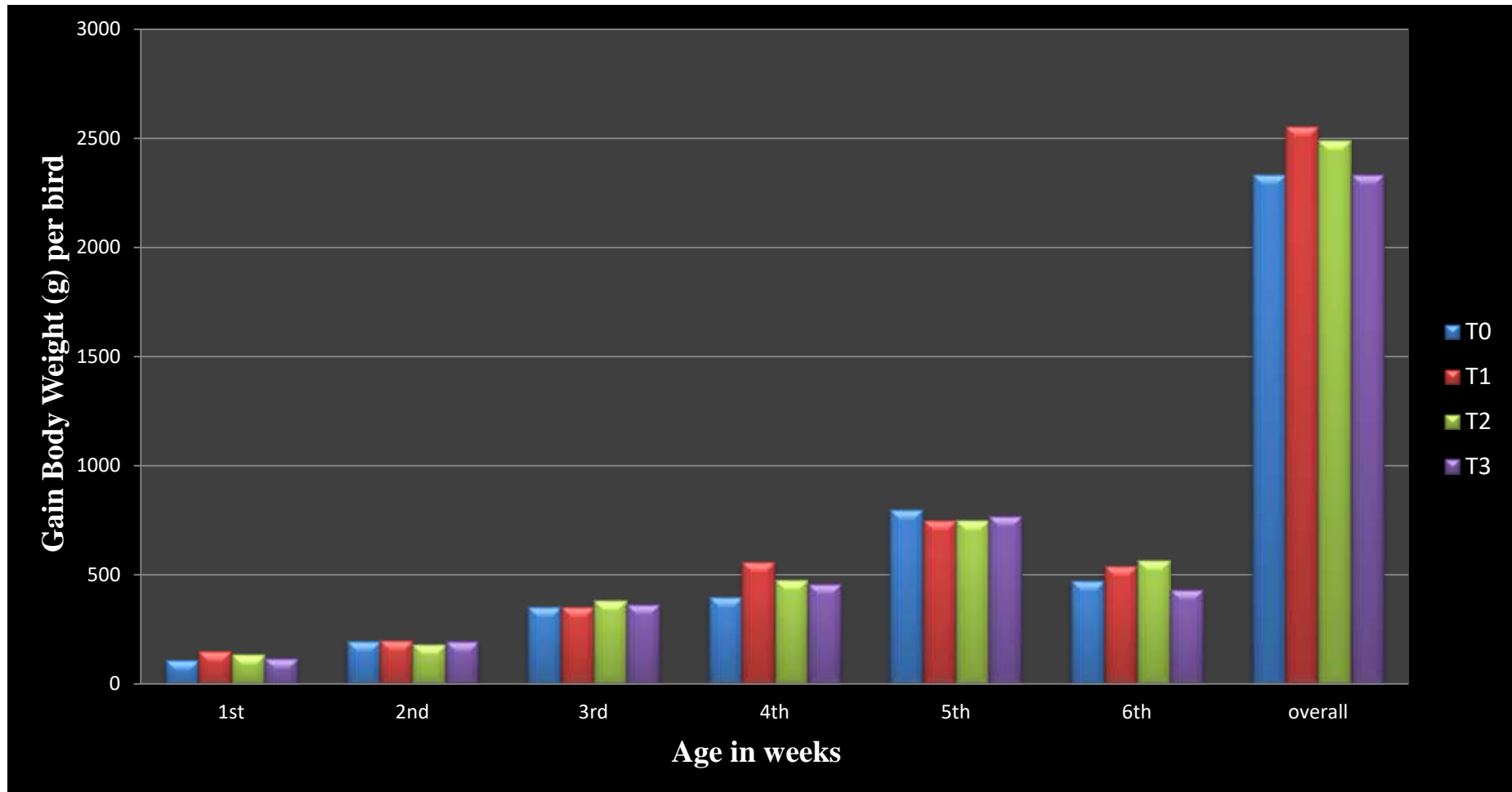
The data on gain in body weight of broiler birds of weekly interval upto sixth week was recorded and subjected to CRD and the results are presented in Table 4.3 and pattern of weight gain is depicted in Fig.2.

**Table 4.3: Average weekly gain in body weight of experimental broiler birds**

Treatment	Weight of Broiler Birds at Weekend (Weighted days from 1 <sup>st</sup> day)						
	1 <sup>st</sup> (8 <sup>th</sup> )	2 <sup>nd</sup> (15 <sup>th</sup> )	3 <sup>rd</sup> (22 <sup>th</sup> )	4 <sup>th</sup> (29 <sup>th</sup> )	5 <sup>th</sup> (36 <sup>th</sup> )	6 <sup>th</sup> (43 <sup>th</sup> )	Total
T <sub>0</sub>	112.13	196.76	355.19	399.13 <sup>a</sup>	797.25	474.41 <sup>a</sup>	2334.86 <sup>a</sup>
T <sub>1</sub>	150.56	199.58	353.55	559.38 <sup>b</sup>	751.38	542.26 <sup>ab</sup>	2556.51 <sup>b</sup>
T <sub>2</sub>	134.27	182.64	381.64	477.03 <sup>bc</sup>	749.63	568.13 <sup>b</sup>	2493.34 <sup>b</sup>
T <sub>3</sub>	117.83	194.10	364.74	456.55 <sup>ac</sup>	769.96	431.67 <sup>ac</sup>	2334.85 <sup>ac</sup>
SE±	9.55	12.22	13.01	22.78	22.57	29.79	28.89
CD at 5%	NS	NS	NS	70.20	NS	91.70	89.01
GM	128.698	193.27	363.78	473.02	767.05	504.11	2429.89

(Means connected with similar superscript do not differ significantly from each other)

It is observed from Table 4.3 that the average weekly gain in body weight fed with probiotic cultured whey in first week were 112.13, 150.56, 134.27 and 117.83 g/bird for birds in treatment group T<sub>0</sub>, T<sub>1</sub>, T<sub>2</sub> and T<sub>3</sub>, respectively. In second week weekly gain in body weight of group of birds in treatment T<sub>0</sub>, T<sub>1</sub>, T<sub>2</sub> and T<sub>3</sub> were 196.76, 199.58, 182.64 and 194.10 g per bird, respectively. In third week average weekly gain in body weight were 355.19, 353.55, 381.64 and 364.74 g per bird in treatment of T<sub>0</sub>, T<sub>1</sub>, T<sub>2</sub> and T<sub>3</sub>, respectively. During fourth week average gain in body weight 399.13, 559.38, 477.03, 456.55 g per bird in treatment T<sub>0</sub>, T<sub>1</sub>, T<sub>2</sub> and



**Fig 4.2: Average weekly gain in body weight (g) per bird**

T<sub>3</sub>, respectively. The corresponding values of average weekly gain in body weight of broiler birds were 797.25, 751.38, and 749.63, 769.96 g per bird in treatments T<sub>0</sub>, T<sub>1</sub>, T<sub>2</sub> and T<sub>3</sub>, respectively in fifth week. During sixth week the average weekly gain body weight of broiler birds were 474.41, 542.26, 568.13, 431.67 g per bird in treatments T<sub>0</sub>, T<sub>1</sub>, T<sub>2</sub> and T<sub>3</sub>, respectively. The total average weekly gain body weight were 2334.86, 2556.51, 2493.34 and 2334.85 g per bird in treatment T<sub>0</sub>, T<sub>1</sub>, T<sub>2</sub> and T<sub>3</sub> respectively. As regards to impact of age the weekly trend in weight gain was almost similar as observed in cumulative body weight. The lowest value of average weekly weight gain was  $112.13 \pm 29.44$  g in first week and highest in sixth week that was  $568.13 \pm 29.79$  g.

The Table 4.3 shows that highest gain in body weight of broilers obtained in T<sub>1</sub> group which was 2556.51 g per bird receiving 10 per cent probiotic cultured whey followed by 2493.34 g/bird with 20 per cent probiotic cultured whey (T<sub>2</sub>), 2334.85 g/bird with 30 per cent probiotic cultured whey (T<sub>3</sub>) and lowest body weight gain was 2334.86 g per bird in control group (T<sub>0</sub>) at the end of sixth weeks.

The statistical analysis on the weekly body weight gain of broiler birds in four different treatments during each week revealed non-significant except fourth and sixth week. At the end sixth week it was seen from Table 4.3 that the total gain in body weight of birds in treatment T<sub>1</sub> and T<sub>2</sub> was significantly superior ( $P < 0.05$ ) as compared to T<sub>0</sub> control group and T<sub>3</sub> group. The treatment T<sub>0</sub> is control group which was significantly lower as compared to all i.e. T<sub>1</sub> (2556.51 g) and T<sub>2</sub> (2493.34 g).

This result is similar with Jin *et al.* (1998) who reported that higher and improved weight gain was in probiotic group and this could be due to better digestive or microbial enzymatic activity.

Panda *et al.* (2005) observed that there was significantly higher body weight gain in probiotics supplemented broilers (1508.09 g) compared to control broiler (1398.09 g) during overall experimental period.

Anjum *et al.* (2005) reported improved body weight gain in probiotic supplemented group than control group.

Aftahi *et al.* (2006) who reported body weight gain was found to be significantly higher in broilers administrated with probiotic than control group.

Sultan *et al.* (2006), who reported weight gain at broilers fed with 1 g/l protexin in water was 592.5 g and yoghurt 5 m/l of water was 633.8 g and fed without any additive was 610 g. The result showed weight gain was significantly higher for group fed with yoghurt as probiotic.

Ashayerizadeh *et al.* (2009), who reported that birds fed with Primalac (probiotic) and Biolex-MB (prebiotic) had increased body weight gain.

Kaushal *et al.* (2019), who reported the better body weight gain of probiotic groups compared with control group.

But contradict results were obtained by Hossain (2004), who fed diet supplemented with yoghurt and protexin boost found no significant effect of probiotic on live weight gain of broiler, might be due to sex effect, weather condition, infection diseases etc.

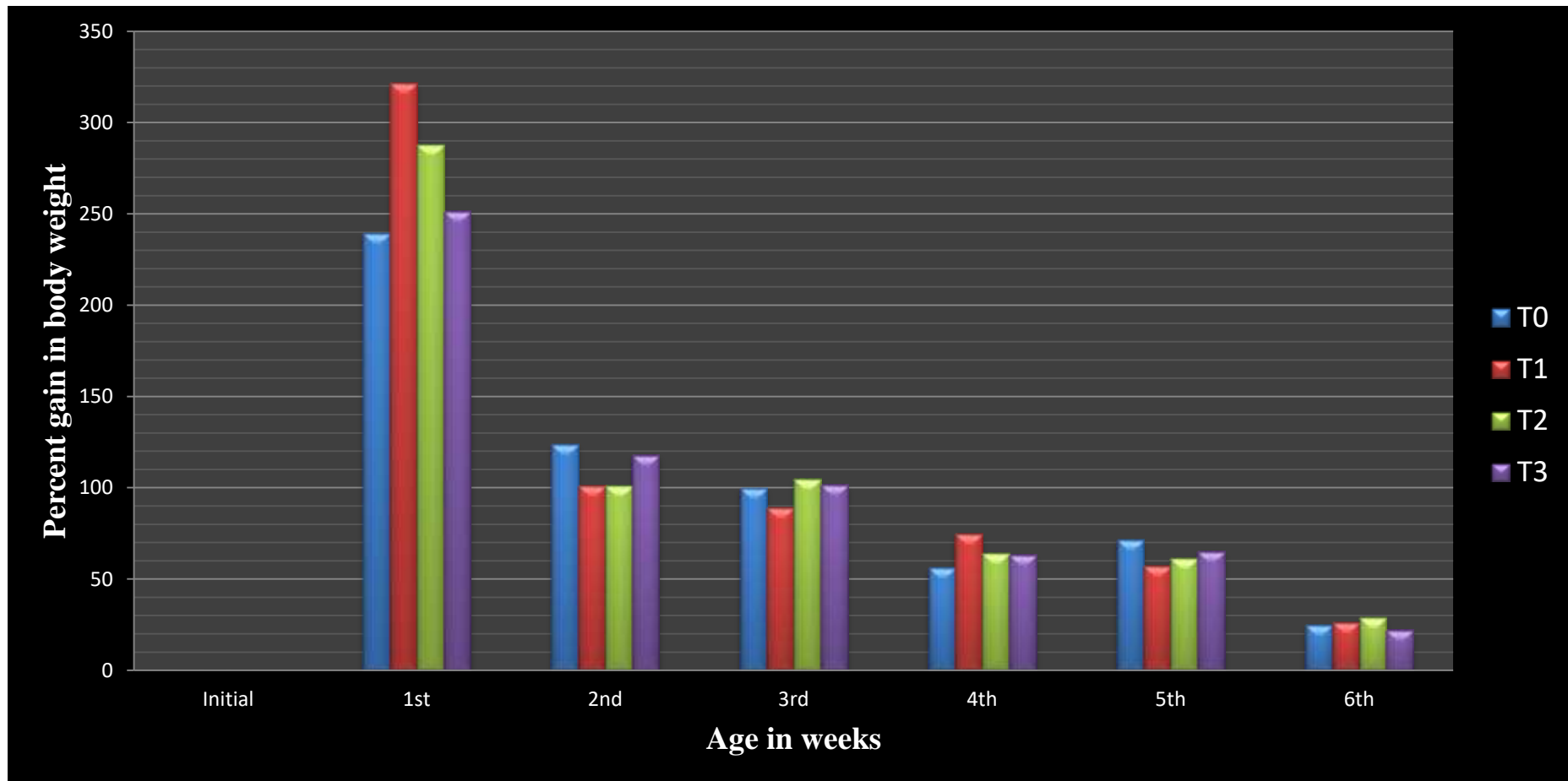
#### 4.2.3 Percent weekly gain in body weight

The percent of weekly gain in body weight of broiler birds at weekly interval upto six weeks were calculated and results are presented Table 4.4 and pattern of percent weekly gain in body weight is depicted in Fig. 3.

**Table 4.4: Percent weekly gain in body weight**

Treatment	Percent gain in body weight at the weekend						
	Initial (1 <sup>st</sup> )	1 <sup>st</sup> (8 <sup>th</sup> )	2 <sup>nd</sup> (15 <sup>th</sup> )	3 <sup>rd</sup> (22 <sup>th</sup> )	4 <sup>th</sup> (29 <sup>th</sup> )	5 <sup>th</sup> (36 <sup>th</sup> )	6 <sup>th</sup> (43 <sup>th</sup> )
T <sub>0</sub>	0.00	239.49	123.79	99.85	56.14	71.82	24.87
T <sub>1</sub>	0.00	321.64	101.12	89.07	74.53	57.36	26.31
T <sub>2</sub>	0.00	287.70	100.94	104.96	64.01	61.33	28.81
T <sub>3</sub>	0.00	251.61	117.88	101.67	63.10	65.25	22.14

From Table 4.4 it was observed that the percent gain in body weight of first week was found more i.e. 239.49 per cent, 321.64 per cent, 287.70 per cent and 251.61 per cent for treatment T<sub>0</sub> (control group), T<sub>1</sub> (fed with 10 per cent probiotic cultured whey), T<sub>2</sub> (fed with 20 per cent probiotic cultured whey), T<sub>3</sub> (fed with 30 per cent probiotic cultured whey) and then continually decreased in successive week. In



**Fig 4.3: Percent weekly gain in body weight**

second week the per cent gain in body weight was 123.79 per cent, 101.12 per cent, 100.94 per cent and 117.88 per cent for treatment T<sub>0</sub>, T<sub>1</sub>, T<sub>2</sub> and T<sub>3</sub>, respectively. In third week the per cent gain in body weight was 99.85 per cent, 89.07 per cent, 104.96 per cent and 101.67 per cent for treatment T<sub>0</sub>, T<sub>1</sub>, T<sub>2</sub> and T<sub>3</sub>, respectively. Fourth week the per cent gain in body weight was 56.14 per cent, 74.53 per cent, 64.01 per cent and 63.10 per cent for treatment T<sub>0</sub>, T<sub>1</sub>, T<sub>2</sub> and T<sub>3</sub>, respectively. The corresponding values of in Fifth week the per cent gain in body weight were 71.82 per cent, 57.36 per cent, 61.33 per cent and 65.25 per cent for treatment T<sub>0</sub>, T<sub>1</sub>, T<sub>2</sub> and T<sub>3</sub>, respectively. In sixth week the per cent gain in body weight were 24.87 per cent, 26.31 per cent, 28.81 per cent and 22.14 per cent for treatment T<sub>0</sub>, T<sub>1</sub>, T<sub>2</sub> and T<sub>3</sub>, respectively. The highest per cent of gain was in first week and lowest in sixth week. From third week significant decreased in per cent gain in body weight was observed. This might be the effect of age observed in all livings and classified as weight growing age, weight stationary age and weight declined age.

The result of present study is supported by, Ashayerizadeh *et al.* (2009), who reported that birds fed with Primalac (probiotic) and Biolex-MB (prebiotic) had increased body weight gain by 7.4 per cent compared to control diet.

Abdel-hafeez *et al.* (2017) who showed that the effect of probiotic additives on body weight started at fifth week with increase of 10 per cent compared with control group.

#### **4.3 Average weekly feed consumption of broiler fed on probiotic cultured whey**

The data on feed consumption of broiler birds at weekly interval up to sixth week was recorded and subjected to CRD. The results are presented in Table 4.5 and pattern of feed consumption is depicted in Fig. 4.

It is observed from Table no. 4.5 that average weekly feed consumption of broiler birds in first week were 137.16, 153.53, 156.55 and 151.18 g per bird in treatment T<sub>0</sub>, T<sub>1</sub>, T<sub>2</sub> and T<sub>3</sub> respectively. The average weekly feed consumption of broiler birds in second week were 274.88, 308.63, 290.3 and 322.54 g per bird in treatment T<sub>0</sub>, T<sub>1</sub>, T<sub>2</sub> and T<sub>3</sub>, respectively. The average weekly feed consumption of broiler birds in third week were 605.6, 643.2, 618.05 and 648 g per bird in treatment T<sub>0</sub>, T<sub>1</sub>, T<sub>2</sub> and T<sub>3</sub>, respectively. Corresponding value of average

weekly feed consumption were 998.7, 947.25, 935.53 and 1088.50 g per bird in fourth week, in treatment T<sub>0</sub>, T<sub>1</sub>, T<sub>2</sub> and T<sub>3</sub>, respectively. In fifth week average weekly feed consumption were 1099, 1132.25, 1125.53, 1239.24 g per bird in treatment T<sub>0</sub>, T<sub>1</sub>, T<sub>2</sub> and T<sub>3</sub>, respectively. And average weekly feed consumption in treatment T<sub>0</sub>, T<sub>1</sub>, T<sub>2</sub> and T<sub>3</sub> were 1117.5, 1181.13, 1134.21 and 1191.2 g per bird, respectively at the end of sixth week. The total average feed consumption per bird for treatment T<sub>0</sub>, T<sub>1</sub>, T<sub>2</sub> and T<sub>3</sub> were 4332.76, 4466.92, 4360.1 and 4741.36 g per bird, respectively.

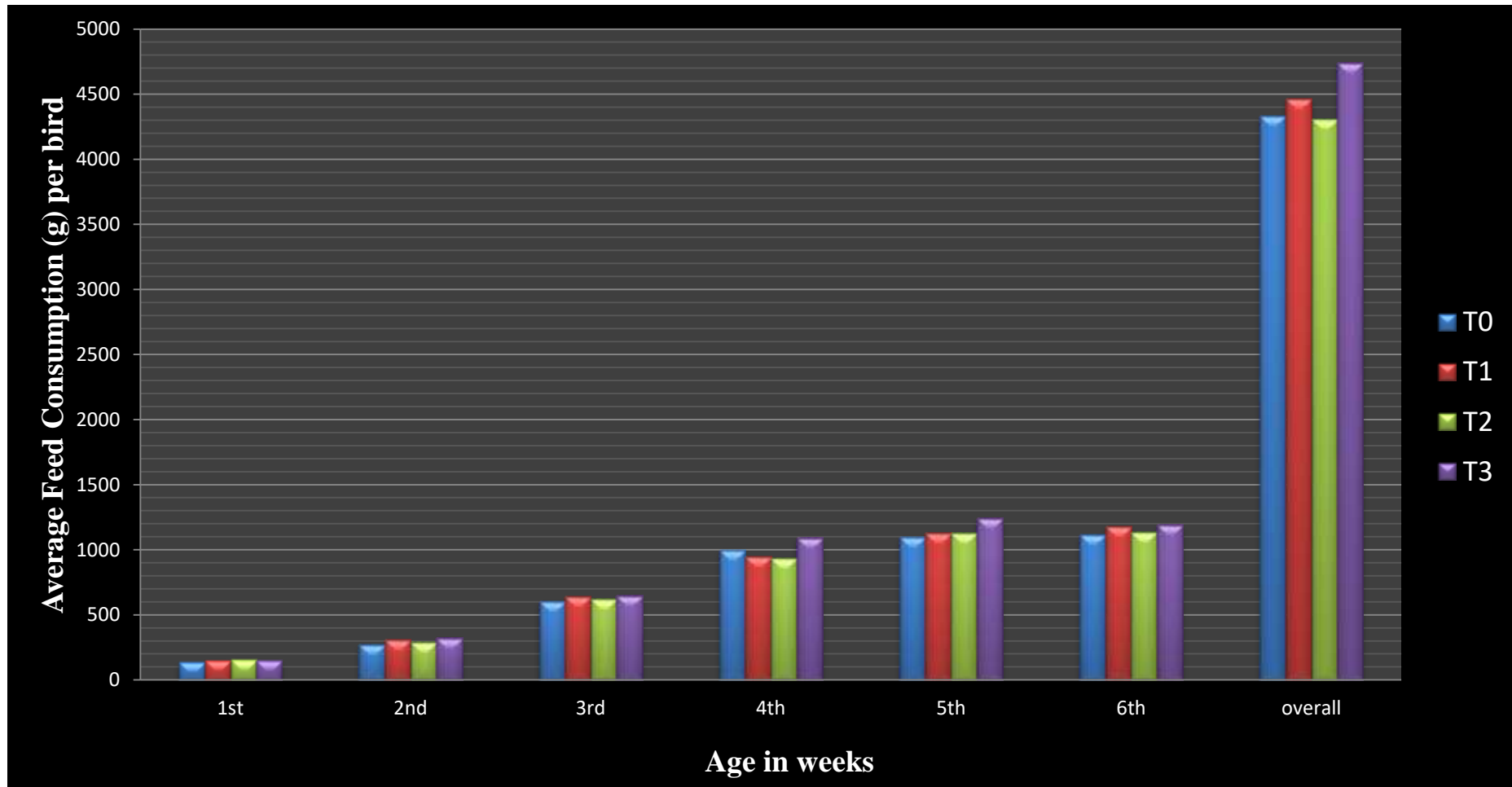
**Table 4.5: Average weekly feed consumption (g) per bird**

Treatment	Feed consumption at Weekend (Weighted days from 1 <sup>st</sup> day)						
	1 <sup>st</sup> (8 <sup>th</sup> )	2 <sup>nd</sup> (15 <sup>th</sup> )	3 <sup>rd</sup> (22 <sup>th</sup> )	4 <sup>th</sup> (29 <sup>th</sup> )	5 <sup>th</sup> (36 <sup>th</sup> )	6 <sup>th</sup> (43 <sup>th</sup> )	Total
T <sub>0</sub>	137.16	274.88	605.6	998.7 <sup>a</sup>	1099.00 <sup>a</sup>	1117.5	4332.76 <sup>a</sup>
T <sub>1</sub>	153.53	308.63	643.2	947.25 <sup>b</sup>	1132.25 <sup>b</sup>	1181.13	4466.92 <sup>a</sup>
T <sub>2</sub>	156.55	290.3	618.05	935.53 <sup>b</sup>	1125.53 <sup>b</sup>	1134.21	4306.1 <sup>a</sup>
T <sub>3</sub>	151.18	322.54	648	1088.50 <sup>c</sup>	1239.24 <sup>c</sup>	1191.2	4741.36 <sup>b</sup>
SE±	NS	NS	NS	37.02	12.42	NS	63.41
CD at 5%	13.50	62.01	10.90	37.02	12.42	83.51	195.37
GM	149.78	299.08	628.71	992.49	1149	54.115	4475.29

(Means connected with similar superscript do not differ significantly from each other)

From Table 4.5 it is observed that lowest total feed consumption of 4332.76 g was observed in T<sub>0</sub> group of broiler which were not supplemented with probiotic cultured whey. Whereas the highest feed consumption of 4741.36 g was observed in T<sub>3</sub> group of broilers receiving 30 per cent probiotic cultured whey, followed by 4466.92 g in T<sub>1</sub> and 4360.36 g in T<sub>2</sub> at the end of sixth week.

It was concluded from Table 4.5 that there were no significant differences among all the treatment groups except fourth and fifth week. At the end of experiment the total feed consumed by different treatment groups of broilers was seen from table 4.5 that T<sub>3</sub> was significantly higher (4741.36g) as compared to T<sub>0</sub> control (4331.76 g), T<sub>1</sub> (4466.92 g) and T<sub>2</sub> (4360.19 g) groups. It is noticed from Table 4.5 that feed intake was increased in broiler groups fed with probiotic cultured whey as



**Fig 4.4: Average weekly feed consumption (g) per bird**

compared to control group. It is also observed here that in treatment T<sub>1</sub> less feed intake was observed than T<sub>3</sub> but more body weight gain than it, indicate that the optimum combination of probiotic whey culture and water observed in treatment T<sub>1</sub> as compared to other treatments. . It may be concluded that the increased dose of probiotic may increase the total feed consumption due to increase digestibility but the nutrient may not utilized for the body weight gain which is ultimately required in broiler production.

The result of present study was similar with Kermanshahi and Rostami (2006), who reported that broilers fed with 2 per cent whey in diet, had higher feed intake and body weight gain than the control group.

Aftahi *et al.* (2006), who reported the feed consumption of broiler fed with 3 g, 4 g, 5 g yoghurt per litre of drinking water and 1 g protexin boost per 10 litre of drinking water was 2253 g, 2265 g, 2239.33 g, 2316.16 g and 2320.66 g from 1 to 35 days of age. That is group fed with 1g protexin boost per 10 litre of drinking water and 5 g yoghurt per litre drinking water consumed highest amount of feed than other.

This result is also supported by Gao *et al.* (2009) showed that the result at feeding *Bacillus substillis* containing probiotics and *Lactobacillus* containing probiotics increase feed intake which is similar to current study.

Patel *et al.* (2015), who observed the feed intake of control was 3140.91 ± 29.97 g/bird, fed with 50 g/ton probiotic in feed was 3134.76 ± 15.244 g/bird and fed with 100 g/ton probiotic in feed was 3165.42 ± 23.12 g/bird. Result showed that there is non-significant effect of probiotics supplementation on feed intake.

Fallah, (2016), who reported that the treatment with adding dried whey powder + protexin had highest feed intake (4380 g) and lowest feed intake was observed in control groups (4220 g).

Bai *et al.* (2017) also found similar finding that is experiment conducted with *Bacillus substillis* containing probiotics for a period of 42 days and observed increased feed intake.

Borgohain *et al.* (2017) who reported that supplementation of garlic powder as prebiotic at different level improved feed intake as compared to control group.

Kalia *et al.* (2017), who reported the effect of probiotic on feed intake of vencobb, RIR cross breed and hubbard which was  $1003.45 \pm 6.90$  g/bird,  $1037.34 \pm 6.43$  g/bird and  $1091.33 \pm 6.13$  g/bird, respectively from 7 to 35 days of age which showed that the feed intake was higher in hubbard strain.

But contradict results were obtained by Shoeib *et al.* (1997) who reported low feed intake in the chicks fed on probiotic as compared to control group, but FCR may be positive in this case.

#### 4.4 Feed Conversion Ratio of broiler birds fed on Probiotic Cultured Whey

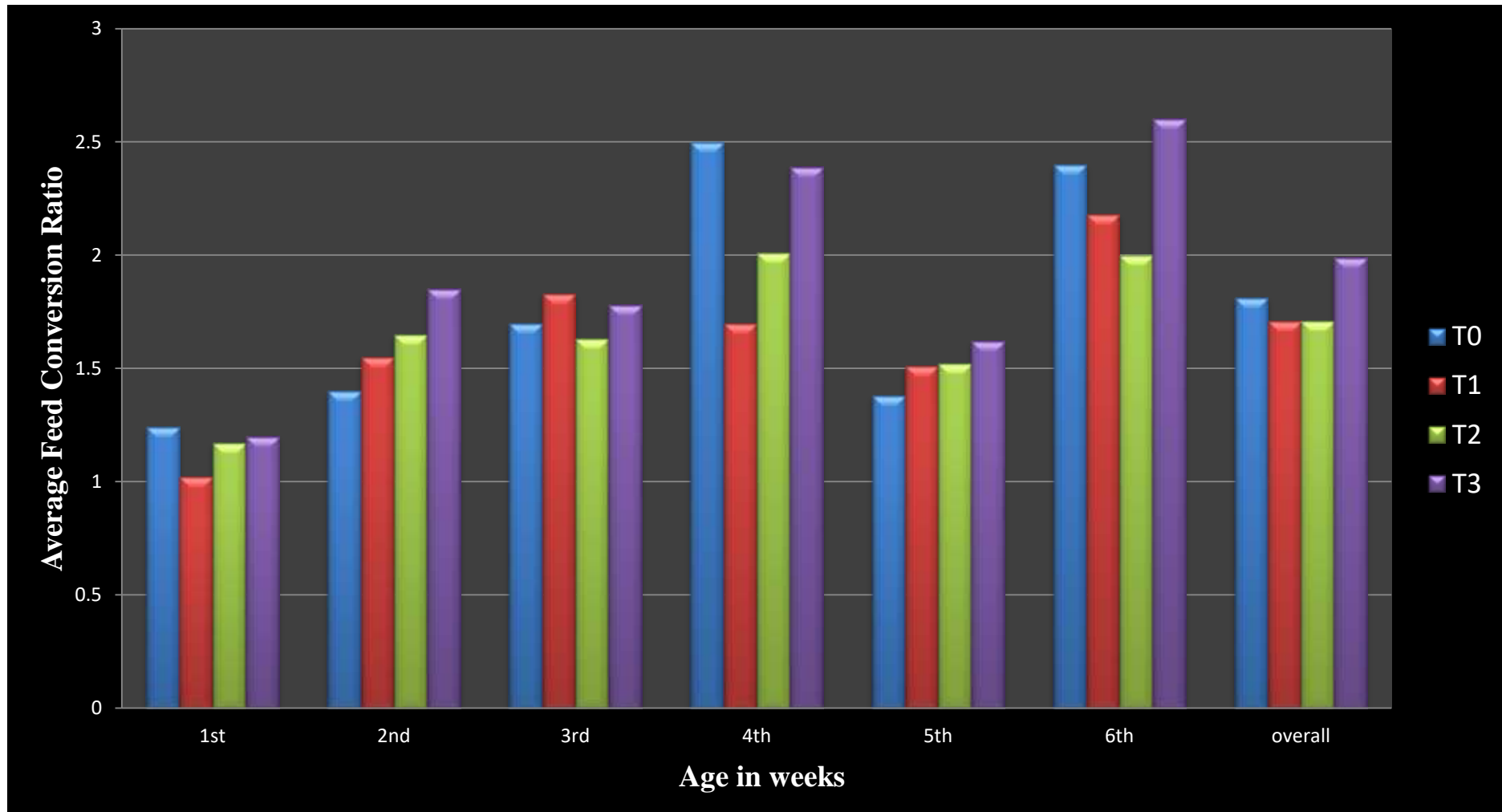
The data on weekly feed conversion ratio of broiler birds at weekly interval up to six weeks were recorded and subjected to CRD. The results are presented in Table 4.6 and pattern of feed conversion ratio was depicted in Fig.5.

**Table 4.6: Average weekly feed conversion ratio of experimental birds**

Treatment	Feed conversion of broiler birds at Weekend (Weighted from 1 <sup>st</sup> day)						
	1 <sup>st</sup> (8 <sup>th</sup> )	2 <sup>nd</sup> (15 <sup>th</sup> )	3 <sup>rd</sup> (22 <sup>th</sup> )	4 <sup>th</sup> (29 <sup>th</sup> )	5 <sup>th</sup> (36 <sup>th</sup> )	6 <sup>th</sup> (43 <sup>th</sup> )	Overall
T <sub>0</sub>	1.24	1.40	1.7	2.5 <sup>a</sup>	1.38	2.40	1.81 <sup>a</sup>
T <sub>1</sub>	1.02	1.55	1.83	1.7 <sup>b</sup>	1.51	2.18	1.71 <sup>b</sup>
T <sub>2</sub>	1.17	1.65	1.63	2.01 <sup>bc</sup>	1.52	2.0	1.71 <sup>b</sup>
T <sub>3</sub>	1.20	1.85	1.78	2.39 <sup>ac</sup>	1.62	2.60	1.99 <sup>c</sup>
SE±	0.2	0.15	0.06	0.13	0.051	0.14	0.03
CD at 5%	NS	NS	NS	0.4	NS	NS	0.095
GM	1.157	1.61	1.74	2.15	1.50	2.29	1.8805

(Means connected with similar superscript do not differ significantly from each other)

Table 4.6 described the average feed conservation ratio of the broiler birds under treatment T<sub>0</sub>, T<sub>1</sub>, T<sub>2</sub> and T<sub>3</sub> was 1.24, 1.02, 1.17, 1.20 in first week, respectively. The feed conversion ratio of broiler birds in second week were 1.40, 1.55, 1.65 and 1.85 in treatment T<sub>0</sub>, T<sub>1</sub>, T<sub>2</sub> and T<sub>3</sub>, respectively. The feed conversion ratio in third week were 1.7, 1.83, 1.63 and 1.78 in treatment T<sub>0</sub>, T<sub>1</sub>, T<sub>2</sub> and T<sub>3</sub>, respectively. The feed conversion ratio of broiler birds in fourth week were 2.5, 1.7,



**Fig 4.5: Average weekly feed conversion ratio of experimental birds**

2.01 and 2.39 in treatment T<sub>0</sub>, T<sub>1</sub>, T<sub>2</sub> and T<sub>3</sub>, respectively. In fifth week, feed conversion ratio for T<sub>0</sub>, T<sub>1</sub>, T<sub>2</sub> and T<sub>3</sub> were 1.38, 1.51, 1.52 and 1.62, respectively. During sixth week the feed conversion ratio of broiler birds were 2.4, 2.18, 2 and 2.6. The overall feed conversion ratio during first to sixth week were 1.81, 1.71, 1.71 and 1.99 in treatments T<sub>0</sub>, T<sub>1</sub>, T<sub>2</sub> and T<sub>3</sub>, respectively.

It is observed from Table 4.6 that average feed conversion ratio from first to sixth week ranged from 1.99 to 1.71, which was significantly higher in T<sub>3</sub> (1.99) as compared to T<sub>0</sub> (1.81), T<sub>1</sub> (1.71) and T<sub>2</sub> (1.71) group.

It was concluded from Table 4.6 that the best feed conversion ratio of 1.71 obtained in T<sub>1</sub> and T<sub>2</sub> group of broilers receiving 10 and 20 per cent of probiotic cultured whey followed by control group (T<sub>0</sub>) which was 1.81 and poor in T<sub>3</sub> group which was 1.99 during the entire period of experiment. It means that 10 per cent and 20 per cent probiotic cultured whey fed group had better feed conversion ratio in broilers birds. It is seen from Table 4.6 that there were no significant difference among the treatment group in all weeks except fourth week. It is seen that best feed conversion ratio in T<sub>1</sub> (1.71) and T<sub>2</sub> (1.71) was lower as compared to T<sub>0</sub> control (1.81) and T<sub>3</sub> (1.99) help to describe the importance of probiotic cultured whey in poultry feed and its proportion in it.

The result of present study is similar with Borgohain *et al.* (2017), who reported that the feed conversion ratio was affected significantly in broiler fed with garlic as prebiotic Ghafouri *et al.* (2013), who reported the effect of whey levels in water on broilers performance, and results of this study showed lowest feed conversion ratio to the treatment with 10 per cent whey, but Shivani *et al.* (2000), who reported the non-significant result of FCR in all groups and Fallah, (2016), also reported that there was no significant differences in FCR among control and other treatment. Variation in FCR of above workers may be due to the different experimental condition and environmental condition.

#### **4.5 Water intake of broiler birds fed on Probiotic Cultured Whey**

The data on water intake of experimental broilers at weekly interval upto sixth week was reported and subjected to CRD. The results are presented in Table 4.7 and pattern of water intake was depicted in Fig.6.

Table 4.7 describe the average weekly water intake in ml of broiler birds. Average weekly water intake in first week was 184.88, 182.38, 185.62 and 185.38 ml per bird in treatment T<sub>0</sub>, T<sub>1</sub>, T<sub>2</sub> and T<sub>3</sub>, respectively. Average weekly water intake in second week was 425, 420.13, 393 and 378.66 ml per bird for treatment T<sub>0</sub>, T<sub>1</sub>, T<sub>2</sub> and T<sub>3</sub>, respectively. In third week average weekly water intake were 937.47, 924.41, 899.5 and 857.5 ml per bird in treatment T<sub>0</sub>, T<sub>1</sub>, T<sub>2</sub> and T<sub>3</sub>, respectively. In fourth week average weekly water intake were 1156, 1139.13, 1083.78 and 1056.75 ml for treatment T<sub>0</sub>, T<sub>1</sub>, T<sub>2</sub> and T<sub>3</sub>, respectively. The corresponding value of average weekly water intake of broiler birds in fifth week as 1823.88, 1756.62, 1713.75 and 1649.13 ml per bird in treatment T<sub>0</sub>, T<sub>1</sub>, T<sub>2</sub> and T<sub>3</sub>, respectively. In sixth week the average weekly water intake in ml of broiler birds as 2444.13, 2378, 2310.38 and 2184.13 ml per bird in treatment T<sub>0</sub>, T<sub>1</sub>, T<sub>2</sub> and T<sub>3</sub>, respectively.

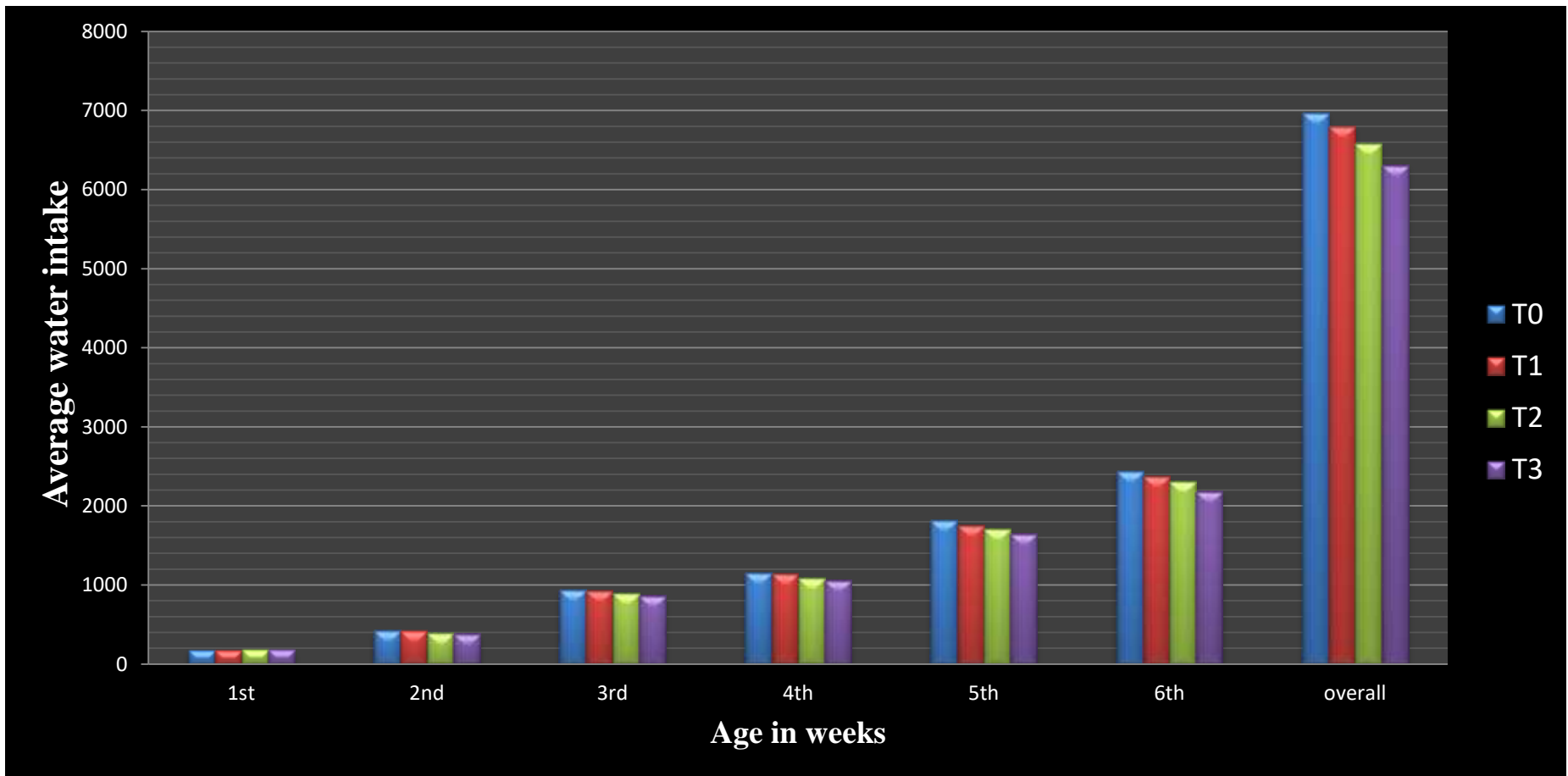
**Table 4.7: Average weekly water intake (ml) of experimental birds**

Treatment	Water intake at Weekend (Weighted days from 1 <sup>st</sup> day)						
	1 <sup>st</sup> (8 <sup>th</sup> )	2 <sup>nd</sup> (15 <sup>th</sup> )	3 <sup>rd</sup> (22 <sup>th</sup> )	4 <sup>th</sup> (29 <sup>th</sup> )	5 <sup>th</sup> (36 <sup>th</sup> )	6 <sup>th</sup> (43 <sup>th</sup> )	Overall
T <sub>0</sub>	184.88	425.00	937.47	1156.00 <sup>a</sup>	1823.88 <sup>a</sup>	2444.13 <sup>a</sup>	6971.25 <sup>a</sup>
T <sub>1</sub>	182.38	420.13	924.41	1139.13 <sup>b</sup>	1756.62 <sup>b</sup>	2378.00 <sup>b</sup>	6800.62 <sup>b</sup>
T <sub>2</sub>	185.62	393.00	899.50	1083.78 <sup>c</sup>	1713.75 <sup>c</sup>	2310.38 <sup>c</sup>	6586.02 <sup>c</sup>
T <sub>3</sub>	185.38	378.66	857.50	1056.75 <sup>d</sup>	1649.13 <sup>d</sup>	2184.13 <sup>d</sup>	6311.53 <sup>d</sup>
SE±	2.065	12.99	18.88	0.164	0.634	0.30	27.53
CD at 5%	NS	NS	NS	0.51	1.95	0.94	84.84
GM	184.56	404.195	904.71	1108.91	1735.84	2329.15	6667.36

(Means connected with similar superscript do not differ significantly from each other)

The total water intake at the end of sixth week were 6971.25, 6800.62, 6586.02 and 6311.53 ml per bird in treatment T<sub>0</sub>, T<sub>1</sub>, T<sub>2</sub> and T<sub>3</sub>, respectively.

It is concluded from Table 4.7 that water intake in first three weeks had non-significant differences in all treatments. In fourth, fifth and sixth week average weekly water intake of control group i.e. T<sub>0</sub> was significant higher and goes



**Fig 4.6: Average weekly water intake (ml) of experimental birds**

on decreasing when supplemented with probiotic cultured whey. On the perusal of table 4.7 it could be seen that highest total water intake was obtained in group T<sub>0</sub> (6971.25 ml) which was not supplemented with probiotic cultured whey, followed by T<sub>1</sub> (6800.62 ml) which was supplemented with 10 per cent probiotic cultured whey, followed by T<sub>2</sub> (6586.02 ml) which was supplemented with 20 per cent probiotic cultured whey and lowest water intake i.e. 6311.53 ml per bird in T<sub>3</sub> group which was supplemented with 30 per cent probiotic cultured whey. It may be due to the taste of water changed due to probiotic cultured whey. It is revealed from Table 4.7 that there was significant difference among the treatment group T<sub>3</sub> over T<sub>2</sub>, T<sub>1</sub> and T<sub>0</sub>. The broiler chicks in T<sub>0</sub> group consumed significantly (P<0.05) higher total water intake (6971.25 ml) as compared to T<sub>1</sub> (6800.62 ml) and T<sub>2</sub> (6586.02 ml), T<sub>3</sub> (6311.53 ml). The total water intake among treatment T<sub>1</sub>, T<sub>2</sub>, T<sub>3</sub> and T<sub>4</sub> were differed significantly with each other at 5 per cent level of significant. Temperature and relative humidity also important factor for water consumption, during experimental period minimum temperature recorded as 10.2<sup>0</sup>C and maximum temperature recorded as 32.5<sup>0</sup>C and relative humidity recorded as minimum 30 percent and maximum 77 per cent.

Brake *et al.* (1992) reported daily feed and water intake increased linearly with time. But for present study the environmental conditions were similar for over all experiment, indicate that the observed effect in water intake was due to only probiotic added water.

It seems that probiotic in water survives the demanding conditions of the upper gut, possibly due to a shorter transit time. Continuous supply of a probiotic may require pure water and might interfere with some medications and in addition may need a special device for appropriate dosing. Micro-organisms are more active in hydrated conditions (in water), which might be imply more susceptibility to environmental condition Torshizi *et al.* (2010).

The result of present study is supported by Torshizi *et al.* (2010), who reported that water intake was not influenced by probiotic provision during first three weeks (21 days). While water intake was influenced by probiotic supplementation in broiler over 22-42 and 1-42 days periods.

The present result is contrast to Kalia *et al.* (2017) who reported that the water intake did not differ between the groups.

The present investigation is compared with Parade (2019), who reported the total water intake of broiler birds fed with 0.5 per cent, 1 per cent and 1.5 per cent lemongrass leaf meal were 6910.55, 7250.16, 7089 and 7566.79 ml/bird. That leaf meal has more water intake than other birds.

Also result is comparable with Patil (2020), who reported total water intake of birds fed with 0.5 per cent, 1 per cent, 1.5 per cent tulsi leaf powder were 6908.18, 7252.85 and 7397.63 ml/bird. That is birds fed with 1.5 per cent tulsi leaf powder have more water intake.

From above discussion and present study result indicate that the water intake was reduced in experimental groups than control group, might be due to the change in water taste on account of probiotic cultured whey added in it. It gave scope for further research in future to find out the effect of probiotic cultured whey on broiler without alters the taste of water.

#### **4.6 Microbial count of probiotic cultured whey added water**

It feel necessary to check the quality of water and to know the probiotic status of water used in present experiments as study material prepared by adding probiotic cultured whey in it. Hence, coliform count and yeast and mould count for quality purpose and standard plate count for know the status of probiotic organism was considered.

##### **4.6.1 Standard plate count of probiotic cultured whey added water**

Standard plate count can be used for the general evaluation for know the status of probiotic organism of water and observation are presented in Table 4.8.

**Table 4.8: Standard plate count of culture, whey and drinking water (in cfu/ml)**

Treatments	Culture (cfu/ml at 10 <sup>5</sup> )	Whey (cfu/ml at 10 <sup>6</sup> )	Drinking water (cfu/ml at 10 <sup>6</sup> )
T <sub>0</sub>	-	-	-
T <sub>1</sub>	2. 20	3. 10	2. 20
T <sub>2</sub>	2. 45	3. 85	2. 45
T <sub>3</sub>	2. 60	3. 95	2. 60

The standard plate count of probiotic culture for treatment T<sub>1</sub> which was fed with 10 per cent probiotic cultured whey was  $2.20 \times 10^5$  cfu/ml, for group of birds fed with 20 per cent (T<sub>2</sub>) probiotic cultured whey was  $2.45 \times 10^5$  cfu/ml and for the group of broilers in treatment (T<sub>3</sub>) fed with 30 per cent probiotic cultured whey was  $2.60 \times 10^5$  cfu/ml. The standard plate count of probiotic cultured whey for treatment group T<sub>1</sub> which were fed with 10 per cent probiotic cultured whey was  $3.10 \times 10^6$  cfu/ml. The standard count of probiotic cultured whey for treatment group T<sub>2</sub> which fed with 20 per cent probiotic cultured whey was  $3.85 \times 10^6$  cfu/ml and for treatment group T<sub>3</sub> which were fed with 30 per cent probiotic cultured whey was  $3.95 \times 10^6$  cfu/ml. After adding 10, 20 and 30 per cent probiotic cultured whey in water the standard plate count were  $2.20 \times 10^6$ ,  $2.45 \times 10^6$  and  $2.6 \times 10^6$  cfu/ml in treatments T<sub>1</sub>, T<sub>2</sub> and T<sub>3</sub>, respectively.

Hrncar *et al.* (2014), studied microbial quantization of drinking water and probiotic and found that in for levels of dose of *Lactobacillus fermentum* ranging from 6 to 7 g there were colony forming units in 1 ml of drinking water ranging from  $3.49 \times 10^5$  to  $2.64 \times 10^6$ . And Bouymajane *et al.* (2018), studied the microbiological quality of whey collected from three randomly selected sale point and two popular neighbourhoods. The total plate counts obtained for lben are from 5.73 to 9.23 log<sub>10</sub> cfu/ml.

#### **4.6.2 Coliform count of probiotic cultured whey added water**

Coliform count gives a general indication of sanitary condition of water fed to bird. Coliform count of probiotic culture, whey and drinking water is given in Table 4.9.

**Table 4.9: Coliform count of culture, whey and drinking water**

Treatments	Culture (cfu/ml at 10 <sup>2</sup> )	Whey (cfu/ml at 10 <sup>2</sup> )	Drinking water (cfu/ml at 10 <sup>2</sup> )
T <sub>0</sub>	-	-	-
T <sub>1</sub>	1.85	2.15	1.40
T <sub>2</sub>	2.01	1.62	1.20
T <sub>3</sub>	1.21	1.80	1.35

From Table 4.9 it is observed that coliform count of probiotic culture for treatment T<sub>1</sub> which was fed with 10 per cent probiotic cultured whey was  $1.85 \times 10^2$  cfu/ml, for group of birds fed with 20 per cent (T<sub>2</sub>) probiotic cultured whey was  $2.01 \times 10^2$  cfu/ml and for the group of broilers in treatment (T<sub>3</sub>) fed with 30 per cent probiotic cultured whey was  $1.21 \times 10^2$  cfu/ml. The coliform count of probiotic cultured whey for treatment group T<sub>1</sub> was 2.15, T<sub>2</sub> was 1.62 and T<sub>3</sub> was 1.80 cfu/ml at 10<sup>2</sup>. The coliform count of drinking water in treatment T<sub>1</sub> (fed with 10 per cent probiotic cultured whey) was 1.40, in T<sub>2</sub> (fed with 20 per cent probiotic cultured whey) was 1.20 and T<sub>3</sub> (fed with 30 per cent probiotic cultured whey) was 1.35 cfu/ml at 10<sup>2</sup>.

Bouymajane *et al.* (2018), studied microbiological quality of whey collected from different sites. The result of total coliforms was 3.40 to 7.20 log<sub>10</sub>cfu/ml.

#### **4.6.3 Yeast and Mould count of probiotic cultured whey added water**

Yeast and mould counts are used to detect and quantify the amount of fungal growth. The yeast and mould count of culture, whey, and drinking water is given in Table 4.10.

**Table 4.10: Yeast and Mould count of culture, whey and drinking water**

Treatments	Culture (cfu/ml at 10 <sup>2</sup> )	Whey (cfu/ml at 10 <sup>2</sup> )	Drinking water (cfu/ml at 10 <sup>2</sup> )
T <sub>0</sub>	-	-	0.03
T <sub>1</sub>	0.15	1.31	0.37
T <sub>2</sub>	0.19	1.40	0.39
T <sub>3</sub>	0.17	1.37	0.39

It is observed from Table 4.10 that the yeast and mould count of probiotic culture in treatment T<sub>1</sub> (fed with 10 per cent probiotic cultured whey), T<sub>2</sub> (fed with 20 per cent probiotic cultured whey) and T<sub>3</sub> (fed with 30 per cent probiotic cultured whey) were 0.15, 0.19 and 0.17 cfu/ml at 10<sup>2</sup> level of dilution. The yeast and mould count of probiotic cultured whey in treatment T<sub>1</sub>, T<sub>2</sub> and T<sub>3</sub> were 1.31, 1.40 and 1.37 cfu/ml at 10<sup>2</sup>. After adding probiotic cultured whey in drinking water for control group was 0.03, at the level of 10 per cent and in 20 per cent and 30 per cent were 0.37, 0.39 and 0.39 cfu/ml at 10<sup>2</sup>, respectively.

Bouymajane *et al.* (2018), studied microbiological quality of whey collected from different sites. The result showed that the yeast and moulds counts ranged from 0.31 log<sub>10</sub>cfu/ml to 3.90 log<sub>10</sub>cfu/ml.

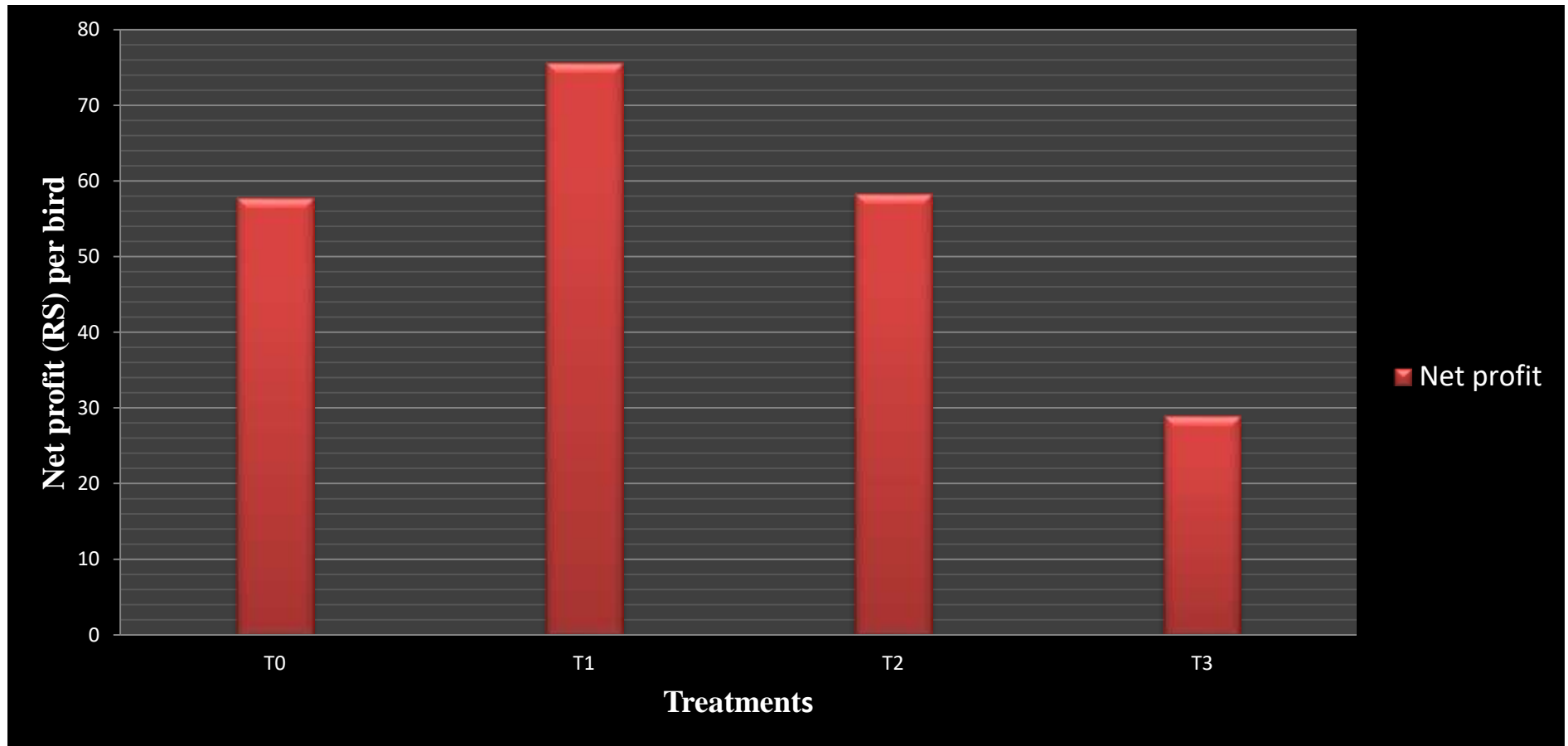
#### **4.7 Economic of broiler production of experiment.**

The profits were calculated by evaluating total amount of feed consumed by broilers under T<sub>0</sub> control and probiotic cultured whey supplemented groups. Other factors like cost of day old chicks, medicine, vaccine and litter material were common for both treatment and control groups. However, being the post-graduation research work, labour cost, electricity etc. was not considered in calculating the economics of broiler production.

The data regarding average live body weight (g), average feed consumption (g), feed consumption per kg live weight gain, cost of feed (Rs), total cost of feed including cost of probiotic used per litre of water under different treatments, cost of feed per kg live weight gain is depicted in Fig 7.

**Table 4.11: Economics of broiler production per bird**

Sr. No	Particular	Treatments			
		T <sub>0</sub>	T <sub>1</sub>	T <sub>2</sub>	T <sub>3</sub>
1.	Cost of day old chicks (Rs.)	29	29	29	29
2.	Probiotic cultured whey consumed per bird (g)	0	13.60	26.34	37.87
3.	Cost of probiotic cultured whey (Rs/g)	0	0.55	0.55	0.55
4.	Cost of consumed probiotic cultured whey drinks (Rs.)	0	7.48	14.487	20.83
5.	Avg. Total feed consumed per bird (g)	4332.76	4466.92	4360.1	4741.36
6.	Cost of feed (Rs/Kg)	32	32	32	32
7.	Cost of feed consumed per bird (Rs.)	138.65	142.94	139.52	151.72
8.	Avg. Body weight gain at the end of 6 <sup>th</sup> week (g)	2334.86	2556.51	2493.34	2384.85
9.	Feed consumption per kg live weight (g)	1855.68	1747.27	1748.69	1988.12
10.	Cost of feed per kg live weight gain (Rs.)	59.38	55.91	55.95	63.62
11.	Cost of medicine, vaccine, and litter material per bird (Rs.)	8	8	8	8
12.	Cost of production (1+4+7+11) per bird (Rs.)	175.65	179.95	191.007	209.5
13.	Avg. Price realized @ Rs.100 per kg (Rs.)	233.49	255.65	249.33	238.49
14.	Net profit per bird (13-12) (Rs.)	57.84	75.7	58.323	28.99



**Fig 4.7: Economics of broiler production**

It was seen from Table 4.11 the net profit per bird was highest is T<sub>1</sub> (Rs.75.7) supplemented with 10 per cent probiotic cultured whey, followed by T<sub>3</sub> (Rs.58.323) supplemented with 20 per cent probiotic cultured whey, control (T<sub>0</sub>) not supplemented with probiotic cultured whey was Rs.57.84 and lowest in T<sub>3</sub> (Rs.28.99) which was supplemented with 30 per cent probiotic cultured whey.

It was seen from Table 4.11 that the cost of day old chicks was Rs.29 per bird. Probiotic consumed per bird was 13.06 g, 26.34 g and 37.87 g in T<sub>1</sub>, T<sub>2</sub> and T<sub>3</sub>, respectively.

Feed consumed per bird was 4332.76, 4466.92, 4360.1 and 4741.36 g per bird in treatment T<sub>0</sub>, T<sub>1</sub>, T<sub>2</sub> and T<sub>3</sub> respectively. The cost for that feed was Rs.138.65, Rs.142.94, Rs.139.52 and Rs.151.72 per bird in treatment T<sub>0</sub>, T<sub>1</sub>, T<sub>2</sub> and T<sub>3</sub>, respectively. The feed consumption per kg live weight gain was 1855.68 g, 1748.69 g and 1988.12 g per bird. Cost of feed per kg live weight gain was Rs.59.38, Rs. 55.91, Rs. 55.95 and Rs.63.62 per bird in treatment T<sub>0</sub>, T<sub>1</sub>, T<sub>2</sub> and T<sub>3</sub>, respectively. The birds were sold at the rate of 100 Rs/kg and price realized from bird was Rs. 233.4g, Rs. 255.65, Rs. 249.33 and Rs. 238.49 per bird in treatment T<sub>0</sub>, T<sub>1</sub>, T<sub>2</sub> and T<sub>3</sub>, respectively. The highest price realized from treatment T<sub>1</sub> i.e. Rs. 255.65, followed by T<sub>2</sub> (Rs. 249.33), T<sub>3</sub> (Rs. 238.49) and lowest price realized from treatment T<sub>0</sub> control i.e. (Rs. 233.49).

The result of present study is similar with Aftahi *et al.* (2006) who reported that the profit of broiler was highest in group of broiler was highest in group of broilers fed with probiotic.

Sultan *et al.* (2006) who reported gross return for yoghurt used group was higher, cost benefit was higher and income/bird was highest in groups alternatively given antibiotic and probiotic at weekly interval.

Omara (2012), reported that adding skimmed milk whey to broiler chick diet improved average values of economics efficiency compared to either control diet or avi-bac supplemented diet.

Patel *et al.* (2015) who fed broilers with 50 g/ton and 100 g/ton probiotic in feed showed that use of probiotic in broilers chicks was financially profitable.

Borghain *et al.* (2017), who showed that group fed with 1 per cent garlic powder was best than other in respect of higher gross profit per bird.

Kalia *et al.* (2017), who reported that broiler group with 18 g probiotic per kg ration have more net profit than control and the birds fed with 9 g per kg probiotic in ration.

**CHAPTER-V**  
**SUMMARY AND CONCLUSIONS**

## CHAPTER-V

### SUMMARY AND CONCLUSION

The experiment was undertaken on “Studies on feeding of probiotic cultured whey on growth performance of broilers”. The trials of experiment was conducted at Mulani Poultry Farm Gadegaon Tq. Barshi, Dist. Solapur and lab work was carried out in the Department of Animal Husbandry and Dairy Science, College of Agriculture, Latur, VNMKV, Parbhani, Maharashtra.

Total one hundred sixty, day old commercial (vencobb-400) broiler birds were distributed in to four equal groups, had four replication of 10 chicks in each treatments were considered. The effect of probiotic cultured whey on growth performance, feed intake, feed conversion ratio, water intake and economics of broiler production were evaluated. The experimental broiler chicks were reared as per standard deep litter system in well ventilated shed from 0-6 weeks.

The control group ( $T_0$ ) was without probiotic cultured whey, ( $T_1$ ) was having 10 per cent probiotic culture whey in addition to normal water. The 20 per cent probiotic culture whey was added in ( $T_2$ ) while ( $T_3$ ) was containing 30 per cent probiotic cultured whey. The result obtained from this investigation is summarized in as per the following heading.

- 5.1 Chemical composition of experimental broiler ration
- 5.2 Cumulative body weight of experimental broiler birds
- 5.3 Gain in body weight of experimental broiler birds
- 5.4 Percent weekly gain in body weight of experimental broiler birds
- 5.5 Feed intake of broiler birds fed on probiotic cultured whey
- 5.6 Feed conversion ratio of broiler birds fed on probiotic cultured whey
- 5.7 Water intake of broiler birds fed on probiotic cultured whey
- 5.8 Microbial count of probiotic cultured whey added water
- 5.9 Economics of broiler rearing

### **5.1 Chemical composition of experimental broiler ration**

The metabolizable energy and calorie protein ratio contained in pre-starter, starter and finisher ration were 2982.42, 3065.7 and 3198.8 kcal/kg and 127.72:1, 141.66:1 and 158.34:1, respectively. The per cent chemical composition of feed used for experiments were 23.34, 4.96, 6.2, 1.56 and 61.58 in pre-starter, 21.65, 3.95, 5.08, 6.3, 1.61 and 63.21 in starter and 20.19, 3.99, 5.11, 5.91, 1.63 and 64.75 in finisher for crude protein, crude fiber, ether extract, total ash, acid insoluble ash and nitrogen free extract, respectively.

### **5.2 Cumulative body weight of broiler birds fed on probiotic cultured whey**

The initial body weight of broiler birds of treatments T<sub>0</sub>, T<sub>1</sub>, T<sub>2</sub> and T<sub>3</sub> were 46.82, 46.81, 46.67 and 46.83 g/bird, respectively. And increased up to sixth week for birds were 2445.01, 2583.72, 2540 and 2381.68 g per bird in treatment of T<sub>0</sub>, T<sub>1</sub>, T<sub>2</sub> and T<sub>3</sub>, respectively.

### **5.3 Gain in body weight of experimental broiler birds**

The average weekly gain in body weight fed with probiotic cultured whey in first week were 112.13, 150.56, 134.27 and 117.83 g/bird for birds in treatment group T<sub>0</sub>, T<sub>1</sub>, T<sub>2</sub> and T<sub>3</sub>, respectively. As regards to impact of age the weekly trend in weight gain was almost similar as observed in cumulative body weight. The lowest value of average weekly weight gain was 112.13±29.44 g in first week and highest in sixth week that was 568.13 ± 29.79 g. The total average weekly gain in body weight was 2334.86, 2556.51, 2493.34 and 2334.85 g per bird in treatment T<sub>0</sub>, T<sub>1</sub>, T<sub>2</sub> and T<sub>3</sub> respectively.

### **5.4 Per cent weekly gain in body weight**

The per cent gain in body weight of first week was found more i.e. 239.49 per cent, 321.64 per cent, 287.70 per cent and 251.61 per cent for treatment T<sub>0</sub> (control group), T<sub>1</sub> (fed with 10 per cent probiotic cultured whey), T<sub>2</sub> (fed with 20 per cent probiotic cultured whey), T<sub>3</sub> (fed with 30 per cent probiotic cultured whey) and then continuously decreased in successive week. This might be the effect of age observed in all livings and classified as weight growing age, weight stationary age and weight declined age.

### **5.5 Average weekly feed consumption of broiler birds fed on probiotic cultured whey**

Average weekly feed consumption of broiler birds in first week were 137.16, 153.53, 156.55 and 151.18 g per bird in treatment T<sub>0</sub>, T<sub>1</sub>, T<sub>2</sub> and T<sub>3</sub> respectively, increased up to 1117.5, 1181.13, 1134.21 and 1191.2 g per bird, respectively up to sixth week. It also observed here that in treatment T<sub>1</sub> less feed intake was observed than T<sub>3</sub> but more body weight gain than it, indicate that the optimum combination of probiotic cultured whey and water observed in treatment T<sub>1</sub> as compared to other treatments.

### **5.6 Feed Conversion Ratio of broiler birds fed on Probiotic Cultured Whey**

The average feed conservation ratio of the broiler birds under treatment T<sub>0</sub>, T<sub>1</sub>, T<sub>2</sub> and T<sub>3</sub> as 1.24, 1.02, 1.17, 1.20 in first week, respectively. During sixth week the feed conversion ratio of broiler birds were 2.4, 2.18, 2 and 2.6 for the overall feed conversion ratio during first to sixth week were 1.81, 1.71, 1.71 and 1.99 in treatments T<sub>0</sub>, T<sub>1</sub>, T<sub>2</sub> and T<sub>3</sub>, respectively.

### **5.7 Water intake of broiler birds fed on Probiotic Cultured Whey**

The average weekly water intake in first week were 184.88, 182.38, 185.62 and 185.38 ml per bird in treatment T<sub>0</sub>, T<sub>1</sub>, T<sub>2</sub> and T<sub>3</sub>, respectively and increased progressively up to sixth week were 2444.13, 2378.00, 2310.38 and 2184.13 ml per bird in treatment T<sub>0</sub>, T<sub>1</sub>, T<sub>2</sub> and T<sub>3</sub>, respectively. The total water intake among treatment T<sub>1</sub>, T<sub>2</sub>, T<sub>3</sub> and T<sub>4</sub> were different significantly with each other at 5 per cent level of significant. Temperature and relative humidity also important factor for water consumption, during experimental period. But for present study the environmental conditions were similar for over all experiment, indicate that the observed effect in water intake was due to only probiotic added water.

### **5.8 Microbial count of probiotic cultured whey added water**

The standard plate count of probiotic culture for treatment T<sub>1</sub> which was fed with 10 per cent probiotic cultured whey was  $2.20 \times 10^5$  cfu/ml, for group of birds fed with 20 percent (T<sub>2</sub>) probiotic cultured whey was  $2.45 \times 10^5$  cfu/ml and for the group of broilers in treatment (T<sub>3</sub>) fed with 30 per cent probiotic cultured whey was  $2.60 \times 10^5$  cfu/ml. After adding 10, 20 and 30 per cent probiotic cultured whey in water the standard plate count were  $2.20 \times 10^6$ ,  $2.45 \times 10^6$  and  $2.60 \times 10^6$  cfu/ml in treatments

T<sub>1</sub>, T<sub>2</sub> and T<sub>3</sub>, respectively. Coliform count of probiotic culture for T<sub>1</sub>, ( $1.85 \times 10^2$  cfu/ml), T<sub>2</sub> ( $2.01 \times 10^2$  cfu/ml) and T<sub>3</sub> ( $1.21 \times 10^2$  cfu/ml). Whereas, coliform count of drinking water in treatment T<sub>1</sub> (fed with 10 per cent probiotic cultured whey) was 1.40, in T<sub>2</sub> (fed with 20 per cent probiotic cultured whey) was 1.20 and T<sub>3</sub> (fed with 30 per cent probiotic cultured whey) was 1.35 cfu/ml at  $10^2$ . Yeast and mould count probiotic cultured whey added in drinking water for control group was 0.03 at the level of 10 per cent and in 20 per cent and 30 per cent were 0.37, 0.39 and 0.39 cfu/ml at  $10^2$ , respectively.

### **5.9 Economic of broiler production of experiment**

The cost of day old chicks was Rs. 29 per bird. Probiotic consumed per bird was 13.06 g, 26.34 g and 37.87 g in T<sub>1</sub>, T<sub>2</sub> and T<sub>3</sub> respectively. Feed consumed per bird was 4332.76, 4466.92, 4360.1 and 4741.36 g per bird in treatment T<sub>0</sub>, T<sub>1</sub>, T<sub>2</sub> and T<sub>3</sub>, respectively. The cost for that feed was Rs. 138.65, Rs. 142.94, Rs. 139.52 and Rs. 151.72 per bird in treatment T<sub>0</sub>, T<sub>1</sub>, T<sub>2</sub> and T<sub>3</sub>, respectively. The feed consumption per kg live weight gain was 1855.68 g, 1748.69 g and 1988.12 g per bird. The birds were sold at the rate of 100 Rs/kg and price realized from bird was Rs. 233.4 g, Rs. 255.65, Rs. 249.33 and Rs. 238.49 per bird in treatment T<sub>0</sub>, T<sub>1</sub>, T<sub>2</sub> and T<sub>3</sub>, respectively. The highest price realized from treatment T<sub>1</sub> i.e. Rs. 255.65, followed by T<sub>2</sub> (Rs. 249.33), T<sub>3</sub> (Rs. 238.49) and lowest price realized from treatment T<sub>0</sub> control i.e. (Rs. 233.49).

### **Conclusion**

As poultry is one of the fastest growing segments and best option for chief protein source need to minimize the cost of feeding in poultry business. From the present investigation it is observed that the use of probiotic cultured whey in broiler rearing improved body weight through by more feed and water intake and obtained best feed conversion ratio. The inclusion of 10 per cent probiotic cultured whey in broiler drink is beneficial in poultry business. The weight of birds fed with 10 per cent probiotic cultured whey increased up to 2583 g whereas the weight of birds reared without use of probiotic cultured whey was 2381.68 g within 42 days. This will not only result in reduction of cost of rearing broiler but also helps in providing a solution for disposal of byproducts of dairy industry.

**CHAPTER-VI**  
**LITERATURE CITED**

## LITERATURE CITED

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# **CURRICULUM VITAE**

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