EFFECT OF PROBIOTIC SUPPLEMENTATION ON THE PERFORMANCE OF BROILER CHICKEN

By

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THESIS

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DECLARATION

I hereby declare that this thesis entitled "**EFFECT OF PROBIOTIC SUPPLEMENTATION ON THE PERFORMANCE OF BROILER CHICKEN**", is a bonafide record of research work done by me during the course of research and that the thesis has not previously formed the basis for the award to me of any degree, diploma, associateship, fellowship or other similar title, of any other University or Society

A. Sabiha

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CERTIFICATE

Certified that thesis entitled "**EFFECT OF PROBIOTIC SUPPLEMENTATION ON THE PERFORMANCE OF BROILER CHICKEN**", is a record of research work done independently by **Miss A. Sabiha Mahaboob Kadari,** under my guidance and supervision and that it has not previously formed the basis for the award of any degree, fellowship or associateship to her.

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A. Sabiha Mahaboob Kadari

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Introduction

1. INTRODUCTION

There has been a remarkable growth in the poultry sector in India with a phenomenal increase in broiler production over the last few years Among various livestock enterprises, poultry farming has metamorphosed into a modern and vibrant industry contributing substantially to the Gross Domestic Product (GDP). As our country faces an overwhelming demand for animal protein, the broiler chicken which provides the cheaper source of animal protein is being exploited to meet the demand However, the productivity levels per bird in India on an average is still low compared to several other countries. The annual per capita availability of poultry meat in 1996 was estimated as 707g in India as against 15 kg in developed countries (Anon, 1994) Hence in the near future there is high scope for the development in poultry sector as the recommendation by Indian Council of Medical Research is 10 8 kg meat per head from all sources per annum

The growth rate of broiler industry at present is 20 per cent per annum Taking into consideration of the growth potential of broilers, the recent trend in broiler raising is to increase its growth rate without maximising the farm inputs In order to achieve high levels of economic efficiency, poultry are raised under intensive production system This inflicts considerable stress due to various factors such as transportation, outbreak of disease, overcrowding, change of weather, vaccination, exposure to pathogenic bacteria especially in the deep litter system etc. Moreover, the chances to develop natural microflora of the intestine in newly hatched chicks are meagre in artificial rearing because of the absence of mother hen which contribute to the gut microflora by pecking the feed particles Due to these factors, an imbalance in the intestinal microflora and a lowering of the body defense mechanism will be created Hence, the bird is unable either to access all the potential nutrients in the diet or to absorb an ideal balance of nutrients from the digestive tract On the whole, the production efficiency is adversely affected with resultant increase in the production cost To alleviate such conditions, growth promoters such as antibiotics were used

In recent years, the use of subtherapeutic levels of antibiotics as growth promoters has been ceased This is because of the possibility of antibiotic residue levels in animal products that may be toxic to human, transferable antibiotic resistance and the promotion of the development of human disease organisms that are resistant to treatment by the antibiotics in question or to other antibiotics So to overcome the defects of antibiotics, nowadays probiotics are used as an alternative

Even though the beneficial effects of probiotics were first recognized by Metchnikoff in 1907, the term 'probiotic' was first introduced by Lilly and Stillwell in 1965 to describe the growth promoting factors produced by microorganisms Probiotics means "for life" as opposed to antibiotics which means "against life" Fuller (1989) defined probiotic as a live microbial feed supplement, which beneficially affects the host animal by improving its intestinal microbial balance The most commonly used probiotic cultures are the strains of Lactobacillus, Streptococcus, Bacillus and yeast. The absolute mode of action of probiotic is still elusive The possible modes of action are suppression of undesirable bacterial count by production of certain organic acids like formic acid, acetic acid, lactic acid, etc , which decrease the pH of the gastrointestinal tract, production of antibacterial compounds, competition for nutrients and adhesion sites; alteration of microbial metabolism by increased and decreased enzyme activity and by stimulation of immunity through increased immunoglobulin G concentration The beneficial effects of probiotics are that they regulate the microbial environment in the gut, reduce the digestive upsets, prevent pathogenic gut bacteria, provide certain essential nutrients, improve feed utilization, improve production efficiency, increase the profit and are cost effective Besides, they leave no harmful residues and do not cause any human health hazards

The efficacy of probiotic is influenced by the inoculant level fed, the stage of maturity of the animal, the level of stress and the rearing environment Because of this wide spectrum of variables, the use of probiotics in broiler diet has revealed conflicting reports concerning growth performance factors like feed efficiency, total weight gain and health conditions under different situations In the present trend of broiler production, feed is the most expensive recurring input accounting for seventy per cent of the total production cost This relative importance of feed cost in broiler production is not likely to decrease in the foreseeable future Therefore, even small improvement in the conversion of feed to poultry meat can result in substantial increase in profit, which would be highly beneficial for the producer.

Taking into account all these factors, the present study was undertaken to evaluate the effect of probiotic supplementation on the performance of broiler chicken.

Review of Literature

2. REVIEW OF LITERATURE

2.1 Body weight and body weight gain

Buche *et al.* (1992) opined that among the dietary supplementations of 0.02 and 0.04 per cent of probiotic (*Lactobacillus sporogenes)* the inclusion level of 0 02 per cent probiotic to the basal diet of broilers significantly increased the body weight gain in comparison to the control group

Takalikar *et al* (1992) reported that the broilers receiving probiotic (Lactobacillus spore powder) at the rate of 0 02 per cent grew significantly ($P < 0.05$) slower than the control birds upto eight weeks of age.

Baidya *et al.* (1993) observed that the addition of probiotics, Biospur (50g/100kg), G probiotic (50 g/100 kg) and Bioboost forte containing live yeast culture of *Saccharomyces cerevisiae* (10g/100kg) in broiler diet upto six weeks had no effect on body weight gain

Mudalgi *et al* (1993) included two Lactobacillus cultures viz , *Lactobacillus acidophilus* and *Lactobacillus bulgaricus* at 10 g/L of drinking water for broiler chicks and found no significant treatment effects on growth But, the probiotic supplemented birds gained numerically higher weights than those fed control diets

Prasad and Sen (1993) opined that the addition of the probiotic, Biospur (containing *Lactobacillus sporogenes* and alpha amylase) at the rate of 5 g/kg to the broiler diet upto six weeks of age caused lower body weight gain than that of control

Baidya *et al* (1994) studied the effect of feeding probiotic on the performance of broiler chicken upto six weeks of age. Dietary supplementation of Biospur, at 50 g/ 100kg of broiler diet did not significantly increase the body weight and body weight gain.

Manickam *et al* (1994) reported that the inclusion of probiotic, *Lactobacillus sporogenes* (Probiosol) at the rate of 1 g/L of drinking water to broilers upto six weeks of age significantly increased the total weight gain but the final body weight did not differ significantly

Yadav *et al.* (1994) evaluated the effect of supplementation of live baker's yeast at 0 2, 0 6 and 1 per cent levels in broiler diet upto seven weeks of age and revealed that the average body weight was not affected by dietary levels of yeast culture.

Bhatt *et al* (1995a) evaluated the effect of dietary supplementation of four strains of *Lactobacillus bulgaricus* viz , L_1, L_2, L_3 and L_4 to broiler chicken upto six weeks of age and found that the body weight gain was lower for birds in all treatments except L_4 as compared to that of control.

Bhatt *et al* (1995b) compared the different strains of *Saccharomyces cerevisiae* (Y_1, Y_3, pigeon yeast and Yeasacc – 1026) at 5 8 x 10^7 cells/kg diet in broilers upto six weeks Significantly higher (P<0 05) weight gain were recorded with Y_3 and pigeon yeast strain supplemented groups

Chiang and Hsieh (1995) observed that broilers when fed diets supplemented with a probiotic (mixture of *Lactobacillus*, *Bacillus* and *Streptococcus*) at 0 25 and 0 5 g/kg diet upto six weeks of age had higher body weight gain

Samanta and Biswas (1995) expressed that the body weight and weight gain were not affected by addition of lactic acid (0 3 per cent) for first two weeks followed by *Lactobacillus acidophilus* culture at the rate of 2ml/L of water for the next four weeks

Jin *et al* (1996) reported that the supplementation of probiotics, *Bacillus subtilis* and *Lactobacillus* culture (10^9 cells/ kg feed) in broilers upto four weeks of age significantly increased (P<0 05) the average weight gain

Lin and Quarles (1996) opined that the addition of probiotic, Primalac, (*Lactobacillus acidophilus, L casei, Bifidobacterium bifidum, Toruplopsis and Aspergillus oryzae*) at 1000g/ton for the first 24 days followed by the dose rate of 500g/ ton for the next 23 days in male broilers significantly increased (P<0 05) the average weight

Mohan *et al* (1996) observed that the dietary inclusion of probiotic, Probiolac (containing five strains of microorganisms namely *Lactobacillus acidophilus, L casei, Bifidobacterium bifidum, Aspergillus oryzae* and Torulopsis) at the rates of 75 and 100 mg/kg diet, caused higher weight gain in broilers upto eight weeks of age It was also reported that at the end of fourth, fifth and sixth week the increase in body weight gain in the 100 mg probiotic supplemented group was statistically significant. But, the differences in body weight gain at seventh and eighth week were not statistically significant.

Yadav *et al.* (1996) reported that the supplementation of live baker's yeast at 0.1, 0.3 and 0.5 per cent levels in drinking water of broilers upto six weeks had no significant effect on average body weight

Jin *et al.* (1997) reviewed the literature on the use of probiotics and concluded that the addition of probiotics improved the growth performance in broilers.

Joy and Samuel (1997) studied the administration of *Lactobacillus sporogenes* to broilers at the rate of 50 and 100 million organisms/ chick/ day orally from day one to day 42 and found that the probiotic treatment at 100 million organisms/chick/ day had shown a significant increase ($P < 0.01$) in weight gain during first three weeks period In the second three weeks period, daily gain was not significantly different among diet groups

Cavazzoni *et al* (1998) observed that the probiotic (*Bacillus coagulans*) addition at 1 6 x 10^{10} cfu/kg for the first week and at 4 x 10^{9} cfu/kg for the next six weeks in broiler diet significantly increased (P<0 05) the mean body weight and daily live weight gain

Choudhury *et al* (1998) found that the dietary supplementation of probiotic, G-pro at the rate of 0 05 per cent had no growth promoting influence in broilers fed with muga silk worm pupae meal

Gohain and Sapcota (1998) revealed that the addition of probiotic, G. Probiotic (*Lactobacillus acidophilus* and *Streptococcus faecium*, 1500 spores each, Betaglucanase 10 g and liver extract 500 mg per 25 g) at the rate of 0 5 g/kg upto seven weeks of age in broiler diet significantly increased the body weight gain (6 32 per cent) It was also reported that the effect of probiotic feeding was more conspicuous in the sixth and seventh week

Jin *et al* (1998) determined the effect of adherent *Lactobacillus* cultures at 0 05, 0 1 and 0 15 per cent in broiler diet upto six weeks and observed that the treatments with 0 05 and 0 1 per cent probiotic produced a significantly greater (P<0 05) body weight

Abdulrahim *et al* (1999) monitored the influence of *Lactobacillus acidophilus* (4 x 10^6 cfu/g diet) and Zinc bactracin (50mg/kg and 60 mg/kg in starter and finisher diets respectively) in broiler either alone or in combination upto eight weeks and found that the body weight and weight gain were significantly higher in the treated groups

Endo and Nakano (1999) studied the effect of probiotic (mixture of *Bacillus, Lactobacillus, Streptococcus, Clostridium, Saccharomyces* and *Candida* sp) supplementation at 3g/kg diet in broilers upto eight weeks It was found that the body weight gain was higher in the probiotic treated males than females

Goh and Hwang (1999) examined the effect of dietary *Aspergillus oryzae* yeast culture incubated in wheat flour at 0 1, 0 3, 0 5, 0 7 and 1 per cent levels in broiler diet and found that the supplementation did not affect the body weight gain

Mahajan *et al.* (1999) reported that the addition of probiotic, Lactosacc (Yeasacc 1026, 4 9 X 10^9, *Lactobacillus acidophilus* 10^8 and *Streptococcus faecium* 10^8 cfu/g) at 25 g per quintal of feed upto six weeks did not increase the body weight gain significantly during winter months whereas during summer there was significant increase in body weight gain.

Mikulec *et al.* (1999) evaluated the effect of added probiotic preparation, Nutrigen (*Saccharomyces cerevisiae*) in broiler diet at 10 per cent level upto six weeks and found that the probiotic did not influence the body weight gain

Panda *et al.* (1999) found that the dietary inclusion of commercial probiotic containing six strains of variable organisms namely *Lactobacillus acidophilus, L. casei, Bifidobacterium bifidum, Aspergillus oryzae, Streptococcus faecium* and *Torulopsis sp* with 27 billion cfu/ 100 g of the product, at the rate of 100, 150 or 200 mg per kg broiler diet upto six weeks of age had no significant effect on body weight gain

Piao *et al* (1999) observed that the dietary supplementation of 0 1 per cent yeast or 0 25 per cent Kemzyme + phytase + yeast (KPY) in broilers upto six weeks had no effect on body weight gain

Saha *et al* (1999a) opined that the dietary supplementation of baker's yeast culture at 0.35 and 0 5 per cent in broilers upto eight weeks did not affect the average body weight.

Saha *et al.* (1999b) studied the effect of supplementation of live baker's yeast at 0.25 per cent in broiler diet upto eight weeks of age. It was inferred that the yeast supplementation had no effect on body weight gain.

Singh and Sharma (1999) observed that among the levels of inclusion of probiotic (*Lactobacillus sporogenes*) at 0.02, 0.03 and 0.04 per cent to broiler diets upto eight weeks of age, 0.02 per cent probiotic fed group had significantly (P < 0 05) higher body weight gain than that of control and 0 04 per cent probiotic and that it was comparable with that of 0 03 per cent probiotic

Biswal *et al* (2000) evaluated the beneficial effects of probiotic (G probiotic, Biovet - YC and Biotan – FS) and found that the sixth week body weight was significantly improved due to inclusion of probiotic.

Kannan and Viswanathan (2000) studied the effect of probiotic (*Lactobacillus sporogenes)* in broiler diet upto seven weeks and found that the probiotic addition at the rate of 10,000 spores/kg significantly increased the body weight gain

Karunakaran *et al* (2000) found that the dietary supplementation of the probiotic, *Lactobacillus acidophilus* 0 5, *L salivarius* 0 25, *Saccharomyces* sp. 0 125 and *Torulopsis* sp 0 125 X 10^6 cfu/ kg broiler diet significantly improved the weight gain by 12 per cent

Kumprechtova *et al.* (2000) observed that the supplementation of probiotic (*Saccharomyces cerevisiae* - Sc 47) at 100 and 200g/ 100kg broiler diet, upto six weeks did not affect the body weight gain

Panda *et al* (2000b) conducted an experiment to evaluate the influence of dietary supplementation of Probiolac, at 100, 150 or 200 mg/kg broiler diet and observed that the 100 mg proboitic supplementation significantly improved the body weight gain

Ramesh *et al* (2000) reported that the *Lactobacillus acidophilus* supplementation at 10^8 cfu/ bird/ day in broiler diet for the first two weeks caused better growth rate.

Sayed *et al* (2000) supplemented live yeast culture, Nutriyeast, at 0 5 and 1 kg per ton of broiler basal diet and found that the body weight gain was significantly increased with 1 kg/ ton of yeast supplementation

Shome *et al.* (2000) inferred that the supplementation of probiotic (*Lactobacillus acidophilus)* in native chicken of Andaman at the dose rate of 10^6 cfu/ day/ bird in water for the first four weeks improved the weight gain

Singh and Prasad (2000) observed that dietary supplementation of live baker's yeast at 0 1, 0.2, 0 3 and 0 4 per cent upto five weeks of age in caged broilers had no significant effect on growth

Talukdar *et al* (2000) studied the effect of probiotic supplementation on broiler performance upto eight weeks of age and found that the mean body weight gain was improved by probiotic (Biospur or Bioboost or Probiolac) supplementation at and beyond four weeks Feeding pure live cultures of probiotic, *Lactobacillus acidophilus* and *L. bulgaricus* was found to be significantly better than the commercial preparation

Zulkifli *et al.* (2000) monitored the effect of feeding two commercial broiler strains (Hubbard and Shaver) with diets containing *Lactobacillus cultures* (1 g/kg) and oxytetracycline (50 mg/kg) under heat stress upto six weeks and found that the body weight and weight gain were significantly (P<0 05) better

2.2 Feed consumption

Buche *et al.* (1992) opined that the dietary supplementation of 0.02 and 0.04 per cent of *Lactobacillus sporogenes* to the basal diet of broiler chicken had no effect on feed intake

Takalikar *et al* (1992) reported that the broilers receiving *Lactobacillus* spore powder at 0 02 per cent upto eight weeks of age consumed less feed as compared to control though not statistically significant

Baidya *et al* (1993) observed that the addition of Biospur, G.probiotic and Bioboost forte at 50, 50 and 10 g/100kg respectively in broiler diet upto six weeks did not influence the feed intake

Mudalgi *et al* (1993) reported that the feed consumption was not affected by addition of *Lactobacillus* cultures in drinking water of broilers

Prasad and Sen (1993) revealed that the addition of Biospur at 5 g/kg to the broiler diet upto six weeks of age had no significant effect on feed intake.

Baidya *et al* (1994) observed that the dietary supplementation of Biospur at 50 g/ 100 kg in broiler diet did not significantly improve the feed intake in comparison to control

Manickam *et al* (1994) inferred that the inclusion of Probiosol at 1 g/L of drinking water to broilers upto six weeks of age did not affect feed consumption.

Yadav *et al* (1994) revealed that the feed consumption was not affected by yeast supplementation at 0.2, 0.6 and 1 per cent in broiler diet

Bhatt *et al* (1995a) reported that the dietary supplementation of four strains of *Lactobacillus bulgaricus* to broiler chicken upto six weeks of age had no significant effect on feed consumption

Bhatt *et al* (1995b) compared the different strains of *Saccharomyces cerevisiae* at 5 8 x 10^7 cells/ kg diet in broilers upto six weeks and found that the feed intake did not differ significantly

Chiang and Hsieh (1995) evaluated the effect of dietary supplementation of probiotic at 0 25 and 0 5g/kg broiler diet upto six weeks of age and reported that there was no significant difference in feed intake between treatments

Samanta and Biswas (1995) observed that the feed intake was not influenced by addition of *Lactobacillus acidophilus* culture in broilers upto six weeks

Mohan *et al* (1996) revealed that the dietary supplementation of Probiolac at 75, 100 and 125mg/ kg diet did not have any effect on feed consumption

Yadav *et al* (1996) reported that the overall average feed consumption was not affected by the supplementation of live baker's yeast at 0 1, 0 3 and 0 5 per cent levels in drinking water of broilers upto six weeks.

Joy and Samuel (1997) found that the probiotic treatment at 100 million organisms per chick per day increased the feed intake significantly (P < 0 01) upto six weeks of age

Samanta and Biswas (1997) monitored the effect of *Streptococcus lactis* supplementation at 2 or 4 ml in water for broilers and found that the feed intake did not differ significantly between the treatments

Sarkar *et al* (1997) observed that the feed intake did not differ significantly between treatments on supplementation of yeasts

Yeo and Kim (1997) reported that the probiotic supplementation at 0.1 per cent level numerically increased the feed intake when compared to that of control

Gohain and Sapcota (1998) opined that the addition of G Probiotic at 0.5 g/kg upto seven weeks of age in broiler diet decreased the feed consumption

Abdulrahim *et al* (1999) expressed that the feed intake did not differ significantly on supplementation of *Lactobacillus acidophilus* in broiler diet upto eight weeks.

Goh and Hwang (1999) found that the average feed intake was not affected by dietary supplementation of *Aspergillus oryzae* at 0.1, 0.3, 0 5, 0.7 and 1 per cent in broiler diet

Panda *et al* (1999) monitored the dietary inclusion of commercial probiotic at 100, 150 or 200 mg per kg broiler diet upto six weeks of age and found that there was no significant effect of probiotic on feed consumption

Piao *et al* (1999) observed that the dietary supplementation of 0 1 per cent yeast in broilers upto six weeks had no effect on feed intake

Saha *et al.* (1999a) opined that the dietary supplementation of baker's yeast culture at 0 35 and 0 5 per cent in broilers upto eight weeks did not affect feed consumption

Saha *et al* (1999b) studied the effect of yeast supplementation at 0.25 per cent in broiler diet and found that the total feed consumption did not differ significantly

Singh and Sharma (1999) reported that the *Lactobacillus sporogenes* supplementation at 0.02, 0 03 and 0.04 per cent did not influence the feed consumption significantly

Kannan and Viswanathan (2000) evaluated the effect of probiotic in broiler diets upto seven weeks and found that the *Lactobacillus sporogenes* addition at 10,000 spores/ kg reduced the feed consumption.

Kumprechtova *et al* (2000) observed that the application of probiotic at 100 and 200g/100kg broiler diet upto six weeks did not significantly influence the feed intake

Panda *et al* (2000b) opined that the Probiolac supplementation in broiler diet at 200 mg/kg did not influence the feed consumption

Ramesh *et al* (2000) observed that the *Lactobacillus acidophilus* supplementation at 10^8 cfu/ bird/ day in broiler diet caused numerically higher feed intake

Shome *et al* (2000) reported that the supplementation of *Lactobacillus acidophilus* in chicken of Andaman at 10^6 cfu/day/ bird in water for the first four weeks did not affect the average feed consumption

Singh and Prasad (2000) observed that the total feed consumption of caged broilers did not differ significantly when live baker's yeast was supplemented at 0 1, 0 2, 0.3 and 0 4 per cent levels upto five weeks of age

Talukdar *et al.* (2000) found that the feed intake was improved by Biospur or Bioboost or Probiolac supplementation at and beyond four weeks It was also observed that the pure live cultures of probiotics were significantly better than the commercial preparation

Zulkifli *et al.* (2000) found that the feed intake was significantly higher (P<0 05) in *Lactobacillus* culture supplemented groups upto six weeks

2.3 Feed efficiency

Buche *et al* (1992) opined that upon the dietary supplementation of 0 02 and 0 04 per cent of *Lactobacillus sporogenes* to the diet of broiler chicken, there was no significant difference in feed conversion ratio

Takalikar *et al* (1992) studied the dietary inclusion of *Lactobacillus* spore powder at 0.02 per cent in broiler diet upto eight weeks of age and reported that the feed conversion ratio was similar ın both control and treatment group at sıx weeks of age but ıt was poor ın probıotıc fed group at eıght weeks of age

Baıdya *et al* (1993) reported that the feed effıcıency dıd not dıffer sıgnıficantly upon addıtıon of Bıospur, G probıotıc and Bıoboost forte ın broıler dıet upto sıx weeks

Mudalgı *et al* (1993) revealed that the ınclusıon of two Lactobacıllus cultures at 10 g/L of drınkıng water ın broıler chıcks had no sıgnıfıcant treatment effect on feed conversıon effıcıency

Prasad and Sen (1993) observed that the addıtıon of Bıospur at 5 g/kg to the broıler dıet upto sıx weeks of age had no sıgnifıcant effect on feed effıcıency ratıo

Baıdya *et al* (1994) opıned that the feed conversıon ratıo dıd not dıffer sıgnıfıcantly among the control and the bırds supplemented wıth Bıospur at 50g/100 kg of broıler dıet

Manıckam *et al* (1994) reported hıghly sıgnıfıcant dıfference between control and bırds supplemented wıth Probıosol at 1g/L of drınkıng water upto sıx weeks of age ın respect of feed conversıon effıcıency

Yadav *et al* (1994) revealed that the feed effıcıency dıd not dıffer sıgnıficantly on yeast supplementatıon at 0 2, 0 6 and 1 per cent ın broıler dıet

Bhatt *et al* (1995a) evaluated the effect of dietary supplementation of four strains of *Lactobacillus bulgaricus* to broiler chicken upto six weeks of age and found that there was no significant effect on feed efficiency.

Bhatt *et al* (1995b) compared the different strains of *Saccharomyces cerevisiae* in broiler diet upto six weeks and found that the feed efficiency did not differ significantly

Chiang and Hsieh (1995) observed that the broilers fed probiotic supplemented diets at 0.25 and 0.5 g/ kg broiler diet upto six weeks of age had poorer feed conversion ratio than control at fourth and sixth weeks of age

Samanta and Biswas (1995) inferred that the *Lactobacillus acidophilus* supplementation at 2ml/ L of water upto sixth week did not produce any significant improvement in feed efficiency

Jin *et al* (1996) reported that the broilers fed probiotics had a significantly lower ($P<0\ 05$) feed conversion ratio

Lin and Quarles (1996) opined that the feed efficiency was significantly better ($P<0\ 05$) in Primalac supplemented group of male broilers

Mohan *et al* (1996) opined that upon the dietary supplementation of Probiolac at 75, 100 and 125mg / kg diet, the feed efficiencies of birds in 75 and 100 mg probiotic supplemented groups were two per cent greater than those in the control and the 125 mg supplemented groups

Yadav *et al* (1996) reported that the feed efficiency was not affected by live baker's yeast supplementation in drinking water of broilers upto six weeks

Jin *et al* (1997) reviewed the literature on the use of probiotics and concluded that the addition of probiotics improved the feed efficiency in broilers

Joy and Samuel (1997) found that the probiotic treatment at 100 million organism/ chick/ day showed significantly improved feed efficiency at the end of six weeks of age.

Kahraman *et al.* (1997) undertook a study on the supplementation of Fastract at 227 mg/kg diet in broilers and found that the feed conversion rates were better than control

Samanta and Biswas (1997) evaluated the effect of *Streptococcus lactis* in water of broilers and found that the feed conversion did not differ significantly.

Sarkar *et al.* (1997) studied the effect of feeding yeasts in broiler diet upto six weeks and found that the feed efficiency did not differ significantly

Yeo and Kim (1997) conducted a six weeks study in broilers to determine the effect of *Lactobacillus casei* and reported that the probiotic supplementation at 0 1 per cent of diet showed numerically better feed conversion efficiency in comparison to those fed the control diet.

Choudhury *et al* (1998) found that upon the dietary supplementation of G-pro at 0.05 per cent to broiler diet, the feed efficiency was not affected by probiotic supplementation.

Gohain and Sapcota (1998) inferred that the difference of feed conversion ratio between the G. probiotic fed group at 50g/100 kg broiler diet and control group was not significant.

Jin *et al.* (1998) opined that the feed conversion ratio was improved significantly (P<0.05) in broilers fed diets containing 0 05 or 0.1 per cent *Lactobacillus* culture upto four and six weeks. The highest level of probiotic inclusion at 0 15 per cent recorded poorer feed efficiency than the other two levels

Abdulrahim *et al* (1999) reported that the feed conversion was significantly (P<0.05) improved by the use of *Lactobacillus acidophilus* and zinc bacitracin in combination in broilers upto eight weeks

Endo and Nakano (1999) found that the feed conversion ratio was better in males than females treated with probiotic at 3g/kg diet in broilers upto eight weeks

Goh and Hwang (1999) expressed that the yeast supplementations at 0.1, 0 3, 0 5, 0 7 and 1 per cent levels in broiler diet significantly (P<0 01) improved the feed efficiency

Mikulec *et al* (1999) observed that the Nutrigen supplementation at 10 per cent did not influence feed efficiency

Panda *et al* (1999) reported that the dietary inclusion of commercial probiotic at 100, 150 or 200 mg/kg broiler diet upto six weeks of age improved the feed efficiency

Piao *et al* (1999) observed that the feed conversion rate was significantly improved by the addition of 0 25 per cent KPY in broiler diet upto six weeks

Saha *et al* (1999a) opined that the feed efficiency was not affected by dietary supplementation of baker's yeast culture at 0 35 and 0 5 per cent in broilers upto eight weeks

Saha *et al* (1999b) studied the effect of live baker's yeast supplementation at 0 25 per cent in broiler diet and found that the feed efficiency did not differ significantly

Singh and Sharma (1999) revealed that the *Lactobacillus sporogenes* supplementation at 0 02 per cent of the broiler diet improved the feed efficiency at six and eight weeks of age

Biswal *et al* (2000) observed that the probiotic supplementation in broiler diets upto six weeks of age significantly improved the feed efficiency

Kannan and Viswanathan (2000) evaluated the effect of probiotic in broiler diets upto seven weeks and found that the probiotic addition at 10,000 spores/ kg improved the feed efficiency

Kumprechtova *et al.* (2000) observed that the effect of *Saccharomyces cerevisiae* supplementation in broilers upto six weeks on feed efficiency was more pronounced in feeds with lower crude protein level

Panda *et al* (2000b) conducted an experiment to evaluate the effect of Probiolac supplementation in broiler diet and observed that the feed efficiency did not differ significantly

Ramesh *et al* (2000) reported that the broilers fed with *Lactobacillus acidophilus* showed better feed efficiency

Sayed *et al* (2000) inferred that upon the dietary supplementation of Nutriyeast, at 0 5 and 1 kg per ton of broiler diet, yeast supplementation at 1 kg/ ton of feed showed better feed conversion ratio

Singh and Prasad (2000) found that the difference in feed conversion ratio between control and experimental groups were non-significant upon dietary supplementation of live baker's yeast at 0 1, 0 2, 0.3 and 0.4 per cent upto five weeks of age in caged broilers

Talukdar *et al* (2000) concluded that feeding pure live cultures of *Lactobacillus acidophilus* and *L bulgaricus* significantly improved the feed efficiency than the commercial preparation of probiotics

Zulkifli *et al* (2000) opined that the feed efficiency was significantly (P<0 05) better by *Lactobacillus* culture supplementation at 1g/kg broiler diet upto six weeks

2.4 Protein efficiency

Studies conducted by Buche *et al* (1992) revealed that dietary supplementation at 0.02 and 0.04 per cent of probiotic to the diet of broiler chicken, did not affect the protein efficiency ratio

Takalikar *et al* (1992) observed that the dietary inclusion of *Lactobacillus* spore powder at 0 02 per cent in broiler diet upto eight weeks of age resulted in poor protein efficiency ratio

Mohan *et al* (1996) opined that upon the dietary supplementation of Probiolac, at 75, 100 and 125 mg/kg diet, the protein efficiency ratios in all probiotic supplemented groups were better than that of the control

Choudhury *et al.* (1998) reported that the dietary supplementation of G-pro at 0.05 per cent in broiler diet fed with muga silk worm pupae meal had no significant effect on the protein efficiency ratio

Gohain and Sapcota (1998) evaluated the addition of G probiotic in broiler diet and found that the broilers on probiotic supplemented diet consumed less protein than the control group

2.5 Serum cholesterol and serum protein

Samanta and Biswas (1994) found no effect of probiotics (*Lactobacillus acidophilus or L. bulgaricus* or both) on serum protein levels in caged broilers upto six weeks

Abdulrahim *et al* (1996) reported that the *Lactobacillus acidophilus* reduces the cholesterol in the blood by deconjugating bile salts in the intestine there by preventing them from acting as precursors in cholesterol synthesis

Mohan *et al* (1996) evaluated the dietary inclusion of Probiolac, at 75, 100 and 125 mg/kg broiler diet upto eight weeks of age and found that the serum cholesterol was significantly reduced in probiotic fed groups. The birds given the 100 mg probiotic/ kg diet had the lowest cholesterol level (84 1 mg/dl)

Joy and Samuel (1997) studied the administration of *Lactobacillus sporogenes* to broilers at 50 and 100 million organism per chick per day orally upto six weeks and found that there was a significant reduction in serum cholesterol during fourth, fifth and sixth week in probiotic treated groups compared to that of control

Gohain and Sapcota (1998) reported that the serum protein and serum cholesterol levels were not affected by dietary supplementation of G probiotic at 0 5g/kg broiler diet upto seven weeks of age

Jin *et al* (1998) determined the serum cholesterol levels in broilers at 10, 20, 30 and 40 days of age and found that the supplementation of adherent *Lactobacillus* cultures at 0.1 per cent level in diet significantly (P<0.05) reduced the serum cholesterol levels at 40 days. It was also reported that the decrease in serum cholesterol level in probiotic supplemented groups might be due to the cholesterol assimilation by the Lactobacillus cells.

Endo *et al.* (1999) observed that the serum cholesterol level was significantly reduced in cocks fed on probiotic (mixture of *Bacillus,* *Lactobacillus, Streptococcus, Clostridium, Saccharomyces* and *Candida)* supplemented cholesterol-enriched diets

Biswal *et al* (2000) found that the dietary supplementation of G. probiotic, Biovet – YC and Biotan – FS in broiler ration did not influence the serum protein level

2.6 Processing yields

Takalikar *et al* (1992) reported that the inclusion of Lactobacillus spore powder at 0 02 per cent of diet had no significant influence on the dressed, eviscerated and giblet yields

Baidya *et al* (1993) opined that the addition of Biospur, G-probiotic and Bioboost forte in broiler diet upto six weeks had no remarkable effect on eviscerated and giblet percentages and weights of liver, heart, gizzard and spleen

Baidya *et al* (1994) found that the dietary supplementation of Biospur at 50 g/ 100 kg of broiler diet had no significant effect on eviscerated and giblet yields

Samanta and Biswas (1994) found that the addition of *Lactobacillus acidophilus* or *L bulgaricus* or a mixed culture of both at 10 x 10^{12} number of organism/L of water in caged broilers upto six weeks of age had no effect on dressed and eviscerated percentages and weights of giblet and spleen

Singh *et al*. (1994) reported that the supplementation of pure cultures of *Lactobacillus acidophilus* and *L bulgaricus* to broiler chicks through the drinking water at 10g/L daily had no effect on the eviscerated weight and weights of liver and spleen

Yadav *et al* (1994) revealed that the giblet yield and dressing percentage did not differ significantly upon yeast supplementation

Bhatt *et al* (1995b) compared the different strains of *Saccharomyces cerevisiae* in broilers upto six weeks and found that the differences in dressing percentage were not significant

Chiang and Hsieh (1995) observed that broilers when fed diets supplemented with probiotic at 0 25 and 0.5g/kg broiler diet upto six weeks of age had no significant difference in abdominal fat content compared to that of control

Samanta and Biswas (1995) observed that the dressed, eviscerated and giblet yields were not affected by supplementation of *Lactobacillus* culture

Mohan *et al* (1996) found that the dietary supplementation of Probiolac at 75, 100 and 125 mg/kg broiler diet had no significant influence on the dressing percentage and weights of heart, liver, spleen and gizzard

Yadav *et al* (1996) reported that the dressing yield was not affected by addition of live baker's yeast in drinking water of broilers.

Samanta and Biswas (1997) evaluated the effect of *Streptococcus lactis* supplementation in drinking water of broilers and found that the carcass yield did not differ significantly

Sarkar *et al* (1997) studied the effect of feeding yeasts in broiler diet upto six weeks and found that the eviscerated and giblet yields did not differ significantly.

Choudhury *et al* (1998) monitored the effect of dietary supplementation of G-pro at 0.05 per cent in broiler diet and found that there were no significant differences in the dressing and giblet yields and the weights of liver, heart and gizzard.

Gohain and Sapcota (1998) observed that upon the addition of G. Probiotic at 0.5g/kg broiler diet there was no significant effect on dressed yield

Abdulrahim *et al.* (1999) monitored the influence of *Lactobacillus acidophilus* in broilers upto eight weeks and found that the giblet weight in females increased with probiotic addition

Mikulec *et al* (1999) evaluated the effect of Nutrigen at 10 per cent in broiler diet upto six weeks and found that the abdominal fat per cent was not significantly different in diets with sufficient quantities of protein.

Panda *et al.* (1999) opined that the dietary inclusion of commercial probiotic at 100, 150 or 200 mg/kg broiler diet upto six weeks had no significant effect on weights of liver, heart, gizzard, spleen, bursa and fat and dressing percentage

Saha *et al* (1999a) inferred that the dietary supplementation of baker's yeast culture in broilers had no effect on dressed and giblet yields.

Biswal *et al.* (2000) evaluated the benefical effect of probiotic and found that the probiotic supplementation in broilers for six weeks did not influence the weight of abdominal fat

Kannan and Viswanathan (2000) found that the addition of *Lactobacillus sporogenes* had no effect on yields of ready-to-cook and giblets.

Panda *et al.* (2000b) observed no significant differences with respect to dressing percentage and weights of bursa, spleen, liver, heart and gizzard upon probiotic supplementation in broilers

Sayed *et al.* (2000) reported that the dietary supplementation of Nutriyeast at 0.5 and 1 kg per ton of broiler diet had no significant effect on ready-to-cook yield and weights of heart, liver and gizzard.

2.7 Livability

Manickam *et al* (1994) revealed that upon the inclusion of Probiosol, at 1g/L of drinking water in broilers upto six weeks of age, the livability percentage remained almost the same between the control and treated group

Bhatt *et al* (1995a) opined that among the dietary supplementation of four strains of *Lactobacillus bulgaricus* to broiler chicken upto six weeks of age, the L_4 strain showed numerically lowest chick mortality

Bhatt *et al* (1995b) compared the different strains of *Saccharomyces cerevisiae* in broilers upto six weeks and revealed that the mortality was not significantly different between treatments

Jin *et al.* (1996) reported that the supplementation of probiotics in broilers had no effect on mortality

Lin and Quarles (1996) revealed that Primalac supplementation in broiler diet significantly ($P<0.05$) reduced the per cent mortality

Kahraman *et al.* (1997) found that the mortality was lowest in the probiotic supplemented group upto six weeks

Samanta and Biswas (1997) observed that the mortality was reduced in probiotic supplemented groups

Cavazzoni *et al* (1998) opined that the probiotic supplementation in broiler diet reduced the mortality

Choudhury *et al* (1998) observed that due to the dietary supplementation of G-pro at 0.05 per cent level in broiler diets the mortality that occurred in high environmental temperature during the rearing period was low in comparison to control

Jin *et al.* (1998) opined that the mortality was not affected by dietary supplementation of adherent *Lactobacillus* cultures in broilers upto six weeks

Piao *et al.* (1999) found that mortality was successfully reduced by dietary supplementation of 0 1 per cent yeast in broilers upto six weeks

Biswal *et al.* (2000) evaluated the beneficial effects of probiotic and found that the livability percentage was higher in the probiotic supplemented group during the entire six week period.

Kannan and Viswanathan (2000) studied the effect of probiotic in broiler diet and found relatively better livability upon probiotic addition

Shome *et al* (2000) conducted a study on the effect of probiotic on the performance of chicken and inferred that the dietary supplementation of probiotic caused a dramatic reduction (12 27 per cent) in early chick mortality.

Zullkifli *et al.* (2000) reported that feeding diets containing *Lactobacillus* cultures had no effect on mortality.

2.8 Cost benefit analysis

Buche *et al* (1992) revealed that the inclusion of 0 02 per cent probiotic to the broiler diet numerically lowered the cost of feed per kg live weight compared to that of control and the higher level of 0.04 per cent probiotic

Takalikar *et al.* (1992) found that the cost of feed per kg live weight gain was apparently higher in broilers fed probiotic at 0 02 per cent upto six weeks of age in comparison to that of control.

Baidya *et al* (1993) opined that the addition of Biospur (50g) G probiotic (50g) and Bioobost forte (10g) per 100kg diet was found to be economic in broilers upto six weeks.

Prasad and Sen (1993) observed that the cost of feed per kg weight gain was higher in the probiotic supplemented group (0 5g/kg)

Baidya *et al.* (1994) concluded from the cost-benefit analysis, that the income per bird was found to be highest in groups fed with antibiotic at 50g/ 100kg broiler diet for the first three weeks followed by probiotic at 50g/ 100kg for the next three weeks.

Sarkar *et al.* (1997) reported that from economic point of view the feeding of antibiotic in starter phase followed by yeasts in the finisher phase in broilers was best

Choudhury *et al.* (1998) opined that the dietary inclusion of G-pro at 0.05 per cent in broiler diets was not economical.

Gohain and Sapcota (1998) observed that numerically less feed was required to produce live weight gain in G. Probiotic supplemented group at 50g/ 100kg broiler diet upto seven weeks of age.

Kannan and Viswanathan (2000) expressed that the addition of *Lactobacillus sporogenes* at 10,000 spores/kg showed a higher profit per kg live weight of broilers protein level was not affected by probiotic supplementation The processing yields did not show any significant difference among treatments The mortality percentage was not affected by treatments. Cost of production of broilers in the 0 025 per cent probiotic group was lower when compared with other two groups at the end of six weeks of age, while it was lower in the 0 05 per cent probiotic supplemented group at the end of eight weeks of age

It can be concluded that probiotic supplementation in standard broiler ration at a lower level was beneficial in the early stages of growth

Materials and Methods

3. MATERIALS AND METHODS

An experiment was conducted in the Department of Poultry Science, College Of Veterinary and Animal Sciences, Mannuthy, for a period of eight weeks from second week of January to second week of March to evaluate the effect of probiotic supplementation on the performance of broiler chicken

3.1 Experimental materials

3.1.1 Experimental birds

One hundred and forty four, one-day old straight-run broiler chicks (Hubchix) procured from a commercial hatchery formed the experimental subjects

3.1.2 Experimental rations

The standard broiler rations (broiler starter and finisher) formulated as per BIS (1992) were used in this study The feed ingredients used for the formulation of the ration were yellow maize, groundnut cake, soyabean meal, gingelly oil cake, unsalted dried fish and rice polish The broiler starter ration was fed upto six weeks of age and broiler finisher ration was fed during the seventh and eighth week. The ingredient composition and chemical composition of the above rations are presented in Tables 1 and 2 respectively

Table 1. Percentage ingredient composition of experimental rations

Sl. No.	Ingredients	Standard broiler ration	
		Starter	Finisher
1.	Yellow maize	44.00	54.00
2.	Groundnut cake	27.00	19 00
3.	Soyabean meal	6.00	7 00
4.	Gingelly oil cake	3 00	-
5.	Unsalted dried fish	8 00	7 00
6.	Rice polish	10.00	11.00
7.	Common salt	0.25	0.25
8.	Mineral mixture[1]	1.75	1 75
	Total	100.00	100 00
Added per 100 kg of feed			
8.	Vitamin mixture (g)[2]	15.00	15.00
9.	Lysine hydrochloride(g)	200.00	100.00
10.	Methionine (g)	100.00	-
11.	Coccidiostat (g)[3]	50.00	50 00
12.	Choline chloride (g)	100.00	100.00
13.	Manganese sulphate (g)	10.00	10.00

1 Mineral mixture composition: Calcium 32 per cent, Phosphorus 6 per cent, Magnesium 1000ppm, Cobalt 60ppm, Zinc 2600ppm, Iron 0.1 per cent, Iodine 100ppm, Copper 100ppm and Manganese 2700ppm.

2. Vitamin mixture composition. Each gram contains. Vitamin A 82,500 IU, Vitamin B_2 50mg, Vitamin D_3 12,000IU and Vitamin K 10mg.

3. Coccidiostat composition: Each gram contains. Maduramicin ammonium 1 per cent w/w

Table 2 Percentage chemical composition of experimental rations (on dry matter basis)

Sl No	Nutrients	Standard broiler ration	
		Starter	Finisher
Analysed values[1]			
1.	Moisture	9 60	9 48
2	Crude protein	23 54	20 35
3	Ether extract	5 87	5 95
4	Crude fibre	5 28	4 96
5	NFE	54 01	57 32
6	Total ash	11 30	11 42
7	Acid insoluble ash	2 46	2 50
8	Calcium	1 40	1 34
9	Phosphorus	0 80	0.73
Calculated Values			
10	ME (kcal/ kg)	2802 00	2904 00
11	Lysine (%)	1 50	1 00
12	Methionine (%)	0 53	0 40
13	Manganese (mg/ kg)	104 00	102 00

1 Average of eight samples

3.1.3 Probiotic

The probiotic used in this study was "Lactosacc", a product manufactured and marketed by M/s Vetcare, Bangalore. Each 500gm of the product contains: Live Yeast culture of specific strain 1026 (Yeasacc 1026) 2450 billion, *Lactobacillus acidophilus* 50,000 million and *Streptococcus faecium* 50,000 million.

3.2 Experimental methods

3.2.1 Housing of birds

The house, feeders, waterers and other equipments were cleaned thoroughly and disinfected prior to housing the chicks. The chicks were weighed and wing banded.

3.2.2 Experimental design

The chicks were randomly divided into twelve groups with twelve chicks in each group. These groups were allotted randomly to three treatments viz. T_1, T_2 and T_3 with four replications in each treatment. The treatments assigned were standard broiler ration (T_1) and two levels of the probiotic viz. 0.025 per cent and 0.05 per cent (T_2 and T_3) respectively The details of the treatment particulars are presented in Table 3

Table 3. Distribution of the different dietary treatments

Treatment	Replication	No.of birds	Probiotic treatment	Level of inclusion (%)
T_1	R1	12	-	
	R2	12	-	
	R3	12	-	-
	R4	12	-	-
T_2	R1	12	Lactosacc	0.025
	R2	12	Lactosacc	0.025
	R3	12	Lactosacc	0.025
	R4	12	Lactosacc	0.025
T_3	R1	12	Lactosacc	0.050
	R2	12	Lactosacc	0.050
	R3	12	Lactosacc	0.050
	R4	12	Lactosacc	0.050

3.2.3 Management

Feed and water were provided *ad libitum* throughout the experiment and the birds were maintained under deep litter system Standard managemental practices were adopted identically to all treatments during the entire experimental period The duration of the experiment was for a period of 56 days from day old

3.2.4 Climatic parameters

The wet and dry bulb thermometer readings were taken at 8 a m and 2 p.m and the maximum and minimum temperature were recorded at 8 a.m on all days throughout the experimental period From this data, weekly mean maximum and minimum temperature and percentage relative humidity were arrived at

3.2.5 Body weight

The body weight of individual birds was recorded at fortnightly intervals from day old to study the pattern of body weight gain under different treatments

3.2.6 Feed consumption

Feed intake of the birds was recorded replication-wise at the end of each week From this data, the average daily feed intake per bird was calculated for various treatment groups

3.2.7 *Feed efficiency*

Feed conversion efficiency (feed consumed (kg) / body weight gain (kg)) was calculated based on the data on body weight gain and feed intake.

3.2.8 *Protein efficiency*

The protein efficiency (protein intake (g) / body weight gain(g)) was calculated based on the data on body weight gain and protein intake.

3.2.9 *Chemical analysis*

The chemical composition of the starter and finisher rations was analysed as per AOAC (1990)

3.2.10 *Serum cholesterol and serum protein*

At the end of eighth week, blood was collected from three males and three females of each treatment and the serum was analysed for total protein (Biuret method) and total cholesterol (CHOD/ POD method) using kits supplied by E Merck (India) limited, and Beacon Diagnostics Private Limited, India, respectively.

3.2.11 *Processing yields*

At the end of the experiment, one male and one female from each replication were randomly selected and sacrificed to study the processing yields as per the procedure described by BIS (1973). Percentages of dressed, giblet and ready-to-cook yields were calculated from the data.

The weights of liver, heart, gizzard, spleen and bursa were also taken. The abdominal fat was separated and weighed as per the procedure described by Health *et al.* (1980) and the percentage of abdominal fat was derived from it

3.2.12 Livability

The mortality of birds from different treatment groups was recorded and post-mortem examination was conducted in each case to find out the cause of the death.

3.2.13 Cost-benefit analysis

Cost of feed, cost of probiotic, live weight produced and quantity of feed consumed by birds in each treatment group were calculated From this data the cost-benefit analysis was worked out

3.2.14 Statistical analysis

Data collected on various parameters were statistically analysed as per the methods described by Snedecor and Cochran (1980)

Results

4. RESULTS

The results of the experiment conducted for a period of eight weeks to evaluate the effect of probiotic supplementation on the performance of broiler chicken are presented in this chapter.

4.1 Climatic parameters

The weekly mean maximum and minimum temperatures and per cent relative humidity during this experiment are presented in Table 4 During the experimental period i.e., from second week of January to second week of March 2001, the mean maximum temperature ranged from 32 7 to 37.1^{0}C and the minimum temperature ranged from 21 4 to 23.9^{0}C The per cent relative humidity in the morning varied from 63 3 to 86 4, while in the afternoon it ranged from 34.0 to 48.0.

4.2 Body weight

Data on mean body weight at fortnightly intervals as influenced by different treatments viz., standard broiler ration (T_1), standard broiler ration with 0.025 per cent probiotic (T_2) and standard broiler ration with 0.05 per cent probiotic (T_3) are charted out on Table 5

Table 4. Mean weekly meterological data during the experimental period

Period (weeks)	Temperature (°C)		Relative Humidity (%)	
	Maximum	Minimum	8 a. m.	2 p. m.
1	32.7	22.6	71.7	36 5
2	33.3	23.4	63.3	35.3
3	32.7	23.9	66.5	43.2
4	33.5	23.6	83.7	47.1
5	34.5	21.4	75.3	34.0
6	35.1	22.9	86.4	44 5
7	34.9	23.7	83.1	47.1
8	37 1	23.7	84.0	48 0
Mean	34.23	23 15	76.75	41 96
SE	0.49	0.27	2.93	1 92

Table 5. Influence of probiotic supplementation on fortnightly mean body weight (g)

Treatment	Age in weeks				
	0	2	4	6	8
T_1 R_1	45.50	236.66	940 42	1564 58	1930.83
R_2	46.25	245.00	936.25	1623 33	2164.54
R_3	46 00	245.00	900.42	1623.50	2085.00
R_4	45 40	245.00	919.17	1645.50	2189.16
Mean	45.78	242.91^{a}	924.06^{a}	1615.73^{a}	2092 38
SE	0 17	1.80	7.90	15.10	50 40
T_2 R_1	45.58	268.33	990.00	1682.50	2025 00
R_2	46.16	252.27	979.54	1758.18	2146.36
R_3	45.40	256.25	984.58	1694.17	2080.83
R_4	46 08	261.66	940.83	1659.17	2080.00
Mean	45.80	259.63^{b}	973 74^{b}	1698.50^{b}	2083.04
SE	0.16	3.00	9 67	18.30	21.49
T_3 R_1	46.58	258.75	940.42	1646.67	2140.50
R_2	45 83	253 75	900.83	1627.08	2034 54
R_3	45 50	254.16	940.45	1682.70	2140.50
R_4	45 50	247.92	932.33	1658 33	2179.17
Mean	45.85	253 64^{b}	928.50^{a}	1653 69^{ab}	2123.67
SE	0.22	1 90	10.70	10 00	26 9
CD	-	9.87	43.12	58 38	-

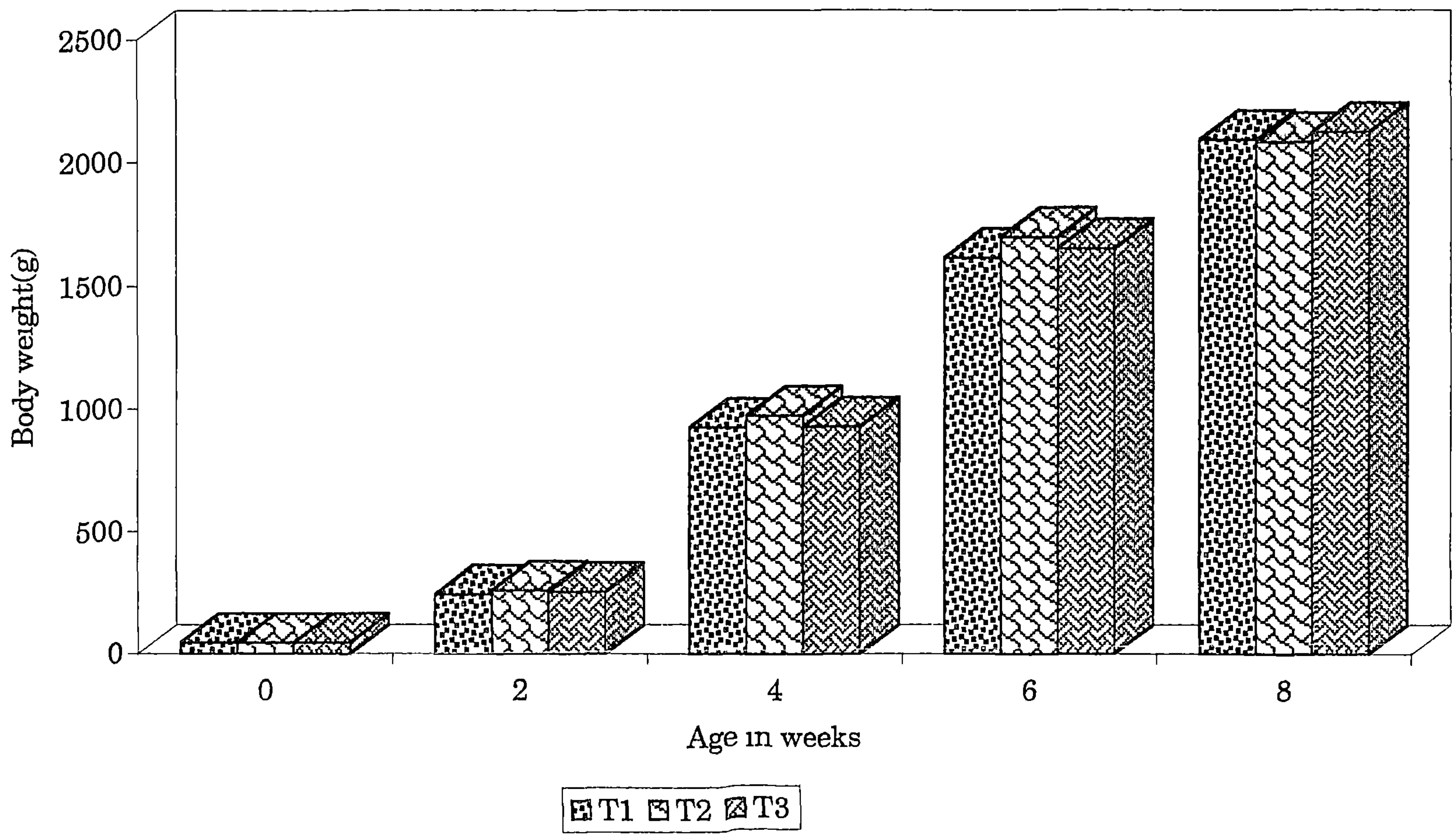
Means bearing the same superscript within the same column do not differ significantly ($P<0$ 05)

The mean body weight of the birds at day old stage recorded with the three treatment groups, T_1, T_2, and T_3, were 45.78, 45.80 and 45 85 g respectively. The statistical analysis given in Table 6 showed no significant difference among the birds of different treatments at the beginning of the experiment at day old stage.

The mean body weights of birds at second week of age were 242.91, 259.63 and 253.64g for the three treatment groups T_1, T_2 and T_3 respectively and the analysis of variance related to this data revealed that there was significant ($P \leq 0.05$) difference between the treatment groups The chicks fed with 0.025 per cent and 0.05 per cent probiotic recorded significantly ($P \leq 0.05$) higher body weight when compared to that of the control group.

At the end of fourth week, the three treatments T_1, T_2 and T_3 recorded a mean body weight of 924.06, 973 74 and 928 50 g respectively. Upon statistical analysis of the data it was found that the birds fed with 0.025 per cent probiotic had significantly ($P \leq 0.05$) higher body weight when compared to both the probiotic supplemented (0.05 per cent) and control groups.

Fig.1 Influence of probiotic supplementation on mean fortnightly body weight



The various treatment groups T_1, T_2 and T_3 recorded a mean body weight of 1615.73, 1698.50 and 1653.69 g respectively at the end of sixth week. Statistical analysis of the data revealed that the birds supplemented with 0.025 per cent probiotic had significantly ($P \leq 0.05$) higher body weight in comparison to control group. Though the 0.05 per cent probiotic fed group had numerically higher body weight than control group, it was not statistically significant. Like wise, six weeks body weights of birds fed 0.025 and 0.05 per cent probiotic were statistically comparable.

The mean body weights of birds at the end of eighth week were 2092.38, 2083.04 and 2123 67 g for the different treatment groups T_1, T_2 and T_3 respectively. Statistical interpretation of the data showed that there was no significant difference between the treatment groups. However the birds supplemented with 0.05 per cent probiotic had numerically higher body weight in comparison to the control and 0.025 per cent probiotic supplemented groups.

The influence of probiotic supplementation in broilers with respect to mean fortnightly body weight are shown in Fig 1.

4.3 Body weight gain

The mean fortnightly body weight gain of chicks during the eight weeks period among different treatment groups are shown in Table 7.

The mean fortnightly body weight gain among the different treatment groups T_1, T_2 and T_3 were 197.12, 213 82 and 207.79 g respectively at the end of second week. Analysis of variance of the data pertaining to the mean fortnightly body weight gain as presented in Table 8, expressed significant difference ($P \leq 0.05$) among the treatment groups at the end of second week Both the probiotic fed groups had significantly higher body weight gain in comparison to the control group of birds.

At the end of fourth week, the three treatment groups T_1, T_2 and T_3 gained 681.15, 714 11 and 674.86 g respectively Statistical interpretation of the data revealed that the 0.025 per cent probiotic supplemented group had significantly ($P \leq 0\ 05$) higher body weight gain when compared to the control group and 0.05 per cent probiotic fed group.

Table 7 Influence of probiotic supplementation on fortnightly mean body weight gain (g)

Treatment	Age in weeks			
	2	4	6	8
T_1 R_1	191 16	703 75	624 17	366 25
R_2	198 75	691 25	687.08	541.21
R_3	199 00	655 42	732.08	452 50
R_4	199.58	674.17	723.33	546.67
Mean	197.12[a]	681.15[a]	691.67	476.66[a]
SE	1 72	9.09	21.23	36 94
T_2 R_1	222 75	721 67	692 50	342 50
R_2	206.11	727.27	778.60	388 18
R_3	210 83	728.33	709.59	386.67
R_4	215.58	679.17	718.33	420.83
Mean	213.82[b]	714 11[b]	724 76	384 55[b]
SE	3 07	10 16	16.20	13.92
T_3 R_1	212 17	681.67	706.25	493 83
R_2	207.92	647.08	726 25	407 46
R_3	208.67	686.29	742.25	457 80
R_4	202 42	684.41	726.00	520 83
Mean	207.79[b]	674 86[a]	725 19	469 98[a]
SE	1 74	8.06	6.38	21 23
CD	9 90	27 40	-	57 50

Means bearing the same superscript within the same column do not differ significantly ($P < 0.05$)

Table 8 Influence of probiotic supplementation on fortnightly mean body weight gain – ANOVA

Week	Source	df	SS	MSS	F value
2	Treatment	2	6922 98	3461.49	5.87*
	Error	140	82472.11	589 08	
	Total	142	89395.09		
4	Treatment	2	40395 59	20197 79	4 38*
	Error	139	645140.91	4608.15	
	Total	141	685536.50		
6	Treatment	2	33912.17	16956 08	0 90^{NS}
	Error	138	2486424.13	18017.57	
	Total	140	252033 63		
8	Treatment	2	243451.65	121725 83	6 00*
	Error	134	2715849 49	20267 53	
	Total	136	2959301.14		

* Significant (P < 0 05)

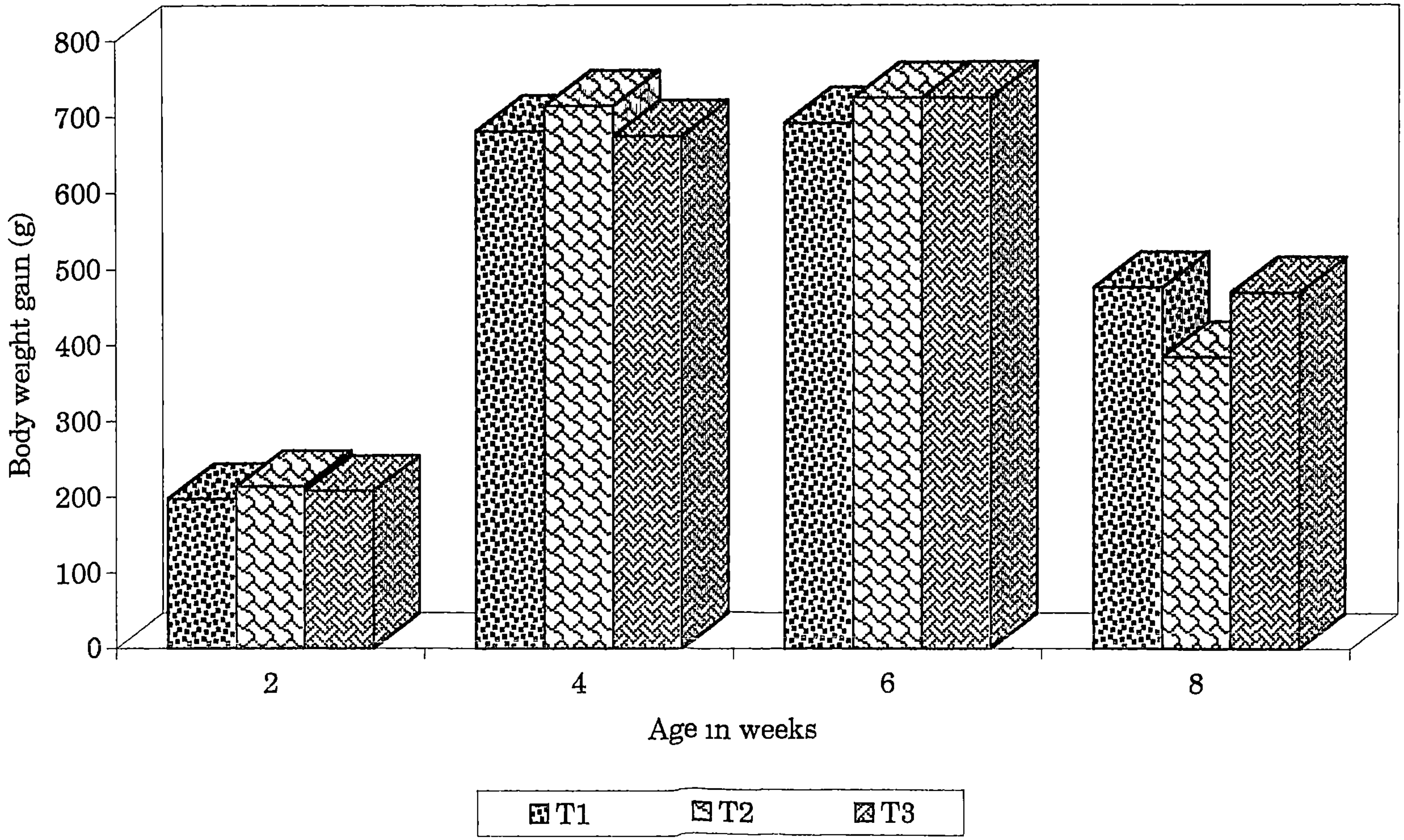
NS Not significant

The different treatment groups, T_1, T_2 and T_3 recorded a body weight gain of 691.67, 724.76 and 725.19 g respectively at the end of sixth week. The results of the statistical analysis of the data showed that there was no significant difference among the various treatment groups. But, the birds supplemented with 0.025 and 0.05 per cent probiotic had numerically higher body weight gain in comparison to control. The cumulative mean body weight gain upto the end of sixth week was 1569.94, 1652.68 and 1607.85 g for the treatments T_1, T_2 and T_3 respectively as shown in Table 13. Statistical analysis of the data as shown in Table 14 revealed that the 0.025 per cent probiotic fed group had significantly higher body weight gain when compared to that of the control and 0.05 per cent probiotic fed groups.

The mean body weight gain among the treatments, T_1, T_2 and T_3 at the end of eighth week were 476.66, 384.55 and 469.98g respectively. Upon statistical analysis it was found that the 0.025 per cent probiotic fed group had significantly ($P \leq 0.05$) lower body weight gain when compared to the other two groups. The cumulative mean body weight gain upto the end of eighth week was 2046.59, 2037.23 and 2077.83 g as shown in Table 13 for T_1, T_2 and T_3 respectively. The statistical interpretation of the data as presented in Table 14 showed that there was no significant difference between the treatments

The mean fortnightly body weight gain of birds for the different treatment groups is pictured in Fig.2.

Fig.2 Influence of probiotic supplementation on mean fortnightly body weight gain



4.4 Feed consumption

The mean daily feed intake per bird during each weeks period among different treatment groups are given in Table 9

The mean daily feed intake per bird among the three treatment groups, T_1, T_2 and T_3 were 18 32, 18 54 and 18 29g at first week and it was found that there was no statistical significance with respect to feed intake among the treatment groups during this period, as shown in Table 10

At second week, the mean daily feed intake per bird was 32.90, 33 75 and 34 20 g for the treatments T_1, T_2 and T_3 respectively In this case also the feed intake was not statistically different between the treatment groups However, numerically higher feed consumption among the birds supplemented with 0.025 and 0 05 per cent probiotic over the birds fed with standard broiler ration could be observed

In the three treatment groups, T_1, T_2 and T_3 birds consumed 56 28, 58.55 and 56.20 g of feed respectively per bird daily at third week and there was no significant difference between the treatments. The birds fed with 0 025 per cent probiotic had numerically higher feed intake in comparison to that of the 0 05 per cent probiotic fed group and the control group

Table 9. Influence of probiotic supplementation on weekly feed consumption (g)

	Age in weeks							
Treatments	1	2	3	4	5	6	7	8
T_1 R_1	18.28	31 20	60 14	119 00	132 80	142 10	150 10	152.00
R_2	18 14	32 80	55.20	114.90	129.00	139 50	153 50	158 20
R_3	18.45	34 20	56.30	115 30	130 50	140 08	152 20	157.30
R_4	18.40	33.40	53.50	112.80	129.90	139.90	154 20	168.80
Mean ± SE	18.32 ±0.05	32 90 ±0.50	56 28 ±1.20	115.50 ±1.10	130 55 ±0 70	140.39 ±0 50	152.50 ±0 70	159.07 ±3 04
T_2 R_1	18.88	34.20	58.00	117.00	129.10	135.10	150 20	152 00
R_2	18.69	31 20	58.20	117.30	135.80	140 20	152 10	154 20
R_3	18.50	34.10	59.50	118.10	134.20	139 10	150.51	152.80
R_4	18.10	35 50	58 50	117 10	132 10	138 10	150 51	152 60
Mean ± SE	18.54 ±0 10	33.75 ±0.70	58.55 ±0.28	117 37 ±0.20	132.80 ±1.20	138 12 ±0.90	150.82 ±0 37	152.90 ±0 40
T_3 R_1	18 07	34.00	59.20	118.50	132 80	137.90	154 00	157 30
R_2	18.30	34 20	56 30	115 50	130 50	136 20	145 10	150.20
R_3	18 09	34 60	50 50	119 00	125.20	130 90	145 90	148 90
R_4	18 71	34 00	58 80	117 90	132 50	138 30	154 00	157 80
Mean ± SE	18.29 ±0.10	34.20 ±0 10	56 20 ±1.70	117 70 ±0.60	130 25 ±1 50	135 82 ±1.50	149 75 ±2.10	153 55 ±2 01

Table 10. Influence of probiotic supplementation on weekly feed consumption (g) – ANOVA

Age in weekly	Source	df	SS	MSS	F
1	Treatment	2	0.15	0.075	1 04^{NS}
	Error	9	0.65	0 072	
	Total	11	0.80		
2	Treatment	2	3 49	1.745	1 05^{NS}
	Error	9	14 97	1 66	
	Total	11	18 46		
3	Treatment	2	14 213	7 107	0 872^{NS}
	Error	9	73.385	8 154	
	Total	11	87.598		
4	Treatment	2	11.465	5.73	1 85^{NS}
	Error	9	27.89	3 098	
	Total	11	39.36		
5	Treatment	2	15.540	7 770	0 997^{NS}
	Error	9	70.160	7.796	
	Total	11	85 700		
6	Treatment	2	41 770	20 885	3 527^{NS}
	Error	9	53 287	5 921	
	Total	11	95.058		
7	Treatment	2	15 365	7 682	0 818^{NS}
	Error	9	84 537	9 393	
	Total	11	99 902		
8	Treatment	2	92 105	46 05	1 92^{NS}
	Error	9	216 118	24 013	
	Total	11	308 223		

NS Not significant

The mean daily feed intake among the treatments, T_1, T_2 and T_3 at fourth week were 115.50, 117.37 and 117.70 g respectively. Though the feed intake was not statistically significant between the different treatments, the 0.025 and 0.05 per cent probiotic fed group consumed numerically higher feed than the control group.

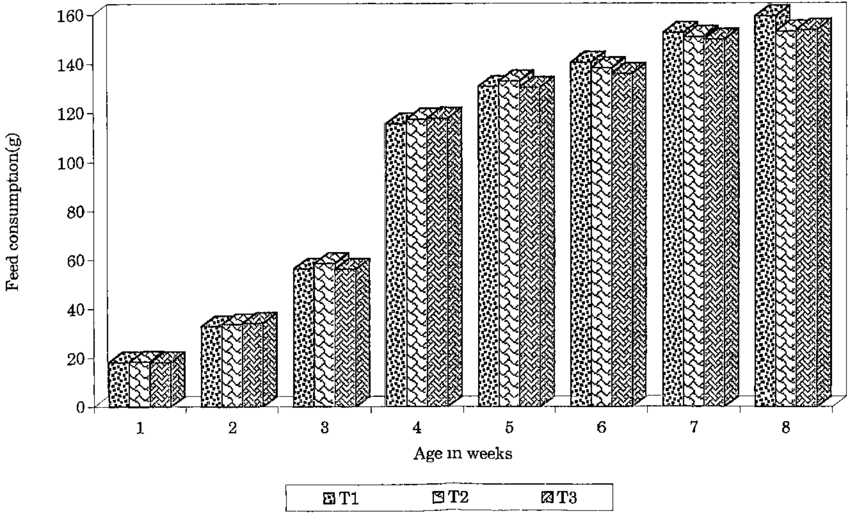
At fifth week, the various treatments, T_1, T_2 and T_3 recorded a mean daily feed intake of 130.55, 132.80 and 130.25 g respectively. Statistical analysis of the data revealed that there was no significant difference but, the birds supplemented with 0.025 per cent probiotic had numerically higher feed intake than the other two groups.

The various treatment groups, T_1, T_2 and T_3 showed a mean daily feed consumption of 140.39, 138.12 and 135.82 g respectively at sixth week. Upon statistical analysis it was found that the treatments were not significantly different with respect to feed intake and that numerically higher feed consumption was recorded among the control group when compared to both the probiotic fed groups. The cumulative feed intake upto sixth week was 3 45, 3.49 and 3.44 kg for the treatments T_1, T_2 and T_3 respectively, as shown in Table 13. Statistical analysis as shown in Table 14 revealed that there was no significant difference between the treatments.

The mean daily feed intake was 152.50, 150.82 and 149.75 g for the treatments, T_1, T_2 and T_3 respectively at seventh week. Though no

upto eighth week as shown in Table 13 was 5.64, 5.61 and 5.56 kg respectively for treatments T_1, T_2 and T_3. The statistical anlaysis in Table 14 showed that there was no significant difference between the treatments with respect to the mean

Fig.3 Influence of probiotic supplementation on mean daily feed consumption



4.5 Feed efficiency

The data on fortnightly feed efficiency (FE) among different treatment groups are set out in Table 11.

The mean feed efficiency among the treatment groups, T_1, T_2 and T_3 at the end of second week were 1.16, 1.10 and 1.15 respectively The results of statistical analysis of the data are presented in Table 12 It was found that the 0.025 per cent probiotic fed group had significantly ($P < 0.01$) better FE when compared to control and 0.05 per cent probiotic fed groups.

At the end of fourth week the mean fortnightly FE were 1.18, 1.15 and 1.22 for the treatments, T_1, T_2 and T_3 respectively. Statistical analysis of the data revealed that the 0.05 per cent probiotic fed group had significantly ($P < 0.05$) inferior FE when compared to the other two groups.

The various treatments, T_1, T_2 and T_3 recorded a mean FE of 1 43, 1.33 and 1.31 at the end of sixth week respectively. Statistical interpretation of the data revealed that the FE was not significantly different between the treatment groups. But, both the probiotic fed groups recorded numerically better feed efficiency value than control. The cumulative FE upto six weeks of age for T_1, T_2 and T_3 were 2.20, 2 10 and 2 13 respectively as shown in Table 13 and their statistical analysis as given in Table 14 revealed that there was no significant difference between the treatments

Table 11. Influence of probiotic supplementation on fortnightly mean feed efficiency

Treatment	Age in weeks			
	2	4	6	8
T_1 R_1	1.14	1.18	1.59	2 90
R_2	1 15	1 16	1.42	2 04
R_3	1 20	1.23	1.34	2.43
R_4	1.17	1.17	1.35	2 16
Mean	1.16^{a}	$1\ 18^{a}$	1.43^{a}	$2\ 38^{a}$
SE	0 01	0 01	0 05	0 16
T_2 R_1	1.07	1 13	1.36	3.10
R_2	1.05	1.12	1.26	2 78
R_3	1.13	1 14	1.37	2.76
R_4	1 15	1.20	1.34	2.54
Mean	1.10^{b}	$1\ 15^{a}$	$1\ 33^{a}$	$2\ 79^{a}$
SE	0.01	0 01	0.02	0.09
T_3 R_1	1.12	1.21	1 37	2 22
R_2	1.15	1.24	1 31	2 58
R_3	1 16	1.21	1 23	2 27
R_4	1 17	1 22	1 33	2 12
Mean	1.15^{a}	$1\ 22^{b}$	$1\ 31^{a}$	2.29^{a}
SE	0.009	0 006	0 02	0 08
CD	0 04	0 04	-	-

Means bearing the same superscript within the same column do not differ significantly ($P < 0\ 05$)

Table 12. Influence of probiotic supplementation on fortnightly mean feed efficiency – ANOVA

Week	Source	df	SS	MSS	F value
2	Treatment	2	0.013	0.006	8.5**
	Error	9	0 007	0.0007	
	Total	11	0.019		
4	Treatment	2	0 011	0.005	6.25*
	Error	9	0.007	0.0008	
	Total	11	0.018		
6	Treatment	2	0.030	0.015	2.50NS
	Error	9	0 058	0.006	
	Total	11	0 088		
8	Treatment	2	0.542	0.27	3.30NS
	Error	9	0.736	0.08	
	Total	11	0 278		

** Highly significant (P < 0.01)

* Significant (P < 0 05)

NS Not significant

Table 13. Influence of probiotic supplementation on production performance at six and eight weeks of age

Treatments	Initial body weight (g)	Upto six weeks			Upto eight weeks		
		Body weight gain (g)	Total feed consumption (kg)	Cumulative FE	Body weight gain (g)	Total feed consumption (kg)	Cumulative FE
T_1 R_1	45.50	1519.08	3.52	2.32	1885.33	5.64	2.99
R_2	46 25	1577 08	3 43	2.18	2118 29	5 61	2 65
R_3	46.00	1586 50	3.46	2.18	2039 00	5.63	2 76
R_4	45.40	1597.08	3 42	2.14	2143.75	5.68	2 65
Mean	45.78	1569 94[a]	3.45	2.20	2046.59	5.64	2.76
SE	0 17	15.10	0 01	0.03	50 40	0.01	0.06
T_2 R_1	45.58	1636.92	3.44	2 10	1979.42	5 56	2 80
R_2	46.16	1711.98	3.50	2.04	2100.16	5 65	2.69
R_3	45.40	1648.75	3 52	2.13	2035 42	5 64	2 77
R_4	46 00	1613 08	3 49	2.16	2033.91	5 61	2.75
Mean	45.80	1652.68[b]	3.49	2.10	2037.23	5 61	2.75
SE	0 16	18.13	0.01	0.02	20.88	0.01	0 02
T_3 R_1	46 58	1600.09	3 50	2 18	2093.92	5 68	2.71
R_2	45.83	1581 25	3.43	2 16	1988.71	5 50	2.76
R_3	45.50	1637.21	3 34	2 04	2095 01	5 41	2 58
R_4	45.50	1612 83	3 50	2.17	2133 66	5.68	2 66
Mean	45 85	1607 85[ab]	3 44	2 13	2077.83	5 56	2.67
SE	0.22	10.16	0 03	0.02	26 94	0 05	0 03
Grand Mean	45 81	1610 40	3 46	2 14	2054 13	5 60	2 72
SE	0 01	13 72	0 01	0.02	20 89	0 01	0 02
CD	-	54 97	-	-	-	-	-

Means bearing the same superscript within the same column do not differ significantly ($P < 0\ 05$)

Table 14. Influence of probiotic supplementation on production performance at six and eight weeks of age – ANOVA

Parameter	Source	df	SS	MSS	F value
Body weight gain					
Upto six weeks	Treatment	2	13726 28	6863.14	5.79*
	Error	9	10651 60	1183 51	
	Total	11	24377 88		
Upto eight weeks	Treatment	2	3615 10	1807 55	0 20^{NS}
	Error	9	59573 24	6619.25	
	Total	11	63188 34		
Feed consumption					
Upto six weeks	Treatment	2	0.004	0.002	1 00^{NS}
	Error	9	0.026	0.002	
	Total	11	0 03		
Upto eight weeks	Treatment	2	0 01	0 005	0 80^{NS}
	Error	9	0 06	0 006	
	Total	11	0 07		
Feed efficiency					
Upto six weeks	Treatment	2	0 02	0 01	2 50^{NS}
	Error	9	0 04	0 004	
	Total	11	0 06		
Upto eight weeks	Treatment	2	0 02	0 01	1 00^{NS}
	Error	9	0 11	0 01	
	Total	11	0 12		

* Significant (P<0 05)
NS Not significant

The mean fortnightly FE among the treatment groups, T_1, T_2 and T_3 were 2.38, 2.79 and 2 29 respectively at the end of eighth week. No statistical significance was observed between the treatment groups with respect to feed efficiency It was observed that the 0.025 per cent probiotic supplemented and control groups recorded numerically poorer FE at the end of eight week when compared to 0 05 per cent probiotic fed group The cumulative FE upto eighth week as shown in Table 13 for T_1, T_2 and T_3 were 2 76, 2 75 and 2 67 respectively and their statistical analysis presented in Table 14 revealed that there was no significant difference between the treatments

The FE for different dietary treatment groups during the eight weeks period is depicted in Fig.4

4.6 Protein efficiency

The data on fortnightly protein efficiency among different treatment groups are presented in Table 15

The mean fortnightly protein efficiency among the treatment groups, T_1, T_2 and T_3 were 1 40, 1 36 and 1.38 respectively at the end of second week. The results of statistical analysis of the data are presented in Table 16. The protein efficiency was not statistically significant throughout the experimental period. The control group of birds recorded numerically higher protein efficiency value when compared to both the probiotic supplemented groups.

Fig.4 Influence of probiotic supplementation on mean fortnightly feed efficiency

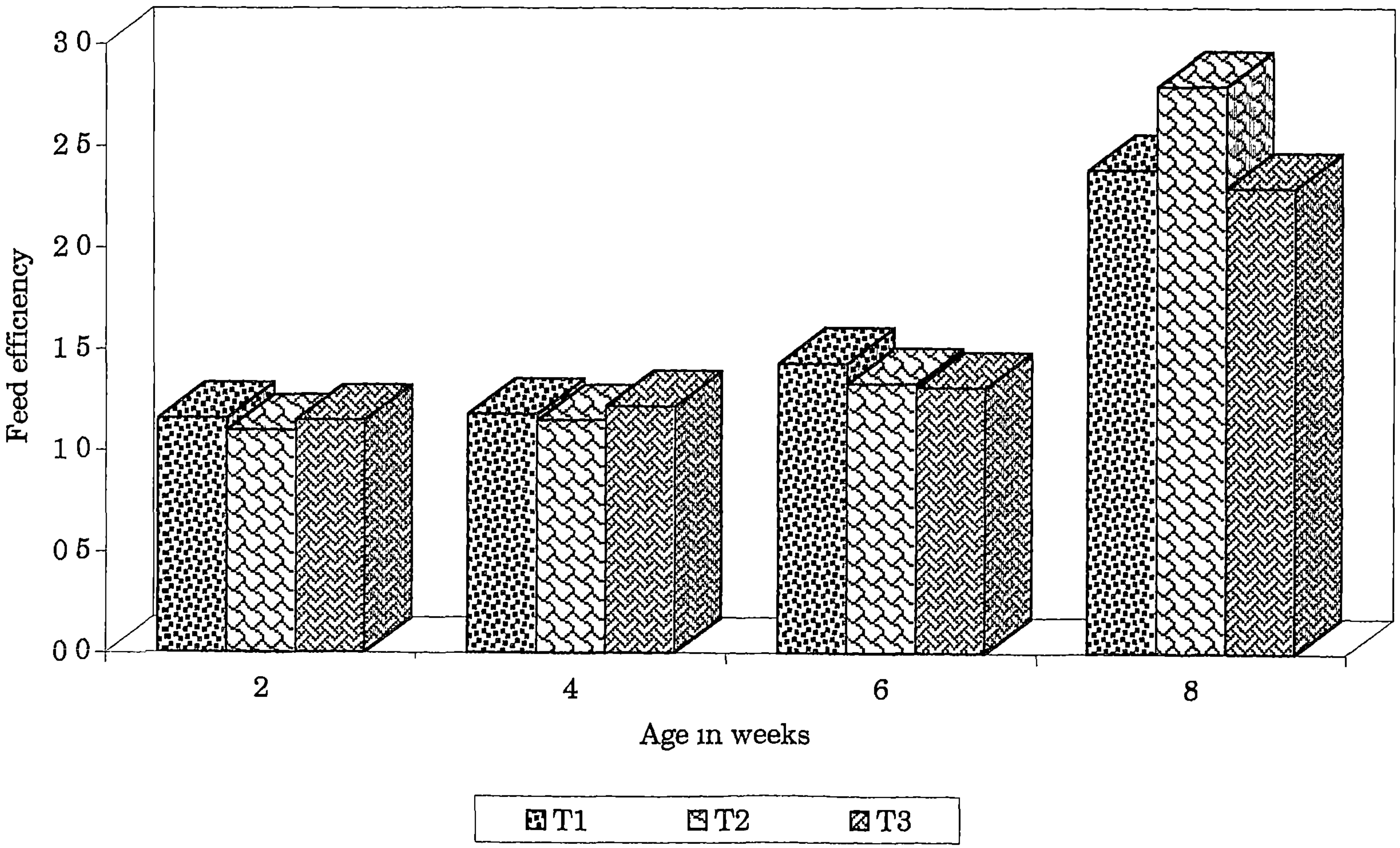


Table 15. Influence of probiotic supplementation on fortnightly mean protein efficiency

Treatment	Age in weeks			
	2	4	6	8
T_1 R_1	1 38	1.4	1.93	3.05
R_2	1 39	1 41	1.72	2 24
R_3	1 45	1 49	1 62	2 56
R_4	1.41	1.42	1 62	2.29
Mean±SE	1.40±0.01	1.43±0 01	1.72±0.06	2.53±0.16
T_2 R_1	1 30	1.37	1.65	3 27
R_2	1 40	1.43	1 46	2.92
R_3	1.37	1.37	1 54	2 91
R_4	1.39	1.46	1.63	2.67
Mean±SE	1.36±0 01	1 40±0 01	1 57±0 03	2.94±0.10
T_3 R_1	1.36	1 41	1 73	2 29
R_2	1 39	1 48	1 61	2.81
R_3	1 40	1 45	1.53	2 39
R_4	1 39	1 42	1 66	2 23
Mean±SE	1 38±0 007	1.44±0 01	1 63±0 03	2 43±0 11

Table 16. Influence of probiotic supplementation fortnightly mean protein efficiency- ANOVA

Week	Source	df	SS	MSS	F value
2	Treatment	2	0 003	0 0015	1 50NS
	Error	9	0.011	0.001	
	Total	11	0 014		
4	Treatment	2	0.002	0.001	0 60NS
	Error	9	0.014	0.0015	
	Total	11	0.016		
6	Treatment	2	0.047	0.023	1 99NS
	Error	9	0.108	0 012	
	Total	11	0 156		
8	Treatment	2	0 587	0 293	3 29NS
	Error	9	0 802	0.089	
	Total	11	1 389		

NS Not significant

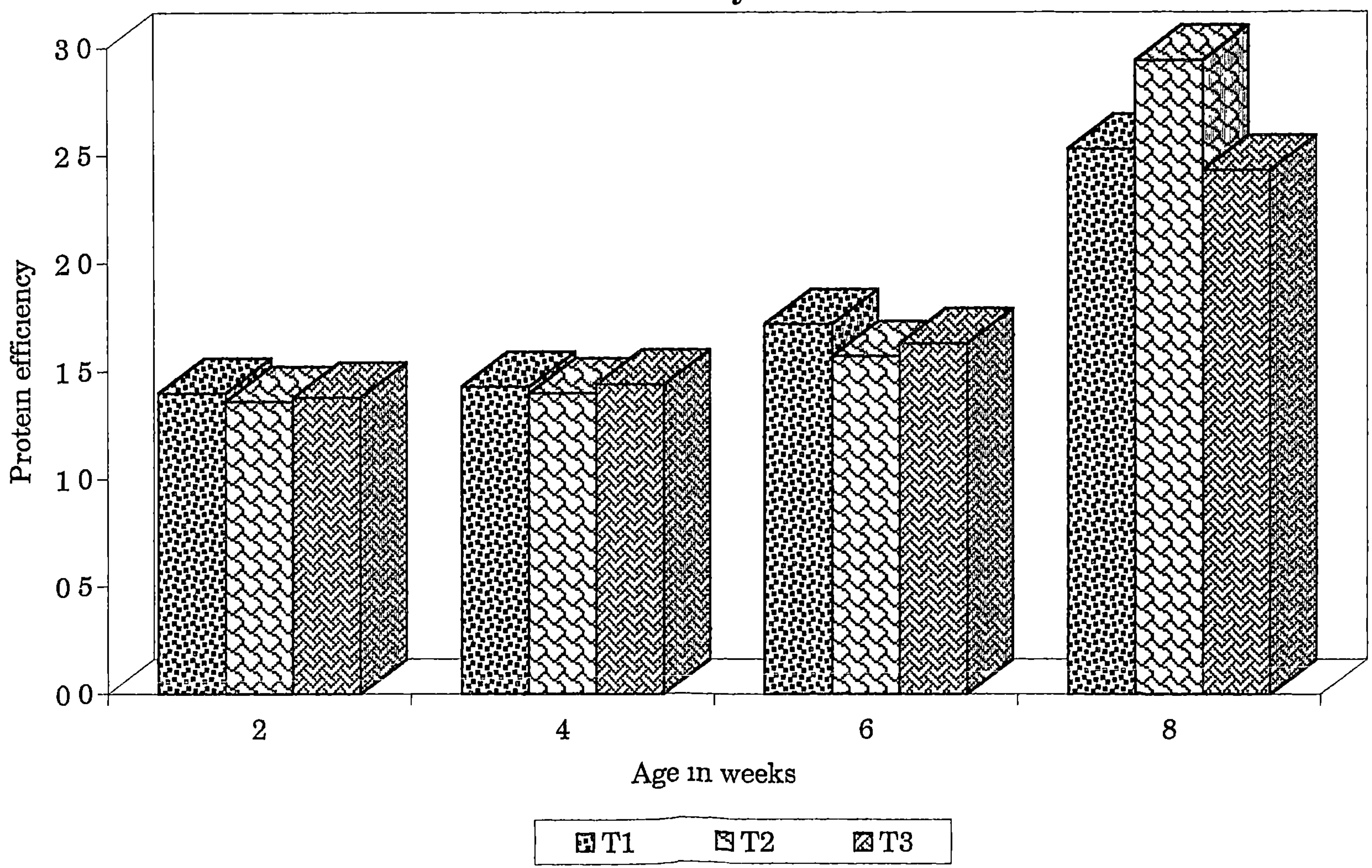
At the end of fourth week, the mean protein efficiency was 1.43, 1.40 and 1.44 for the treatment groups, T_1, T_2 and T_3 respectively A numerically better protein efficiency value was recorded with both the 0 05 per cent probiotic supplemented and control groups in comparison to 0 025 per cent probiotic fed group, which was not statistically significant

The various treatments, T_1, T_2 and T_3 recorded a mean protein efficiency of 1.72, 1.57 and 1 63 respectively at the end of sixth week Though there was no statistical significance, the control and 0 05 per cent probiotic fed groups showed numerically higher protein efficiency value than 0.025 per cent probiotic supplemented group

The mean protein efficiency at the end of eighth week for the treatments, T_1, T_2 and T_3 were 2.53, 2.94 and 2.43 respectively. It was found that the 0.025 per cent probiotic fed group had numerically higher protein efficiency value when compared to the other two groups, but the difference was not statistically significant.

The protein efficiency for different dietary treatment groups during the eight weeks period is depicted in Fig.5

Fig.5 Influence of probiotic supplementation on mean fortnightly protein efficiency



4.7 Serum cholesterol and serum protein

The mean serum cholesterol and protem as influenced by dietary supplementation of probiotic m broilers is presented in Table 17 and its statistical analysis in Table 18.

Mean serum cholesterol for the treatments, T_1, T_2 and T_3 were 125.93, 95.07 and 59.44mg per cent in males and 104.52, 79 08 and 31 54 mg per cent in females Higher serum cholesterol was noticed with birds fed standard broiler ration (T_1) and those offered probiotic (T_2 and T_3) recorded lower values.

Statistical analysis of the mean serum cholesterol also confirmed this trend. Birds fed with standard broiler ration exhibited significantly higher values ($P \leq 0\ 01$), whereas birds supplemented with probiotic recorded significantly ($P \leq 0\ 01$) lower values. The 0 05 per cent probiotic supplemented group of birds recorded significantly ($P \leq 0\ 01$) lower serum cholesterol levels compared to those supplemented with 0 025 per cent probiotic Similarly, the sex also had significant influence on mean serum cholesterol The females had significantly ($P \leq 0\ 01$) lower cholesterol than males.

Table 17. Influence of probiotic supplementation on serum cholesterol and serum protein

Serum cholesterol		T_1	T_2	T_3
Male	R_1	137 60	100 30	65 56
	R_2	120.60	89.60	60 51
	R_3	119 60	95 30	52 25
Mean ± SE		$125\ 93^{a} \pm 4\ 70$	$95\ 07^{b} \pm 2\ 50$	$59\ 44^{c} \pm 3\ 20$
Female	R_1	105 37	65.59	28.67
	R_2	104.30	85 66	34.76
	R_3	103 89	86 01	31.18
Mean ± SE		$104\ 52^{A} \pm 0.36$	$79\ 08^{B} \pm 5\ 60$	$31\ 54^{C} \pm 1\ 40$
CD		13 04	13.04	13.04
Serum protein		T_1	T_2	T_3
Male	R_1	4 23	4 30	4 28
	R_2	4.08	4 25	4 02
	R_3	4 18	4 36	4 16
Mean ± SE		4 16± 0 03	4 30± 0 02	4 15± 0 06
Female	R_1	4 18	4 50	4 27
	R_2	4 20	4 25	4 12
	R_3	4 25	4 22	4 20
Mean ± SE		4 21± 0 01	4 32 ± 0 07	4 19 ± 0 03

Means bearing the same superscript within the same column do not differ significantly ($P<0\ 01$)

Table 18 Influence of probiotic supplementation on serum cholesterol and serum protein – ANOVA

Source	df	SS	MSS	F
Serum cholesterol				
Treatment	2	14770 976	7385 488	137 320**
Sex	1	2132 023	2132 023	39 641**
Interaction	2	106 851	53 426	0 993NS
Error	12	645 395	53 783	-
Total	17	17655 245	-	-
Serum Protein				
Treatment	2	0 070	0 035	3 720NS
Sex	1	0.006	0 006	0.638NS
Interaction	2	0 002	0 0007	-
Error	12	0.113	0 009	-
Total	17	0.190	-	-

** Highly significant (P<0 01)

NS Not significant

Fig.6 Influence of probiotic supplementation on mean serum cholesterol

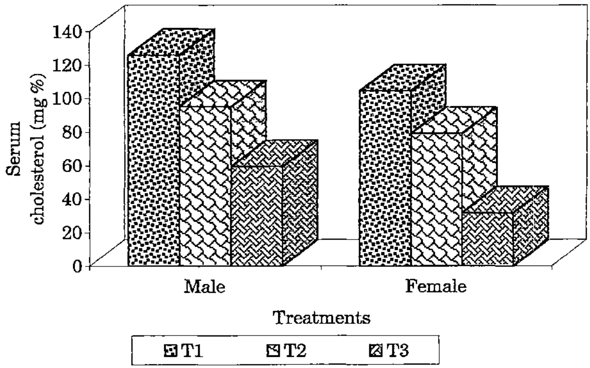
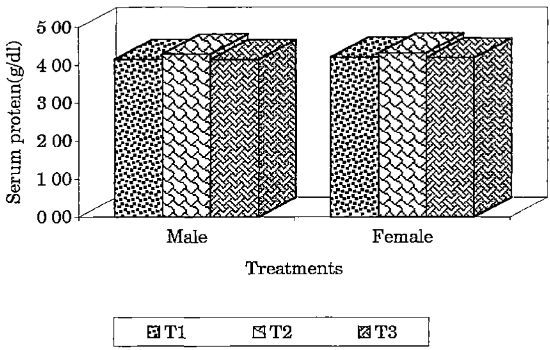


Fig.7 Influence of probiotic supplementation on mean serum protein



The mean serum protein level for the treatments T_1, T_2 and T_3 at eight weeks of age were 4.16, 4.30 and 4.15g/dl in males and 4.21, 4.32 and 4.19 g/dl in females respectively. The 0 025 per cent probiotic supplemented group had numerically higher serum protein when compared to that of control and 0 05 per cent probiotic supplemented groups The statistical analysis of the data showed no significant difference between both the treatments and the sex

The mean serum cholesterol and protein as influenced by dietary supplementation of probiotic is depicted in Fig.6 and Fig 7 respectively.

4.8 Processing yields

The data on dressed and ready-to-cook yields as influenced by probiotic supplementation are presented in Table 19. The mean percentage dressed yield was 86.02, 87 58 and 86 52 in males and 88 49, 88.59 and 86.60in females and the mean percentage ready-to-cook yield was 73 98, 73 87 and 72.77 in males and 74 44, 72 56 and 71 81 in females among treatment groups, T_1, T_2 and T_3 respectively Statistical analysis of the data (Table 21) did not reveal any significant difference either between treatments or sex for both the parameters

Table 19. Influence of probiotic supplementation on dressed yield and ready-to-cook yield

Treatment	Male		Female	
	Dressed yield	Ready-to-cook yield	Dressed yield	Ready-to-cook yield
T_1 R_1	84.90	74.88	89.47	76 84
R_2	85.28	72.07	84.95	73.27
R_3	86.40	76.08	88.88	73.43
R_4	87.50	72.92	90.66	74.22
Mean±SE	86.02±0.50	73.98±0.79	88 49±1.07	74.44±0 70
T_2 R_1	94.76	79.68	91.11	73.00
R_2	85.83	73.46	90.52	76.94
R_3	85.20	72.43	86.28	70.28
R_4	84.55	69.92	86 48	70.05
Mean±SE	87.58±2.08	73.87±1.70	88.59±1.10	72 56±1.38
T_3 R_1	85 83	72 75	87.00	69.90
R_2	87 55	74 65	87 57	73 01
R_3	83.92	68 75	89 36	74 35
R_4	88.80	74.96	82 52	70.00
Mean±SE	86.52±0.90	72.77±1.20	86 60±1 20	71.81±0.96

The mean percentage giblet yield and abdominal fat values are presented in Table 20. The percentage giblet yield was 3.51, 3.43 and 3.80 in males and 3.77, 3.60 and 3.26 in females and the abdominal fat yield was 1.40, 0.87 and 1.37 in males and 1 96, 1.57 and 1.52 in females among treatment groups, T_1, T_2 and T_3 respectively. The data were subjected to statistical analysis and is presented in Table 22. It revealed no significant difference between treatments in both percentage giblet and abdominal fat yields. Eventhough the sex had no significant influence on giblet and abdominal fat yields the females had numerically higher percentage of fat than males.

The data on weights of liver, heart, gizzard, bursa and spleen are presented in Table 23. The mean percentage of weights of liver was 1.66, 1 44 and 1.48 in males and 1.59, 1.46 and 1.37 in females respectively for the treatments, T_1, T_2 and T_3. The mean percentage organ weights of heart, gizzard, spleen and bursa among the treatments, T_1, T_2 and T_3 were 0.38, 0.44 and 0 45; 1.45, 1.54 and 1.86, 0.10, 0.08 and 0 10 and 0.06, 0 07 and 0.07 respectively in males and 0 43, 0 49 and 0 45, 1 74, 1 63 and 1.42, 0 12, 0.16 and 0.10 and 0 14, 0 16 and 0 15 respectively in females Statistical analysis of the data as presented in Table 24 and Table 25 did not reveal any significant difference between treatments for all of the organ weights. The sex also had no significant influence on the organ weights except for bursa. The bursa weighed significantly ($P \leq 0.01$) more in females than males

Table 20. Influence of probiotic supplementation on giblet yield and abdominal fat (%)

Treatment	Male		Female	
	Giblet	Fat	Giblet	Fat
T_1 R_1	3.83	2.64	4 20	2.10
R_2	3 69	0.45	3 80	2 21
R_3	3.20	1.68	3.53	2.22
R_4	3 33	0.83	3 55	1.33
Mean±SE	3.51±0.10	1.40±0.40	3.77±0.10	1.96±0.18
T_2 R_1	3.14	1.15	3.44	0 66
R_2	3.71	0.58	4 31	4 20
R_3	3.47	1.10	3 42	0.57
R_4	3 41	0.65	3.24	0 86
Mean±SE	3.43±0.10	0.87±0 10	3 60±0 20	1 57±0.76
T_3 R_1	3.33	0.25	3 00	0.90
R_2	4 05	1.47	3 43	2.13
R_3	4.46	1.78	2.84	1.89
R_4	3 36	2 00	3 78	1.16
Mean±SE	3.80±0.20	1.37±0.30	3.26±0 18	1.52±0.25

Table 21. Influence of probiotic supplementation on dressed yield and ready-to-cook yield – ANOVA

Source	Dressed yield				Ready-to-cook yield			
	df	SS	MSS	F	df	SS	MSS	F
Treatment	2	9.30	4.65	0.55^{NS}	2	14.71	7.35	0.94^{NS}
Sex	1	8 49	8.49	$1\ 01^{NS}$	1	2.19	2.19	0.28^{NS}
Interaction	2	5 77	2 88	$0\ 34^{NS}$	2	3 48	1 74	$0\ 22^{NS}$
Error	18	150.68	8 37	-	18	139 97	7.77	-
Total	23	174 24	-	-	23	160.35	-	-

NS Not significant

Table 22. Influence of probiotic supplementation on giblet yield and abdominal fat – ANOVA

Source	Giblet				Fat			
	df	SS	MSS	F	df	SS	MSS	F
Treatment	2	0.07	0 03	0.18^{NS}	2	0.85	0 43	$0\ 48^{NS}$
Sex	1	0.004	0 004	$0\ 02^{NS}$	1	1.33	1 33	1.52^{NS}
Interaction	2	0.77	0.38	$2\ 40^{NS}$	2	0.34	0.17	0.19^{NS}
Error	18	2.86	0.16	-	18	15.75	0.88	-
Total	23	3 70	-	-	23	18.27	-	-

NS Not significant

Table 23 Influence of probiotic supplementation on weights of liver, heart, gizzard, spleen and bursa

Treatment	Liver	Heart	Gizzard	Spleen	Bursa
Male					
T_1 R_1	1.91	0.36	1.55	0 09	0.04
R_2	1.58	0 45	1.66	0.07	0.03
R_3	1 52	0.32	1.36	0 16	0 16
R_4	1 66	0 42	1.25	0 08	0 04
Mean± SE	1.66±0.07	0.38± 0.02	1.45± 0.07	0.10± 0.02	0.06^{a}± 0 02
T_2 R_1	1 36	0.52	1.25	0 10	0.10
R_2	1 45	0 42	1.83	0 08	0 08
R_3	1.65	0 34	1.47	0.08	0 08
R_4	1 30	0 48	1.62	0 08	0 04
Mean± SE	1.44± 0.06	0.44± 0.03	1.54± 0.10	0.08± 0.004	$0\ 07^{a}$± 0.01
T_3 R_1	1.42	0 42	1.50	0.16	0.04
R_2	1.47	0.46	2.11	0.09	0 09
R_3	1.52	0.54	2.40	0.08	0 08
R_4	1.52	0.40	1.44	0 08	0 08
Mean± SE	1.48± 0.02	0.45± 0.02	1.86± 0.20	0.10± 0.02	0.07^{a}±0.009
Female					
T_1 R_1	1.89	0 42	1.89	0.10	0.10
R_2	1.59	0.44	1.76	0 08	0 08
R_3	1.31	0 50	1.71	0 20	0 20
R_4	1.60	0.35	1.60	0.08	0 17
Mean± SE	1.59± 0.10	0.43± 0.02	1.74± 0.05	0.12± 0 02	$0\ 14^{b}$± 0.02
T_2 R_1	1 44	0 55	1 44	0 11	0.11
R_2	1 78	0 42	2 10	0.10	0 10
R_3	1.14	0 57	1.71	0 23	0.34
R_4	1 51	0 43	1 29	0 22	0 10
Mean± SE	1.46± 0 11	0 49± 0.03	1.63± 0.15	0.16± 0 03	$0\ 16^{b}$± 0.05
T_3 R_1	1 30	0.50	1.20	0 10	0 20
R_2	1 53	0 47	1 42	0 12	0 12
R_3	1 32	0.37	1.13	0 09	0 09
R_4	1 35	0 48	1 94	0 09	0 19
Mean± SE	1 37±0.04	0 45 ± 0 02	1 42 ± 0.15	0.10± 0.006	$0\ 15^{b}$± 0 02
CD	-	-	-	-	0.04

Means bearing the same superscript within the same column do not differ significantly (P<0 05)

Table 24. Influence of probiotic supplementation on weights of liver, heart, gizzard – ANOVA

Source	Liver				Heart				Gizzard			
	df	SS	MSS	F	df	SS	MSS	F	df	SS	MSS	F
Treatment	2	0 190	0 090	3 09 NS	2	0 015	0 007	1 875 NS	2	0 013	0 006	0 060 NS
Sex	1	0 016	0 016	0 48 NS	1	0 005	0 005	1 250 NS	1	0 003	0 003	0 030 NS
Interaction	2	0 019	0 009	0 29 NS	2	0 004	0 002	0 500 NS	2	0 560	0 280	2 860 NS
Error	18	0 570	0 032		18	0 08	0 004		18	1 770	0 098	
Total	23	0 807			23	0 105			23	2 35		

Table 25. Influence of probiotic supplementation on weights of bursa and spleen – ANOVA

Source	Bursa				Spleen			
	df	SS	MSS	F	df	SS	MSS	F
Treatment	2	0.001	0.0005	0.125 NS	2	0.002	0 001	0 60 NS
Sex	1	0 036	0 036	9.000**	1	0 006	0 006	3 75 NS
Interaction	2	0 001	0 0005	0.125 NS	2	0 008	0 004	2 50 NS
Error	18	0.069	0 004	-	18	0 030	0 002	-
Total	23	0 107	-	-	23	0.050	-	-

** Highly significant (P<0 01)

NS Not significant

The percentage dressed and ready-to-cook yields are depicted in Fig 8 and the mean percentage of giblet and abdominal fat yields are depicted in Fig.9 The organ weights of liver, heart and gizzard are depicted in Fig 10 and the organ weights of spleen and bursa as influenced by probiotic supplementation among different dietary treatments are depicted in Fig 11

4.9 Livability

Mortality pattern of birds in the different treatment groups are shown in Table 26. Altogether seven birds died during the course of study One bird from control (T_1), one bird from T_2 and five birds from T_3 died during the entire experimental period There was less mortality in the group fed with 0.025 per cent probiotic and the control group in comparison to the 0 05 per cent probiotic supplemented group Necropsy of dead birds were conducted to detect the causes of death which did not show any signs that are attributable to treatment effects The overall mortality in the experiment was within the standards prescribed for broiler house mortality

Fig.8 Influence of probiotic supplementation on mean dressed and ready-to-cook yields

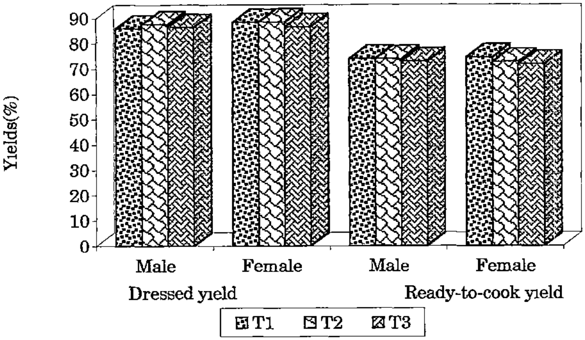


Fig.9 Influence of probiotic supplementation on mean giblet and abdominal fat yields

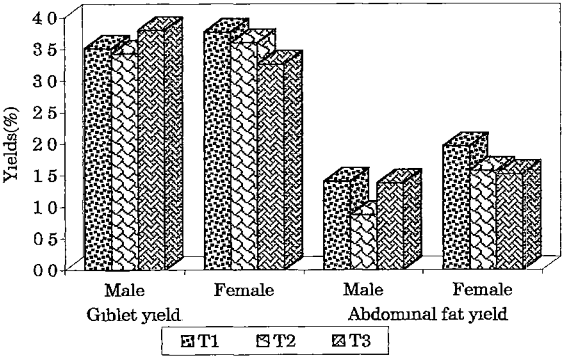


Fig.10 Influence of probiotic supplementation on mean weights of liver, heart and gizzard

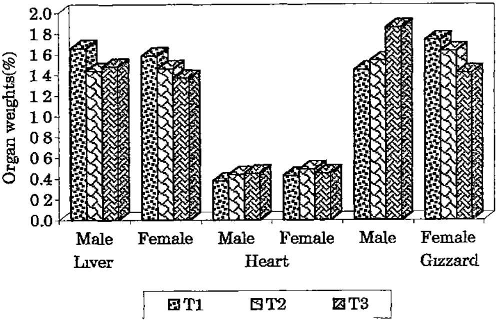


Fig.11 Influence of probiotic supplementation on mean weights of spleen and bursa

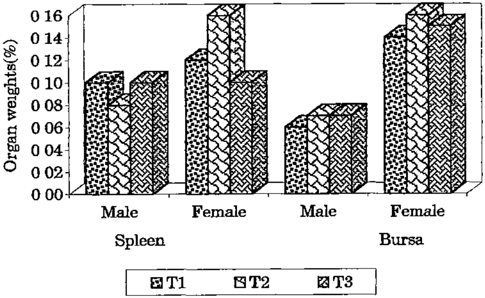


Table 26. Mortality pattern among different treatments

Treatment	Period(Weeks)								Total
	1	2	3	4	5	6	7	8	
T_1 R_1	-	-	-	-	-	-	-	-	-
R_2	-	-	-	-	-	-	1	-	1
R_3	-	-	-	-	-	-	-	-	-
R_4	-	-	-	-	-	-	-	-	-
Total	-	-	-	-	-	-	1	-	1
T_2 R_1	-	-	-	-	-	-	-	-	-
R_2	-	1	-	-	-	-	-	-	1
R_3	-	-	-	-	-	-	-	-	-
R_4	-	-	-	-	-	-	-	-	-
Total	-	1	-	-	-	-	-	-	1
T_3 R_1	-	-	-	-	-	-	-	2	2
R_2	-	-	-	-	-	-	1	-	1
R_3	-	-	-	1	-	1	-	-	2
R_4	-	-	-	-	-	-	-	-	-
Total	-	-	-	1	-	1	1	2	5
Grand Total	-	1	-	1	-	1	2	2	7

4.10 Cost benefit analysis

In order to assess the cost-benefit particulars of supplementation of probiotic in the standard broiler ration, the cost of the ration used in the study was calculated based on the actual price of feed ingredients which prevailed at the time of experiment and are presented in Table 27 Cost of rations computed for different treatments, T_1, T_2 and T_3 were 10 52, 10 61 and 10.71 rupees per kg starter and 9 53, 9 62 and 9 72 rupees per Kg finisher feed respectively

The cost benefit analysis for different dietary treatments set out in Table 28 and 29 indicated that feed cost for production of Kg live weight was Rs 22.40, 21 90 and 22.32 at six weeks of age and Rs. 27 34, 27.60 and 27 09 at eight weeks of age for different treatments, T_1, T_2 and T_3 respectively This revealed that the cost was lower in the 0 025 per cent probiotic supplemented group when compared with the control and 0 05 per cent probiotic supplemented groups at six weeks of age, whereas at eight weeks of age, the 0 05 per cent probiotic supplemented diet was cheaper when compared to the other two groups

Table 27 Cost of experimental rations

Ingredients	Cost/ kg*	Starter			Finisher		
		T_1	T_2	T_3	T_1	T_2	T_3
Yellow maize	6 72	2 95	2 95	2 95	3 62	3 62	3 62
Groundnut cake	12 39	3 34	3 34	3 34	2 35	2 35	2 35
Soyabean meal	10 72	0 64	0 64	0 64	0 75	0 75	0 75
Gingelly oil cake	12 14	0 36	0 36	0 36	-	-	-
Rice polish	4 94	0 49	0 49	0 49	0 54	0 54	0 54
Dried fish	12 60	1 008	1 008	1 008	0 88	0 88	0 88
Mineral mixture	16 99	0 29	0 29	0 29	0 29	0 29	0 29
Salt	2 94	0 007	0 007	0 007	0 007	0 007	0 007
Vitamin mixture	477 84	0 07	0 07	0 07	0 07	0 07	0 07
Coccidiostat	510 00	0 25	0 25	0 25	0 25	0 25	0 25
Lysine	129 00	0 26	0 26	0 26	0 13	0 13	0 13
Methionine	213 18	0 21	0 21	0 21	-	-	-
Choline	631 33	0 63	0 63	0 63	0 63	0 63	0 63
Manganese sulphate	173 80	0 017	0 017	0 017	0 017	0 017	0 017
Probiotic	190/ 0 5kg	-	0 09	0 19	-	0 09	0 19
Total Cost (100kg)	-	1052	1061	1071	953	962	972
Cost (kg)	-	10 52	10 61	10 71	9 53	9 62	9 72

* The rate contract approved by the University was taken as the cost of feed ingredients

Table 28. Cost benefit analysis per bird for the different treatment groups at the end of six weeks

Sl. No	Particulars	T_1	T_2	T_3
1	Live body weight (kg)	1.62	1.69	1 65
2.	Feed consumed upto six weeks (kg)	3 45	3.49	3.44
3	Feed cost (Rs)	36.29	37 02	36.84
4.	Feed + chick cost (Rs)	48.29	49.02	48.84
5	Total cost (Rs)*	53 29	54 02	53 84
6.	Returns from sale of broiler (Rs)	56.70	59.15	57.75
7.	Profit over feed cost (Rs.)	20 41	22.13	20 91
8	Profit over feed + chick cost (Rs.)	8 41	10.13	8 91
9	Net profit per bird (Rs)	3.41	5 13	3.91
10.	Feed cost per kg body weight (Rs.)	22 40	21.90	22 32
11	Total cost per kg body weight (Rs)	32 89	31 96	32 63
12	Profit over feed cost per kg body weight (Rs.)	12 59	13 09	12 67
13.	Net profit per kg body weight (Rs)	2.10	3 04	2.37

* Rs 5/- per bird was accounted as miscellaneous cost for vaccination, medicines etc

Table 29. Cost benefit analysis per bird for the different treatment groups at the end of eight weeks

Sl. No	Particulars	T_1	T_2	T_3
1.	Live body weight (kg)	2.09	2.08	2.12
2.	Total feed consumption (kg)	5.64	5 61	5.56
	a) Starter ration (kg)	3 45	3 49	3 44
	b) Finisher ration (kg)	2.19	2 12	2 12
3.	Feed cost (Rs.)	57.16	57.41	57 44
4.	Feed + chick cost (Rs.)	69.16	69.41	69.44
5.	Total cost (Rs.)*	74.16	74.41	74.44
6.	Returns from sale of broiler (Rs.)	73.15	72.80	74.20
7.	Profit over feed cost (Rs.)	15.99	15 39	16 79
8.	Profit over feed + chick cost (Rs.)	3.99	3.39	4 76
9	Net profit per bird (Rs.)	-1.01	-1 61	0 24
10.	Feed cost per kg body weight (Rs)	27.34	27.60	27 09
11.	Total cost per kg body weight (Rs.)	35.48	35.77	35 11
12.	Profit over feed cost per kg body weight (Rs.)	7.65	7 39	7.91
13.	Net profit per kg body weight (Rs)	-0 48	-0 77	0.11

* Rs. 5/- per bird was accounted as miscellaneous cost for vaccination, medicines etc.

Discussion

5. DISCUSSION

The results of the experiment undertaken to evaluate the effect of probiotic supplementation on the performance of broiler chicken are discussed in this chapter.

5.1 Climatic parameters

The meteorological data revealed that the maximum temperature was highest during the eighth week of the experiment and was lowest during the first and third weeks. The maximum temperature and relative humidity were higher at the last two weeks of the experiment. Since the mean weekly maximum temperature ranged from 32.7 to 37.1^{0}C and the relative humidity ranged from 34.0 to 86.4 per cent the environment was hot and humid throughout the experimental period

5.2 Body weight

The data on bodyweight presented in Table 5 revealed that the mean body weight of chicks of different treatments at day old stage ranged from 45 78 to 45.85g and were statistically comparable between the treatment groups

Probiotic supplementation at the level of 0 025 per cent in the standard broiler ration resulted in a significant ($P \leq 0\ 05$)

improvement in the fortnightly body weight from second week onwards and this trend continued till the end of sixth week At the end of fourth week, the birds with 0.025 per cent probiotic had a significantly higher body weight when compared to that of other two groups.

When the birds attained sixth week of age, the body weight of the group fed 0 025 per cent probiotic was significantly ($P \leq 0\ 05$) higher than that of control but it was statistically comparable with 0 05 per cent supplemented group The 0 025 per cent probiotic supplemented group recorded a 4.87 and 2 64 per cent increase in body weight at six weeks of age when compared to control and 0 05 per cent probiotic supplemented groups respectively

The above finding is in agreement with those of Kahraman *et al* (1997), Jin *et al* (1998), Mahajan *et al* (1999), Biswal *et al* (2000) and Zulkifli *et al* (2000), who reported that the sixth week body weight was highly significant ($P \leq 0\ 05$) in broilers fed diets supplemented with probiotic. On the contrary, Manickam *et al* (1994), Bhatt *et al.* (1995b), Yadav *et al* (1996), Samanta and Biswas (1997), Mikulec *et al* (1999) and Piao *et al* (1999) reported that there was no improvement in body weight among broiler chicken fed probiotic upto six weeks of age

Numerically higher body weight observed in 0.05 per cent probiotic fed group was statistically comparable with control and 0 025 per cent probiotic fed groups at the end of eighth week These findings are in line with the findings of Buche *et al* (1992), Saha *et al* (1999a) and Saha *et al* (1999b) The authors reported no significant effect of probiotic on average body weight upto eight weeks of age in broilers On the contrary, Abdulrahim *et al.* (1999) reported that the eighth week body weight was highly significant in broilers fed diets supplemented with probiotic

The results of the present study revealed that the 0 025 per cent probiotic is effective in improving the body weight upto six weeks of age The probiotic supplied in the feed might have helped in maintaining the balance of intestinal microflora, improved the feed utilisation and subsequently improved the growth of broilers The probiotic supplementation was more beneficial in the early stages of growth of broilers at 0.025 per cent level than the later stages Eventhough the growth rate was faster in the 0.025 per cent supplemented group during the first six weeks of age, the growth rate was found to have declined during the seven and eighth weeks of age Whereas, in the 0 05 per cent supplemented group a better growth rate was obtained during the last four weeks of the experiment The poor performance at the higher level of inclusion during the first four weeks of the experiment might be due to the additional load of microbes than the threshold which might have disturbed the equilibrium resulting in no additional improvement (Panda *et al.*, 2000a). The better growth rate in probiotic supplemented groups might also be due to the alleviation of summer stress.

5.3 Body weight gain

The fortnightly mean body weight gain of the birds in different groups presented in Table 7 indicated that the body weight gain of both the probiotic fed groups were significantly ($P \leq 0.05$) higher than control at the end of second week.

During the third and fourth week a significantly ($P \leq 0.05$) higher body weight gain was recorded by 0 025 per cent supplemented group than control and 0 05 per cent supplemented groups.

The weight gain during the fifth and sixth week was statistically comparable in all the treatment groups, though the probiotic supplemented groups had a numerically better weight gain than the control group at fifth and sixth week of age. These findings corroborates with that of Bhatt *et al* (1995b), Gohain and Sapcota (1998) and Piao *et al.* (1999) who reported that probiotic supplementation had no effect on body weight gain at the end of sixth week. These findings are contrary to that of Chiang and Hsieh

(1995), Mohan *et al* (1996) and Zulkıflı *et al* (2000) The authors recorded a sıgnıficant ımprovement ın body weıght gaın at the end of sıxth week on probıotıc supplementatıon

Sımılar to the above data, the cumulatıve mean body weıght gaın upto sıxth week showed that the 0.025 per cent probıotıc fed group gaıned sıgnıficantly ($P \leq 0.05$) hıgher body weıght than the control. These fındıngs are ın agreement wıth those of Manıckam *et al* (1994), Bhatt *et al* (1995b), Chıang and Hsıeh (1995), Sıngh and Sharma (1999) and Zulkıflı *et al* (2000) who reported sıgnıficantly hıgher body weıght gaın wıth probıotıc supplemented dıets ın broılers upto sıx weeks of age ın broılers

Contrary to the above fındıngs, Baıdya *et al* (1993), Mudalgı *et al* (1993), Baıdya *et al* (1994), Samanta and Bıswas (1995), Sarkar *et al* (1997), Panda *et al* (1999) and Pıao *et al* (1999) reported no effect of probıotıc on body weıght gaın ın broılers upto sıx weeks of age

Body weıght gaın durıng the seventh and eıghth week was sıgnıficantly ($P \leq 0.05$) lower ın the 0 025 per cent probıotıc fed group when compared to the other two groups The control and 0.05 per cent probıotıc supplemented groups were statıstıcally comparable. At seventh and eıghth week the 0 05 per cent probıotıc supplemented group showed maximum weight gain whereas the ability to gain weight by the birds in the 0.025 per cent probiotic supplemented group was exploited in the first six weeks of age. These findings contradicted with those of Abdulrahim *et al.* (1999) who expressed a significantly higher body weight gain at the end of eighth week due to probiotic supplementation. Whereas, Mohan *et al.* (1996) reported that the probiotic supplementation did not affect the body weight gain at the end of eighth week in broilers.

The cumulative mean data related to body weight gain upto eighth week revealed that the treatment groups were statistically similar. These findings are in line with those of Saha *et al.* (1999a) and Saha *et al* (1999b) who observed that the probiotic supplementation did not affect the body weight gain upto eight weeks. The findings contradicted with those of Buche *et al.* (1992) and Singh and Sharma (1999) who reported significant improvement in body weight gain upto eight weeks of age in broilers on probiotic supplementation at 0 02 per cent level in diet Takalikar *et al.* (1992) also observed that the body weight gain was significantly lower in the probiotic supplemented group.

Significantly superior cumulative body weight gain upto six weeks of age with supplementation of 0 025 per cent probiotic and numerically higher cumulative body weight gain upto eight weeks of age with supplementation of 0.05 per cent probiotic observed in this trial could be due to better utilisation of nutrients consequent to probiotic supplementation.

5.4 Feed consumption

A perusal of the data on daily mean feed intake at weekly intervals presented in Table 9 revealed that the feed intake did not differ significantly throughout the experimental period and was statistically similar between the treatment groups

The cumulative feed intake data given in Table 13 showed that irrespective of probiotic supplementation in the diet, the feed intake from zero to six weeks was statistically similar The same trend followed for the feed intake upto eight weeks of age

The above findings agree with those of Buche *et al* (1992) Takalikar *et al.* (1992), Mohan *et al.* (1996), Abdulrahim *et al* (1999), Saha *et al* (1999a), Saha *et al.* (1999b) and Singh and Sharma (1999) who reported that the probiotic supplementation had no effect on feed intake Contrary to the above findings, Joy and Samuel (1997) and Zulkifli *et al* (2000) recorded significantly higher feed consumption at the end of six weeks in probiotic fed broilers.

5.5 Feed efficiency

The mean fortnightly feed efficiency (FE) as influenced by probiotic supplementation presented in Table 11 showed that the 0.025 per cent probiotic fed group had significantly better ($P \leq 0.01$) FE than the other two groups at the end of second week. This finding is contrary to that of Gohain and Sapcota (1998) and Singh and Sharma (1999) who reported no effect of probiotic on FE during the first two weeks.

The FE at the end of fourth week showed that the 0.05 per cent probiotic supplemented birds had significantly ($P \leq 0.05$) poorer FE than the other two groups. The better FE at four weeks of age observed in the 0.025 per cent supplemented group indicated that the conversion efficiency of feed was improved by probiotic inclusion at a lower level. The significantly poorer FE in the 0.05 per cent probiotic supplemented group might be due to the additional load of microbes than the threshold which might have disturbed the equilibrium resulting in no additional improvement (Panda *et* al., 2000a). These findings are in line with that of Jin *et al.* (1998) who observed significantly ($P \leq 0.01$) poorer FE at a higher level of inclusion of probiotic at the end of fourth week. Contrary to this, Jin *et al.* (1996) recorded significantly better FE at the end of fourth week when probiotic was supplemented in a higher level to broilers.

Bhatt *et al* (1995a), Bhatt *et al* (1995b), Gohain and Sapcota (1998) and Singh and Sharma (1999) observed that the FE was not affected by probiotic supplementation at the end of fourth week

At the end of sixth week, the FE was statistically similar between treatments The same trend followed for the sixth week mean cumulative FE These findings corroborate with those of Takalikar *et al* (1992), Baidya *et al* (1993), Prasad and Sen (1993), Yadav *et al* (1994), Samanta and Biswas (1995), Sarkar *et al* (1997) and Gohain and Sapcota (1998) who reported no effect of probiotic on FE of broilers at the end of sixth week. Contrary to this, Manickam *et al.* (1994), Jin *et al* (1998), Biswal *et al* (2000) and Zulkifli *et al* (2000) revealed that there was significant improvement in FE in broilers fed with probiotic supplemented diets upto six weeks of age Chiang and Hsieh (1995) and Singh and Sharma (1999) observed significantly poorer FE in broilers fed with probiotic supplemented diets upto six weeks of age

The FE at the end of eighth week as well as the mean cumulative FE upto eighth week were statistically comparable between the treatment groups These findings are in agreement with those of Buche *et al* (1992), Saha *et al.* (1999a) and Saha *et al* (1999b) who observed that the probiotic supplementation did not affect the FE at the end of eight weeks.

Contrary to this, Singh and Sharma (1999) recorded a significantly poorer FE in broiler diets supplemented with 0.02 per cent of probiotic upto eight weeks of age Takalikar *et al.* (1992) observed poorer FE in broilers fed with diets containing probiotic

The probiotic would have been efficient in converting feed into body mass only during the early stages of growth, which led to the better feed efficiency at that period

5.6 Protein efficiency

The fortnightly protein efficiency presented in Table 15 revealed that the supplementation of probiotic in broiler diets had no significant influence on protein efficiency throughout the experimental period These findings are in line with those of Buche *et al* (1992) and Choudhury *et al* (1998) who observed that the protein efficiency was not significantly improved by probiotic supplementation Takalikar *et al* (1992) recorded poor protein efficiency in probiotic supplemented birds

The 0.025 per cent probiotic supplemented group had a numerically better protein efficiency ratio when compared to other groups upto six weeks of age During the seventh and eighth week, the control and 0.05 per cent probiotic supplemented groups had a better protein efficiency than the 0 025 per cent probiotic supplemented group. This suggested that the probiotic is efficient in converting feed protein into tissue protein during the early stages of growth at 0.025 per cent level than later stages. Whereas, the higher level of inclusion (0 05 per cent) of the probiotic was more effective during the seventh and eighth weeks of age.

5.7 Serum cholesterol and serum protein

The data on mean serum cholesterol as influenced by probiotic supplementation presented in Table 17 showed that the serum cholesterol levels of both males and females were significantly ($P \leq 0.01$) reduced in both the probiotic supplemented groups when compared to control There was 24 50 and 52 79 per cent reduction in serum cholesterol levels in 0 025 and 0 05 per cent probiotic supplemented groups respectively than control in males Similarly, a reduction of 24 34 and 69.82 per cent was recorded with 0 025 and 0 05 per cent probiotic fed groups respectively than control in females Among sexes, females had 17 00, 16 82 and 46 93 per cent lower cholesterol levels in control, 0 025 per cent and 0 05 per cent probiotic supplemented groups of birds respectively than males Similar findings were reported by Mohan *et al* (1996), Joy and Samuel (1997), Jin *et al* (1998) and Endo *et al* (1999) The authors recorded significant reduction in serum cholesterol levels when birds were supplemented with diets containing probiotic. Contrary to the above findings, Gohain and Sapcota (1998) could not observe any variation in the serum cholesterol levels due to dietary supplementation of probiotic in broilers

The decrease in serum cholesterol level in probiotic supplemented groups might be due to the cholesterol assimilation by the Lactobacillus cells (Jin *et al.*, 1998) It is also reported that the *Lactobacillus acidophilus* reduces cholesterol in the blood by deconjugating bile salts in the intestine thereby preventing them from acting as precursors in cholesterol synthesis (Abdulrahim *et al* , 1996).

The data on mean serum protein presented in Table 17 revealed that there was no effect of probiotic on both males and females and that the treatments were statistically comparable The mean serum protein varied from 4.15 to 4.30 g/dl in males and 4 19 to 4 32 g/dl in females

Similar findings were also observed by Samanta and Biswas (1994), Gohain and Sapcota (1998) and Biswal *et al* (2000) The authors reported that the serum protein levels were not affected by supplementation of probiotics in broilers

5.8 Processing yields

The mean percentages of dressed and ready-to-cook yields presented in Table 19 revealed that there was no statistical significance either between treatments or sexes These findings are in close agreement with those of Takalikar *et al* (1992), Mohan *et al* (1996) and Saha *et al* (1999a) who reported that the probiotic supplementation did not affect the dressed and eviscerated yields in broilers at eight weeks of age These findings are in partial agreement with those of Baidya *et al.* (1994), Samanta and Biswas (1994), Sarkar *et al* (1997) and Sayed *et al* (2000) who observed that the dressed and ready to-cook yields were not affected by probiotic supplementation at six weeks of age in broilers

The data on percentage giblet yield showed no significant influence by either treatment or sex as presented in Table 20 These findings are in line with those of Takalikar *et al* (1992) and Saha *et al.* (1999a) who reported no effect of probiotic supplementation on giblet yield at eight weeks of age Reports by Baidya *et al.* (1993), Baidya *et al.* (1994) and Sarkar *et al.* (1997) showed that the giblet yield at sixth week was not affected by probiotic supplementation Contrary to this, Abdulrahim *et al.* (1999) reported that the giblet weight in females increased with probiotic addition at eight weeks of age.

The data pertaining to per cent abdominal fat presented in Table 20 revealed no significant difference among treatments and sex. These findings are in line with those of Abdulrahim *et al.* (1999) who reported that the abdominal fat per cent was not affected by probiotic treatment in broilers at eight weeks of age. Studies by Chiang and Hsieh (1995), Panda *et al.* (1999) and Biswal *et al* (2000) also revealed that the abdominal fat per cent in broilers at six weeks was not affected by probiotic supplementation.

The data on weights of liver, heart, gizzard and spleen presented in Table 23 revealed that there was no significant difference between treatments and sexes due to probiotic supplementation. But the bursa was significantly ($P \leq 0.01$) heavier in females than males.

The above finding corroborates with that of Baidya *et al.* (1993), Samanta and Biswas (1994), Mohan *et al.* (1996), Panda *et al* (1999), and Sayed *et al.* (2000) who reported that the weights of liver, heart and gizzard were not affected by probiotic supplementation at six and eight weeks of age. Studies by Baidya *et al.* (1993) Samanta and Biswas (1994), Singh *et al.* (1994), Mohan *et al* (1996), Panda *et al.* (1999) and Panda *et al.* (2000b) revealed that probiotic addition in broiler diets had no effect on weight of spleen at six and eight weeks of age. Similarly, Panda *et al.* (1999) and Panda *et al*

(2000b) observed that the weight of bursa was not affected by feeding broilers with diets containing probiotic at six weeks of age

5.9 Livability

The data on the mortality pattern among different treatments presented in Table 26 revealed that altogether seven birds died during the entire experimental period and the mortality percentage was 2 08, 2 08 and 10 42 per cent in T_1 T_2 and T_3 respectively Low mortality was observed in both the control and the 0 025 per cent probiotic supplemented groups. Though a higher mortality was recorded with birds fed 0 05 per cent probiotic, necropsy findings revealed that the birds died due to non-specific reasons, which were not attributable to the treatment effects Thus it was evident that probiotic supplementation did not have any detrimental effects on the physiological well being of broiler birds The overall mortality in the experiment was within the standards prescribed for broiler house mortality

Similar findings were reported by Manickam *et al.*(1994), Bhatt *et al* (1995b), Jin *et al* (1996), Jin *et al* (1998) and Zulkifli *et al* (2000) The authors reported that the percentage mortality was not affected by probiotic supplementation in broilers at six weeks of age However, Bhatt *et al* (1995a), Kahraman *et al* (1997), Samanta and Biswas (1997), Piao *et al* (1999) and Biswal *et al* (2000) recorded numerically reduced mortality in probiotic supplemented birds at six weeks of age

5.10 Cost benefit analysis

An assessment of the cost of different rations used in this trial, presented in Table 27 indicated that the 0.05 per cent probiotic supplemented diet was costlier This was due to increased cost of the probiotic which enhanced the cost of ration in proportion to the level of probiotic addition The cost of 0 025 and 0 05 per cent probiotic supplemented diets were nine and 19 paise more than the standard broiler starter and finisher rations respectively.

When the feed cost alone for the production of kg live weight was calculated, it was observed that the 0.025 per cent probiotic supplemented diet was cheaper than the other two diets, at six weeks of age. The net profit per bird was Rs. 3.41, 5 13 and 3.91 for treatments, T_1, T_2 and T_3 respectively, at six weeks of age This showed that the 0 025 per cent probiotic was economical for Rs 1 72 and 1.22 when compared to the control and 0 05 per cent probiotic supplemented groups respectively at six weeks of age

The above findings are in line with those of Baidya *et al* (1994) who indicated higher profit/ kg live weight in the probiotic supplemented broilers at six weeks of age Contrary to the above findings, Prasad and Sen (1993) expressed that the cost of feed/ kg weight gain was higher in the probiotic supplemented group at six weeks of age

At the end of eight weeks of age, the feed cost per kg body weight was costlier in the 0.025 per cent probiotic supplemented diet, whereas, the 0.05 per cent probiotic supplemented diet was comparatively cheaper The net profit per bird was Rs. –1.01, -1 61 and 0.24 for treatments, T1, T2 and T3 respectively at eight weeks of age This showed that the 0.05 per cent probiotic was economical for 77 paise and Rs. 1 37 when compared to the control and 0.025 per cent probiotic supplemented groups at eight weeks of age.

The above findings are in support of those of Takalikar *et al* (1992) who expressed that the cost of feed/ kg weight gain was higher in the probiotic supplemented group at eight weeks of age Contrary to this, studies by Buche *et al* (1992) revealed that the cost of feed/ kg live weight gain was lower in the group supplemented with probiotic at a lower level

The lower net profit per kg live weight in the present trial irrespective of treatments was due to high feed consumption, higher feed cost and low sale price of broilers The net profit can be improved by increasing the sale price of broilers and by marketing the birds at six weeks of age

Summary

6.SUMMARY

An investigation was carried out in the Department of Poultry Science, College of Veterinary and Animal Sciences, Mannuthy, using 144, one-day old commercial broiler chicks to assess the influence of probiotic supplementation on their performance for a period of eight weeks The chicks were randomly distributed into three dietary treatments having four replicates of 12 birds each. The dietary treatments consisted of standard broiler ration (T_1) and standard broiler ration with 0 025 and 0 05 per cent probiotic (T_2 and T_3) respectively. All the diets were formulated as per Bureau of Indian Standards specifications

The birds were housed at random in individual pens and reared under deep litter system. Standard managemental practices were adopted identically for all the treatments throughout the experimental period The body weights of individual birds were recorded at the beginning of the experiment followed by fortnightly intervals till the end of the experiment Weekly feed consumption was recorded replication wise From the above data, the body weight gain and the feed efficiency for different treatments were worked out

At the end of the experimental period, four male and four female birds from each treatment were randomly selected and sacrificed to study the processing yields such as dressed, ready-to-cook and giblet, percentage of abdominal fat and weights of liver, heart, gizzard, spleen and bursa

During slaughter, blood was collected from three males and three females of each treatment, the serum was allowed to separate and was analysed for total protein and total cholesterol using standard kits The mortality of the birds were recorded Cost benefit analysis due to probiotic supplementation was worked out by calculating the cost of production

The overall performance of the birds fed under different dietary regimen are presented in Table 30

Based on the results obtained in this study, the following conclusions were made

1 The mean body weight of the birds for different treatment groups, T_1, T_2 and T_3 were 1615, 1698 and 1653g at six weeks and 2092, 2083 and 2123g at eight weeks of age respectively The 0.025 per cent probiotic supplemented group recorded significantly ($P \leq 0.05$) higher body weight over the control group at six weeks of age

2 Birds fed with diet containing 0 025 per cent probiotic showed significantly ($P \leq$ 0 05) more body weight gain over the other two groups upto six weeks of age The body weight gain was not significantly different among treatment groups upto eight weeks of age.

3. The mean total feed intake per bird under different dietary treatments ranged from 3 44 to 3 49 kg upto six weeks and 5.56 to 5.64 kg upto eight weeks of age. The daily feed intake per bird was not significantly different among all the treatment groups through out the experimental period

4. The 0.025 per cent probiotic supplemented group had a significantly ($P \leq 0$ 05) better feed efficiency at second week. During the second to fourth week period the 0 025 per cent probiotic supplemented group of birds had a significantly better FE than that of 0.05 per cent probiotic supplemented group but was statistically similar to that of control However, the feed efficiency was statistically similar among the treatment groups upto six and eight weeks of age

5 The protein efficiency did not differ significantly throughout the experimental period among the treatment groups

6. The serum cholesterol levels were significantly ($P \leq 0$ 01) reduced in both the probiotic supplemented groups when compared to that of control The 0 05 per cent probiotic supplemented group had significantly ($P \leq 0.01$) lower cholesterol level than both 0 025 per cent probiotic supplemented and control groups Among sexes, the females had significantly ($P \leq 0$ 01) lower serum cholesterol level than males at eight weeks of age

The serum protein levels were not affected by probiotic supplementation

7. Data on slaughter studies viz., dressed, ready-to-cook and giblet yields, abdominal fat and weights of liver, heart, gizzard and spleen did not reveal any significant differences between treatments and sexes The weight of bursa was significantly ($P \leq 0.01$) higher in females than males irrespective of probiotic treatment.

8. The survivability of broiler chicken was not affected by probiotic supplementation in their diet.

9. The feed cost per kg live weight varied from Rs 21.90 to 22.40 and from Rs. 27.09 to 27.60 for the different treatment groups at the end of sixth and eighth week of age respectively. Cost of production of broilers was lowest in the 0.025 per cent probiotic supplemented group at the end of sixth week, while it was lowest in the 0.05 per cent probiotic supplemented group at the end of eighth week.

10. Among the different treatment groups, the performance parameters of birds fed with lower level of probiotic (0.025 per cent) was found to be the best upto six weeks of age

Based on the above findings, it can be concluded that probiotic supplementation in standard broiler ration at a lower level was beneficial in the early stages of growth. However, in the later stages of growth of broilers the higher level of inclusion seems to be beneficial.

Table 30 Influence of probiotic supplementation on the performance of broiler chicken

Sl No	Parameters	Dietary treatments		
		T_1	T_2	T_3
1	Live body weight at six weeks (g)	1615	1698	1653
2	Live body weight at eight weeks (g)	2092	2083	2123
3	Cumulative body weight gain upto six weeks (g)	1569	1652	1607
4	Cumulative body weight gain upto eight weeks(g)	2046	2037	2077
5	Total feed consumed upto six weeks (kg)	3 45	3 49	3 44
6	Total feed consumed utpo eight weeks (kg)	5 64	5 61	5 56
7	Cumulative feed efficiency upto six weeks	2 20	2 10	2 13
8	Cumulative feed efficiency upto eight weeks	2 76	2 75	2 67
9	Protein efficiency at six weeks	1 72	1 57	1 63
10	Protein efficiency at eight weeks	2 53	2 94	2 43
11	Serum cholesterol (mg per cent) i) Male	125 93	95 07	59 44
	ii) Female	104 52	79 08	31 54
12	Serum protein (g/dl) i) Male	4 16	4 30	4 15
	ii) Female	4 21	4 32	4 19
13	Processing yields (per cent)			
	i) Male			
	a) Dressed yield	86 02	87 58	86 52
	b) Ready-to-cook-yield	73 98	73 87	72 77
	c) Giblet yield	3 51	3 43	3 80
	d) Abdominal fat	1 40	0 87	1 37
	e) Liver	1 66	1 44	1 48
	f) Heart	0 38	0 44	0 45
	g) Gizzard	1 45	1 54	1 86
	h) Spleen	0 10	0 08	0 10
	i) Bursa	0 06	0 07	0 07
	ii) Female			
	a) Dressed yield	88 49	88 59	86 60
	b) Ready-to-cook-yield	74 44	72 56	71 81
	c) Giblet yield	3 77	3 60	3 26
	d) Abdominal fat	1 96	1 57	1 52
	e) Liver	1 59	1 46	1 37
	f) Heart	0 43	0 49	0 45
	g) Gizzard	1 74	1 63	1 42
	h) Spleen	0 12	0 16	0 10
	i) Bursa	0 14	0 16	0 15
14	Mortality (per cent)	2 08	2 08	10 42
15	Cost per kg of feed (Rs) i) Starter ration	10 52	10 61	10 71
	ii) Finisher ration	9 53	9 62	9 72
16	Feed cost per kg live weight production at the end of six weeks (Rs)	22 40	21 90	22 32
17	Feed cost per kg live weight production at the end of eight weeks (Rs)	27 34	27 60	27 09

References

REFERENCE

Abdulrahim, S.M., Haddadin, M S Y , Hashlamoun, E A R and Robinson, R.K (1996) The influence of *Lactobacillus acidophilus* and bacitracin on layer performance of chickens and cholesterol content of plasma and egg yolk *British Poult Sci* **37** 341-346.

Abdulrahim, S M., Haddadin, M S Y , Odetallah, N.H M and Robinson, R K (1999) Effect of *Lactobacillus acidophilus* and zinc bacitracin as dietary additives for broiler chickens. *British Poult. Sci* **40**· 91-94.

Anon, (1994). *Indian Poultry Industry Year book*, Shakuntala, P Gupta, New Delhi 10th Ed p 80

AOAC (1990). *Official Methods of Analysis* Association of Official Analytical Chemists, Washington, DC. 15th Ed

Baidya, N., Mandal, L and Banerjee, G.C. (1993) Efficiency of feeding antibiotic and probiotics in broilers *J. Vet. Anim Sci.* **24**(2) 120-124

Baidya, N., Mandal, L , Sarkar, S K and Banerjee, G.C. (1994) Combined feeding of antibiotic and probiotic on the performance of broiler *Indian J. Poult. Sci* **29**(3) 228-231

Bhatt, R.S., Katoch, B.S., Dogra, K.K., Gupta, R., Sharma, K.S. and Sharma, C.R. (1995a) Effect of dietary supplementation of different strains of *Lactobacillus bulgaricus* on the performance of broilers. *Indian J Poult. Sci.* **30**(2) 117-121.

Bhatt, R.S., Katoch, B.S., Dogra, K.K., Gupta, R., Sharma, K.S. and Sharma, C.R. (1995b). Effect of dietary supplementation of different strains of (*Saccharomyces cerevisiae*) on the biological performance of broilers *Indian J. Anim. Nutr* **12**(2): 61-66.

BIS (1973). Bureau of Indian Standards Code for handling, processing, quality evaluation and storage. IS· 7049-1973. Manak Bhavan, 9, Bhadurshah Zafar Marg, New Delhi

BIS (1992). Bureau of Indian Standards. Requirements for Chicken Feeds. IS: 1374-1992. Manak Bhavan, 9, Bhadurshah Zafar Marg, New Delhi

*Biswal, A.K., Mishra, S C., Dehuri, P.K. and Mishra, P K (2000) Study on the combined effect of probiotics and antibiotics on the performance of synthetic broilers. *Souvenir and Abstracts*. XX Annual Conference and Symposium of Indian Poultry Science Association, Chennai Abstr No. PPN-16.

Buche, A.V., Gaffar, M.A., Kalbande, V.H. and Deshmukh, S.V. (1992). Influence of probiotic and nitrofuran on the performance of broilers. *Indian J Poult. Sci.* **27**(3): 160-162.

Cavazzoni, V., Adami, A. and Castrovilli, C. (1998). Performance of broiler chickens supplemented with *Bacillus coagulans* as probiotic. *British Poult. Sci.* **39**: 526-529.

Chiang, S.H. and Hsieh, W.M. (1995). Effect of direct-fed microorganisms on broiler growth performance and litter ammonia level. *Asian-Australasian J. Anim Sci.* **8**(2) 159-162.

Choudhury, K., Das, J., Saikia, S., Sengupta, S. and Choudhury, S.K. (1998) Supplementation of broiler diets with anitbiotic and probiotic fed muga silk worm pupae meal. *Indian J. Poult Sci.* **33**(3): 339-342.

Endo, T. and Nakano, M. (1999). Influence of a probiotic on productivity, meat components, lipid metabolism, caecal flora and metabolites, and raising environment in broiler production. *Anim Sci. J.* **70**(4): 207-218.

*Endo, T., Nakano, M., Shimizu, S., Fukushima, M. and Miyoshi, S. (1999). Effects of a probiotic on the lipid metabolism of cocks fed on a cholesterol-enriched diet. *Bioscience, Biotechnology and Biochemistry.* **63**(9): 1569-1575.

Lilly, D. M. and Stillwell, R.H. (1965). Probiotics: growth promoting factors produced by micro organisms. *Science*. **147**: 747-748.

Lin, L. and Quarles, C. (1996). Evaluation of Primalac R probiotic concentrate on reduction of *E. coli* in male broilers. *Proceedings of 20th World's Poultry Congress* held at New Delhi. Vol. II. pp.147-151.

Mahajan, P., Kumar, S. and Sahoo, J (1999). Effect of Lacto-Sacc (Probiotic) feeding on growth promotion and *E. coli* infection in broilers. *Indian J Poult. Sci.* **34**(1): 99-102.

Manickam, R , Viswanathan, K. and Mohan, M. (1994). Effect of probiotics in broiler performance. *Indian Vet J.* **71**· 737-739.

Metchnikoff, E. (1907). *Prolongation of Life*. G.P Putnam and Sons, New York.

Mikulec, Z , Serman, V., Mas, N and Lukac, Z (1999). Effect of probiotic on production results of fattened chickens fed different quantities of protein *Veterinarski Arhiv* **69**(4) 199-209

Mohan, B , Kadirvel, R., Natarajan, A and Bhaskaran, M. (1996). Effect of probiotic supplementation on growth, nitrogen utilisation and serum cholesterol in broilers. *British Poult Sci.* **37**· 395-401

Mudalgı, P., Singh, R. and Verma, S.V.S. (1993). Effect of feeding probıotics on the performance of broılers I Feed consumptıon, growth and nutrıent utilızatıon. *Indıan J. Poult. Scı.* **28**(3)· 195-199.

Panda, A.K., Rao, S.V.R., Reddy, M.R. and Praharaȷ, N K. (1999) Effect of dıetary ınclusıon of probıotıc on growth, carcass traıts and ımmune response ın broilers *Indıan J. Poult Scı.* **34**(3) 343-346

Panda, A.K., Reddy, M.R., Rao, S.V.R. and Praharaȷ, N.K. (2000a) Effect of dıetary supplementation of probıotıc on performance and ımmune response ın layers ın the decline phase of production. *Indıan. J. Poult. Scı.* **35** (1) 102-104.

*Panda, A.K., Reddy, M.R., Rao, S.V.R., Raju, M.V.L.N and Praharaj, N.K. (2000b) Growth, carcass characterıstıcs, ımmunocompetence and response to *Escherıchıa colı* of broılers fed dıets wıth varıous levels of probıotıc *Archıv fur Geflugelkunde.* **64**(4) 152-156.

Pıao, X S , Han, In K., J.H., Kım, Y.H , Cho, W.T , Kım, Y H and Lıang, C. (1999). Effects of kemzyme, phytase and yeast supplementatıon on the growth performance and pollutıon reductıon of broıler chıcks *Asıan-Australasıan J Anım Scı.* **12**(1). 36-41

Fuller, R. (1989). Probiotics in man and animals. *J. Appl Bact.* **66**: 365-378

*Goh, Y.G and Hwang, Y.H. (1999). Effects of feeding yeast culture fermented with *Aspergillus oryzae* on performance of broiler chicks. *Korean J Anim Sci.* **41**(1): 15-22.

Gohain, A K and Sapcota, D (1998) Effect of probiotic feeding on the performance of broilers. *Indian J Poult. Sci.* **33**(1) 101-105

Health, J.L., Covey, R.C. and Owens, S L (1980) Abdominal leaf fat separation as a result of evisceration of broiler carcasses *Poult. Sci.* **59**: 2456-2461.

Jin, L.Z., Ho, Y.W., Abdullah, N and Jalaludin, S (1996) Influence of dried *Bacillus subtilis* and Lactobacilli cultures on intestinal microflora and performance in broilers. *Asian – Australasian J Anim. Sci* **9**(4)· 397-403

Jin, L.Z., Ho, Y W , Abdullah, N and Jalaludin, S (1997). Probiotics in poultry modes of action *World's Poult Sci J.* **53**. 351-368

Jin, L.Z , Ho, Y W , Abdullah, N and Jalaludin, S. (1998) Growth performance, intestinal microbial populations, and serum cholesterol of broilers fed diets containing *Lactobacillus* cultures *Poult Sci.* **77**· 1259-1265.

Joy, A.D. and Samuel, J.J. (1997). Effect of probiotic supplementation on the performance of broilers *J. Vet. Anim. Sci.* **28**(1)· 10-14

*Kahraman, R., Alp, M., Kocabaglı, N , Abas, I , Aksu, H and Tanor, A (1997). Effects of probiotic supplementation to the oxidized diets on performance, ileal pH and Enterobacteriaceae population, ascites incidence and mortality rate of broilers. *Pendik–Veteriner – Mikrobiyoloji – Dergisi* **28**(2): 181-190.

*Kannan, D and Viswanathan, K (2000). Effect of feeding antibiotic and probiotic on broiler performance. *Souvenir and Abstracts*. XX Annual Conference and Symposium of Indian Poultry Science Association, Chennai. Abstr No PPN-20.

*Karunakaran, R , Nachimuthu, K. and Kadirvel, R. (2000). Effects of probiotic on performance of broiler chicks *Souvenir and Abstracts*. XX Annual Conference and Symposium of Indian Poultry Science Association, Chennai. Abstr. No PPN-19.

*Kumprechtova, D., Zobac, P. and Kumprecht, I. (2000). The effect of *Saccharomyces cerevisiae Sc* 47 on chicken broiler performance and nitrogen output. *Czech J Anim. Sci* **45**(4) 169-177

Prasad, J. and Sen, A.K. (1993). Effect of different growth promoters on the performance of broilers. *Poult Adviser* **26**(7): 49-52.

Ramesh, B.K., Satyanarayana, M L.,Gowda, R.N.S., Vijayasarathi, S.K. and Rao, S. (2000). Effect of *Lactobacillus acidophilus* on growth in *Salmonella gallinarum* infected broilers *Indian J. Poult. Sci* **35**(3). 338-340

Saha, S.K., Senani, S. and Padhi, M.K.(1999a) Effect of baker's yeast on growth, nutrient utilisation and the carcass quality of broilers *Indian J Anim. Nutr* **16**(1) 81-83

Saha, S.K., Senani, S., Padhi, M.K. and Rai, R B. (1999b) Effect of live yeast supplementation on the growth and nutrient utilization in commercial hubbard broilers. *Indian Vet. J* **76**. 169-170.

Samanta, M. and Biswas, P (1994) Influence of Lactobacillus culture and lactic acid on carcass characteristics, haematological parameters and pH of intestinal contents in broilers. *J Vet Anim Sci* **25**(2). 106-109

Samanta, M. and Biswas, P (1995) Influence of Lactobacillus culture, lactic acid and acetic acid on the performance of broilers *Indian J Anim Hlth.* **34**(2)· 137-140

*Samanta, M. and Biswas, P. (1997). Effect of feeding Streptococcus culture on the performance of broilers. *J Interacademicia*. **1**(2): 118-120.

Sarkar, S. Mandal, L. and Banerjee, G.C. (1997). Effect of feeding yeasts and antibiotic on the performance of broilers. *Indian J. Poult. Sci.* **32**(2)· 126-131

* Sayed, A.H., Ranade, A.S., Desan, D.N. and Patil, M B (2000) Effect of live yeast culture on the performance of broilers. *Souvenir and Abstracts*. XX Annual Conference and Symposium of Indian Poultry Science Association, Chennai. Abstr. No. PPN-24.

Shome, B.R, Senani, S., Shome, R., Padhi, M.K., Kumar, A., Verma, N.D. and Saha, S.K. (2000). Effect of probiotics on performance of native chicken of Andaman. *Indian J Poult. Sci* **35**(3): 258-261.

Singh, R., Verma, S.V.S. and Mudalgi, P. (1994) Effect of probiotic feeding on carcass traits and gut microflora of chicks *Indian J. Poult. Sci.* **29** (1)· 85-87.

Singh, S and Sharma, V P (1999) Performance of broiler chicks under different energy and probiotic levels during summer season *Indian J Poult Sci*. **34**(1)· 34-37.

Singh, V K and Prasad, J (2000) Effect of live yeast supplemented diets on the growth and nutrient utilization in caged broilers *Indian J Poult Sci* **35**(3) 322-323

Snedecor, G W and Cochran, W G (1980) *Statistical Methods* 7th Ed The Iowa State University Press, Ames, IA

Takalikar, D A , Garrar, M A , Deshmukh, S V and Kalbande, V H (1992) Studies on the effect of probiotic (*Lactobacillus sporegenes*) on the performance of broilers *Poult Guide* **29**(8)· 29-31.

Talukdar, J.K , Sundararasu, V , Prabakaran, R. and Mahanta, D (2000) Effect of probiotic supplementation on broiler performance *Souvenir and Abstracts.* XX Annual Conference and Symposium of Indian Poultry Science Association, Chennai Abstr No. PPN-16

Yadav, B.S., Srivastava, R K and Shukla, P K (1994) Effect of supplementation of the broiler ration with live yeast culture on nutrient utilization and meat production *Indian J Anim. Nutr* **11**(4) 225-227.

Yadav, B.S., Srivastava, R.K and Shukla, P.K. (1996). Effect of supplemental live yeast culture on the performance of broilers *Indian Vet Med J.* **20**· 45-47

Yeo, J and Kim, K I (1997) Effect of feeding diets containing an antibiotic, probiotic or yucca extract on growth and intestinal urease activity in broiler chicks *Poult Sci* **76**(2) 381-385

Zulkifli, I , Abdullah, N , Aziin, N M and Ho, Y W (2000) Growth performance and immune response of two commercial broiler strains fed diets containing *Lactobacillus* cultures and oxytetracycline under heat stress conditions *British Poult Sci* 41 593 597

* Originals not consulted

Yeo, J. and Kim, K.I. (1997). Effect of feeding diets containing an antibiotic, probiotic or yucca extract on growth and intestinal urease activity in broiler chicks. *Poult. Sci.* **76**(2): 381-385.

Zulkifli, I., Abdullah, N., and Azrin, N.M. and Ho, Y.W. (2000) Growth performance and immune response of two commercial broiler strains fed diets containing *Lactobacillus* cultures and oxytetracycline under heat stress conditions. *British Poult. Sci.* **41**: 593-597.

EFFECT OF PROBIOTIC SUPPLEMENTATION ON THE PERFORMANCE OF BROILER CHICKEN

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ABSTRACT OF A THESIS

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ABSTRACT

The effects of different levels of probiotic (*Lactobacillus acidophilus, Streptococcus faecium* and Yeasacc 1026) supplementation at 0.025 and 0.05 per cent of the ration on the performance of broiler chicken were evaluated using 144, one-day old, commercial broiler chicks for a period of eight weeks. The birds were divided into three dietary treatment groups viz., standard broiler ration (T_1), standard broiler ration with 0.025 per cent probiotic (T_2) and standard broiler ration with 0.05 per cent probiotic (T_3). Standard broiler ration was formulated as per Bureau of Indian Standards (1992) specification for broiler chicken feed. The 0.025 per cent probiotic supplemented birds showed a significantly higher ($P<0.05$) body weight upto six weeks of age. At the end of eight weeks of age, the 0.05 per cent probiotic fed birds grew faster. The body weight gain was significantly higher in 0.025 per cent probiotic supplemented group upto six weeks of age but was statistically non-significant upto eight weeks of age. The feed intake was not statistically significant throughout the experimental period. Eventhough the feed efficiency was significantly ($P\leq0.01$) better in the group fed with 0.025 per cent probiotic at the end of second week, it was statistically non-significant at sixth and eighth weeks of age. The protein efficiency was not significantly different throughout the experimental period. The serum cholesterol levels were significantly ($P<0.01$) reduced in both the probiotic supplemented groups. The serum