# EFFECT OF SUPPLEMENTATION OF PHYTOBIOTICS ON THE PERFORMANCE OF BROILER CHICKENS


**THESIS**

**SUBMITTED TO THE**

**BIHAR AGRICULTURAL UNIVERSITY**
**SABOUR (BHAGALPUR) , BIHAR**

*In Partial fulfillment of the requirements*

**FOR THE DEGREE OF**

**Master of veterinary science**

(LIVESTOCK PRODUCTION AND MANAGEMENT)

*By*

**SANJEEV KUMAR**
Registration no.: M/LPM/10/2009-10
**DEPARTMENT OF LIVESTOCK PRODUCTION AND MANAGEMENT**

**BIHAR VRTERINARY COLLEGE**
**PATNA-800 014**
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**DEPARTMENT OF LIVESTOCK PRODUCTION AND MANAGEMENT**
**BIHAR VRTERINARY COLLEGE,PATNA-800 014**
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## CERTIFICATE-I

This is to certify that the thesis entitled "***EFFECT OF SUPPLEMENTATION OF PHYTOBIOTICS ON THE PERFORMANCE OF BROILER CHICKENS***" submitted in partial fulfillment of the requirements for the award of **Master of Veterinary Science (Livestock production and management)** of the faculty of post graduate studies,Bihar Agricultural university, Sabour, Bhagalpur,Bihar is the record of bonafide research work carried out by **Dr. Sanjeev Kumar, Registration no. M/LPM/10/2009-10** under my supervision and guidance. No part of the thesis has been submitted for any other degree or diploma.

This is further certified that the assistance and help received during the course of this investigation and preparation of the thesis have been fully acknowledged.

10/6/11

**(M.K.CHOUDHARY)**
Major Advisor

Endorsed

10/6/11

.....
(Chairman/Head of Department)

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**BIHAR VRTERINARY COLLEGE, PATNA-800 014**

**BIHAR AGRICULTURAL UNIVERSITY, SABOUR (BHAGALPUR) , BIHAR**

# CERTIFICATE-II

We the undersigned members of the advisory committee of **Dr. Sanjeev Kumar, Registration No.; M/LPM/10/2009-10,** a candidate for the degree of **Maser of veterinary science** with major in **Livestock Production and Management,** have gone through the manuscript of the thesis and agree that the thesis entitled ***EFFECT OF SUPPLEMENTATION OF PHYTOBIOTICS ON THE PERFORMANCE OF BROILER CHICKENS*** may be submitted by Dr. Sanjeev Kumar in partial fulfillment of the requirements for the degree.

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## CERTIFICATE-III

This is to certify that the thesis entitled "***EFFECT OF SUPPLEMENTATION OF PHYTOBIOTICS ON THE PERFORMANCE OF BROILER CHICKENS***" submitted by **Dr. Sanjeev Kumar, Registration No. M/LPM/10/2009-10,** in partial fulfillment of the requirements for the Degree of Master of Veterinary science **(Livestock Production and Management)** of the **faculty of post graduate studies, Bihar Agricultural University, Sabour, Bhagalpur, Bihar** was examined and approved on 23.01.2012

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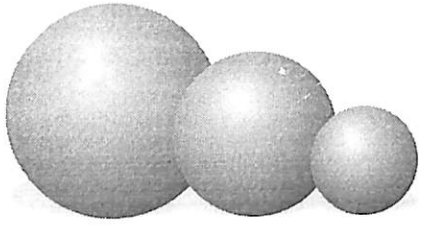
   (Nominee of Dean, Post-Graduate Studies)

**DEDICATED TO**
**MY**
**ADORABLE PARENTS**



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B.V.C., PATNA
June, 2011

(***SANJEEV KUMAR***)

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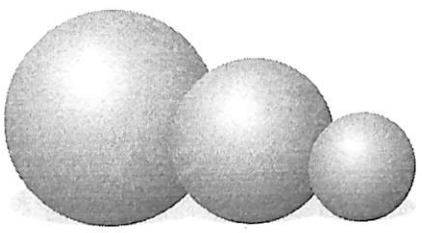
# INTRODUCTION



# INTRODUCTION

Poultry industry is the rapidly expanding sector of Indian Livestock Economy, with the annual growth rate of 10-12% per annum. India ranks third in egg production and fifth in broiler production. Poultry industry provides employment to 1.5 million people, with an annual turnover of Rs. 130 billion, which contributes 2% to our GDP (Bootwala, 2005). Production of the quality assured eggs and broiler meat has opened the global market opportunity and improved economics of poultry farming. Poultry nutrition is going through a gradual but constant change in the feed formulation designed for rapidly growing broiler chickens with a steady improvement in feed efficiency from around 2.2 in the early 1980s to 1.75 as on today. This improvement is due to the improved genetic potential, better nutrition and managemental practices.

It is well accepted that the faster growth rate with superior feed efficiency is difficult to obtain by the conventional feeding standards and ingredients. For improved broiler performance, broiler feed has also evolved from time to time and many supplements and additives for desired performance are used. Various additives like antibiotics, prebiotics, probiotics, enzymes, hormones and yeast cultures, etc. are used to improve the performance of birds.

Synthetic drugs and chemicals such as antibiotics were regularly used in poultry industry as growth promoters. However, these drugs have their own inherent disadvantages. In this context herbal products are safer alternatives to synthetic drugs. The natural products are preferred due to decreased side effect, low cost of production, being environment friendly

and have reduced risk of toxicity. Now-a-days, food safety and public health issues are of increasing importance with the growth of commercial agriculture and international trade. As a result, there is an increased demand for natural products and safe alternatives to antibiotic growth promoters in the animal feed industry. Hence, to manage the challenge of antibiotic free feeding, a sustainable approach is the use of phytobiotics. Phytobiotics are becoming popular due to following disadvantages of antibiotic growth promoters;

a. Ban on Antibiotic Growth Promoters (AGP's) feeding in animals and birds in many countries.
b. Residual effect of certain Antibiotic Growth Promoters.
c. Development of resistant microflora due to prolonged use of antibiotics.

Phytogenic feed additives or phytobiotics is a relatively new term in the animal feed industry and used to describe natural compounds derived from aromatic and other plants, which are applied to animal feed due to variety of beneficial properties associated with them. Phytobiotics not only have different aromatic characteristics, but also show variety of biological effects, e.g. anti-oxidative, fungicidal, anti-microbial and physiological effects.

As a result of their multifunctional composition, phytobiotics have a very complex mode of action when applied to broiler feed, whereby the positive effects seen in broiler performance are increased appetites, improved feed conversion and increased growth performance in comparison to antibiotics. This is not only due to an anti-microbial effect, but probably more a result of a positive effect on digestion through increased production of saliva, gastric and intestinal juices and thus the

release of more digestive enzymes. The nutrients are better digested and absorbed by the bird from small intestine; as a result fewer nutrients will reach the colon, which will again minimize the nutrients available to the bacterial population for growth in the colon. Thus, phytobiotics can also control the microflora indirectly by supporting the endogenous defence mechanisms in the birds.

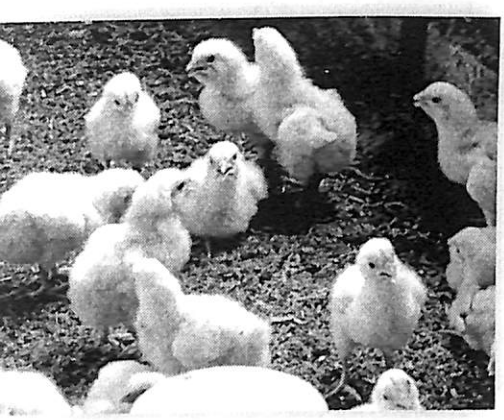
Thus the, phytobiotics improve overall performance of birds by :

i. Improving palatability of the feed as well as appetite of the birds.
ii. Increasing saliva-secretion.
iii. Increasing gastric-acid production and intestinal juices.
iv. Improving digestion of nutrients in birds.
v. Improving release of digestive enzymes.
vi. Maintaining favourable pH in gastro-intestinal tract.
vii. Phytobiotics can also act as anti-oxidants, fungicidal, anti-microbial by supporting animal's endogenous defence mechanism (Pande *et al.* 2008; Sirvydis *et al.* 2003; K. Svoboda *et al.* 2007).

Hence, the present study was undertaken to evaluate the effect of Phytobiotics on the performance of the broilers. The trials were designed with the following objectives;

1. To study the effect of Phytobiotics supplementation on the growth performance of broilers.
2. To study the effect of phytobiotics supplementation on the carcass characteristics of broiler chicken.
3. To estimate the economics of broiler production by using phytobiotics supplementation.

# CHAPTER-2
# REVIEW OF LITERATURE



# REVIEW OF LITERATURE

Phytobiotics are the compounds which are derived from the combination of different natural beneficial compounds extracted from medicinal plants and spices; are used in poultry feeding now-a-days. Phytobiotics are better than antibiotics as they do not have any ill effects due to residues. Thus, as an alternative to antibiotics, the phytobiotics are used as growth promoters. Hence, it is necessary to evaluate the efficiency of phytobiotics along with economic consideration. The present trial was aimed to study the effect of phytobiotics on the performance of broilers. Thus, while reviewing the literature more emphasis was given on the use of phytobiotics and herbal growth promoters, their effective combinations and effects on performance and economics of broiler production.

Jinturkar (1989) studied the effect of different growth promoters in 300 day-old Hubbard broilers to compare the efficiency of four commercially available growth promoters. The different growth promoters 'CHQ-60', 'Livol', 'Livon', and 'Animol' were fed at the rate of 0.1%, 0.5%, 5 ml/100 birds and 30 ml/100 birds, respectively, through feed or water for six weeks. The birds receiving Livon were found to be more efficient in feed utilization as compared to control. It was concluded that different growth promoters when used in broilers, improved the gain in weights, feed consumption and efficiency of utilization of feed.

Chakrabarty *et al.* (1991) divided 400 one-week-old broilers into four groups. Group I was given 'Tefroli' at the dose level of 15 ml/100 birds on alternate days upto seventh week (alternate day medicine) in water. Group II was given same dose alternatively after 7 days upto

seventh week (Interrupted medicine). Group III was given similar quantity of drug on continuous basis upto seventh week (continuous medication). Group IV was control without any supplementation. The results of the study indicated that the interrupted use of medicine facilitated better feed utilization, feed conversion and weight acceleration.

Huang *et al.* (1992) evaluated the effect of Chinese medicinal herbs additives on the growth of broilers. 400 broilers were fed on diets supplemented with 1% of a mixture of Chinese medicinal herbs *Astragalus chinensis*, *Polygonum multiflorum*, plus malt, yeast and *Ziziphus jujuba var. spinosa.* For broilers of two strains, weight gain increased by 5.37 and 6.09% and feed conversion efficiency improved by 9.0 and 10.1%, respectively, for broilers given herbal supplement as compared with controls. It is concluded that the Chinese medicinal herbs has a stimulating effect on growth of broilers.

Dey and Samantha (1993) evaluated the effect of feeding garlic (*Allium sativum*) as a growth promoter in broiler. For 42 days, caged broilers were freely given a commercial diet alone, or with 0.25 and 0.5% garlic (*Allium sativum*), or a conventional growth promoter, Aureomycin (0.01%). Final body weight gain was 552.44, 585.89, 636.99 and 650.22 g, respectively.

Prasad and Sen (1993) observed the effect of different growth promoters, viz. 'Livol', Leptaden' and 'Biospur' on the performance of broilers. They reported that none of the growth promoters affected growth rate, but Livol significantly improved feed conversion ratio.

Gendi *et al.* (1994) evaluated the effect of Cocci-Nel and Lomoton dietary supplementation as herbal growth promoters on productive performance in broilers for eight weeks. One-day-old 161 Hubbard

chickens were fed on diet supplemented with herbal growth promoters (mixtures of fermented and dried extracts of several herbs and edible plants plus dried condensed maize distillers' byproducts, Cocci-Nel and Lomoton) @ 0, 500, 1000 or 1500 g/T. Lomoton and Cocci-Nel @ 500 or 1000 g/T improved live weight, weight gain, feed conversion ratio and economic efficiency while @ 1000 or 1500 g/T decreased mortality rate. Lomoton @ 1000 g/T and Cocci-Nel @ 500 g/T of diet were adequate to achieve favourable results.

Deshpande *et al.* (1995) conducted a trial on 80 broilers divided into four groups, with or without' Nutrospel', an herbal feed additive at the rate of 1.5, 2.0 and 2.5 g/kg of feed. It was observed that at the given dose rate, the drug did not have either significant growth promoting or immunomodulating effect on the birds under study, although the trend indicated beneficial effects in terms of gain in body weight, FCR and raised cellular immune response.

Pisarski *et al.* (1995) fed starter and grower ration with 0 or 8% feed fat without or with probiotic C (*L. Acidophilus. Bacillus subtilis*) 3g/kg or probiotic L (*L. Acidophilus, Streptococcus faecium* and *Sacch cerevisiae*) 1g/kg to Astra B broiler chickens in two feeding trials. They observed no significant effect of probiotic on dressing percentage or on carcass meat than control.

Ather (1996) observed a significant increase in body weight with much lower mortality in birds receiving 'livfit', an herbal growth promoter. This resulted in extra economic benefit of Rs. 3.00 per bird. The profitability improved further by taking in to account the prevention of mortality losses in the treated birds.

Dobretsberger *et al.* (1996) studied the effect of addition of the herbal preparations ASIM (Anti-stress), Neblon (healthy and stable gut function) and Livol (efficient liver function, digestion and metabolism) in broiler feed and observed almost similar results as the addition of antibiotics (tetracycline and virginiamycin). Herbal products showed additional benefits by lowering morbidity and mortality and improving feed conversion ratio and quality of meat as observed in fatty acid analysis. They concluded that the herbal animal feed supplements could be used as alternatives to antibiotics to avoid the problems of residual toxicity and development of resistant bacterial strains.

Kaistha *et al.* (1996) studied the effect of useful microbes (L. Acidophilus, Streptococcus uberis, Saccharimyces cerevisiae and their respective strain, L. *Bulgaricus* $L_4$. *Streptococcus lactis* $S_1$ and *Saccharomyces cerevisiae* $Y_3$) isolate from Bottle gourd and Bitter gourd on broilers. They found that difference in the dressing percentage were non-significant.

Narhari (1996) reported that supplementation of 'Livfit' at 0.2% level in broilers recorded higher body weight, improved feed conversion efficiency, thereby resulting in a favourable cost-benefit ratio.

Sarkar *et al.* (1996) fed a basal diet without or with 3 type of yeast viz. Yea-Sacc 1026-50g, pure line yeast culture-10g and Soluyeast to day old straight run commercial broiler chicks and found no significant difference in eviscerated yield, giblet and edible meat yield.

Taklimi *et al.* ((1996) designed an experiment to evaluate the performance of broilers fed two levels of energy (2800 and 2540 kcal/kg ) and two levels of protein (23 and 21%) with or without live yeast in

broilers. The dressing percentage were not affected by energy, protein or yeast levels.

Yadav *et al.* (1996) supplemented live Baker's yeast at the level of 0, 0.1, 0.3 and 0.5% in drinking water in broilers and found no significant effect of yeast supplementation on dressed yield.

Dobretsberger *et al.* (1997) incorporated three herbal preparations Neblon, Stresscare and Livol, in the diet of turkey poults. Neblon, a herbal preparation for optimizing enteric function, was incorporated in the diet for first two weeks of life at a dose of 2kg / ton feed. Stresscare, a product with anti-stress and immunomodulatory effects, was given in the first week @ 2 kg /T of feed and second week @ 1 kg/T of feed. Livol, a digestion enhancer, was given in the third week @ 2 kg /T of feed and then onwards 1.5 kg/T of feed. The treated poults performed better than the unsupplemented group. The mean live weight of male and female turkeys in the supplemented group at 21 and 15 weeks of age was 18.20 and 9.30 kg. respectively. These were 3.9 and 7.3% higher compared to the control groups with 17.51 and 8.67 kg, respectively. Feed conversion ratio for the supplemented and control groups was 2.756 and 2.900, respectively. Mortality rates were 4.81 and 8.20% in the supplemented and control groups, respectively.

Kailaswar *et al.* (1997) studied the effect of dietary supplementation of Roxarsone and Livol on the performance of broilers. Day-old broiler chicks with 43.33 g initial weight were divided into three groups of 20 each with three replicates. The treatments were standard basal ration (T0), basal ration + Roxarsone (an arsenical) @ 1 kg/T (T1) and basal ration + Livol (an herbal product) @ 5 kg /T (T2). Total live weight gain and feed intake were higher ($P<0.05$) in the Livol

supplemented group. Feed conversion efficiency and carcass quality did not differ between treatments. The cost of feeding was estimated to be Rs. 10.51, 10.06 and 10.06 per kg weight gain in groups T0, T1 and T2, respectively.

Patil (1997) undertook an experiment on 400 day-old broiler chicks in two trials, to study the effect of 'Megacal' on the performance and other parameters in broilers by dividing the birds into eight groups of 50 birds each. Results of first trial indicated that the Megacal supplementation numerically improved the performance of birds; however the improvement was statistically non-significant. In the second trial groups with lesser level of calcium and phosphorus by 10 and 20% , respectively, showed significantly improved live weights due to Megacal supplementation at the rate of 500-750 g/T of feed. The results indicated that an herbal product Megacal is useful in improving the calcium and phosphorus availability to the birds and also in improving the performance.

Panda *et al.* (1999) Showed that no significant effect of probiotics on carcass yield.

Mishra and Singh (2000) evaluated the effect of feeding root powder of *Withania somnifera* (Ashwagandha) on growth rate, feed consumption, feed efficiency and mortality rate in broiler chicks. 200 day old chicks from same hatch lot were selected randomly and divided into four groups (G1, G2, G3 and G4) with fifty birds in each group, Group G1, G2 and G3 were fed broiler mash supplemented with 0.5%, 1% and 2% Ashwagandha root powder, respectively. While group G4 served as control. The differences between groups for weekly body weight gain from day-old chicks to first, second, fourth, fifth, sixth, seventh and eight

weeks of age were found statistically non-significant but at third week the differences between groups were significant ($P<0.01$). However, the differences in the average live body weights from the different groups were statistically non-significant. The weight gains in group G1 was better than control group but at par with other G2 and G3. The total feed consumption upto eight weeks of age was 2365.72, 2477.75, 2454.30 and 2626.20 g for groups G1, G2, G3 and G4, respectively. The feed consumption in control group was slightly higher as compared to treated group. The feed efficiency in treatment group G1 and G2 were better as compared to group G3 and control. The cumulative feed efficiency in treatment groups was also better than control group. The mortality rate was 4, 4, 6 and 12% in group G1, G2, G3 and G4, respectively. The highest mortality percentage was noticed in the control group. It was concluded that the age of chicken advances 0.5% Ashwagandha supplementation has shown definitely better response as compared to control and other treated groups.

Muhammad-Akram *et al.* (2000) investigated the effect of 'Digestarcom' an herbal feed additive on the performance of broiler chicks fed different levels of rapeseed cake. Fourteen experimental rations containing seven rapeseed (0, 2, 4, 6, 8, 10 and 12%) x Digestarcom (0 and 150 g/T feed) levels feed to 14 treatment groups with 3 replicates of 10 chicks each. A higher weight gain per bird was observed for all the levels of rapeseed treated with 'Digestarcom' as compared to non-supplemented groups. More feed was consumed by broilers supplemented with Digestarcom as compare to control. The birds from groups supplemented with 'Digestarcom' recorded better feed to gain ratio than the non-supplemented control.

Hong *et al.* (2001) conducted a trial on 1000 day-old broiler chickens to study the effects of supplementary herbal products (Miracle 20 or M 20) on the performance, nutrient digestibility, and small intestine microflora and serum lgG level. Growth performance was not significantly affected by dietary treatments. The herbal product supplementation improved the weight gain of male broiler chicks. The colony-forming unit (CFU) of *Clostridium perfringens* in the small intestine was significantly lowered in treatments. Dietary herbal products did not significantly affect growth performance and nutrient digestibility in broiler chickens.

Maiorka *et al.* (2001) conducted a trial to test the substitution of antibiotics with prebiotics, probiotics or symbiotics in broiler diet upto 45 days. The groups were as follows; T1- no additives, T2- antibiotics (Olaquindoxa and Nitrovina), T3- prebiotic (0.2% S. Cerevisiae cell wall), T4- probiotic (300 ppm B. substilis) and T5-symbiotic (T3+T4). Better live weight gain was observed with symbiotic followed by antibiotic, prebiotics, probiotics and control feed. The feed conversion ratio was found to be poorest in control group. Thus, they concluded that substitution of antibiotic by symbiotics in broiler chicken diets is better alternative for the poultry industry.

Shafey *et al.* (2001) studied the response of dietary supplementation of Bio-Mos (BM). They reported that BM did not influence body weight gain, feed efficiency and nutrient utilization. The highest dietary BM level (3 verses 1.5 or 0 G/ kg) increased carcass abdominal fat and reduced the proportion of drumstick in the carcass of meat chickens. It was concluded that, addition of BM to the diet of

chickens did not significantly influence the performance and nutrient utilization of meat chickens.

Alcicek *et al.* (2003) determined the effect of an essential oil combination (EOC) derived from selected herbs growing wild in Turkey on broiler performance. A total of 1250 sexed day-old broiler chicks obtained from a commercial hatchery were divided randomly into five treatment groups (negative control, antibiotic and essential oil combination (EOC) at three levels) of 250 birds each. The EOC at 24, 48 or 72 mg/kg diet and an antibiotic at 10 mg Avilamycin per kg. diet were added to the basal diet. There were significant effect of dietary treatments on live weight, feed intake (except at day 42), feed conversion ratio and carcass yield at 21 and 42 days. Live weights were significantly different between the treatments. The birds fed on diet containing 48 mg essential oil /kg recorded the highest live weight, followed by the birds receiving the diets containing 72 mg. essential oil /kg., the antibiotic, the negative control and the 24 mg. essential oil/kg. at day 42, respectively.

Demirozu *et al.* (2003) studied the effect of a phytogenic product on growth performance in broilers. The addition of Biomin P.E.P. to the diet improved growth performance and feed conversion in broilers compared to the control group. Mortality was also decreased in the Biomin P.E.P. group, resulting in an improved European Efficiency Factor in the Biomin P.E.P. group compared to the control group. Results showed that the addition of the phytogenic product Biomin P.E.P. to the diet of boilers could successfully replace conventional antibiotic growth promoters.

Guo *et al.* ( 2003) conducted two trials to study the effects of polysaccharide extracts of two mushrooms, *Lentinus edodes* (LenE) and

*Tremella fuciformis* (TreE), and a herb, *Astragalus membranaceus* (AstE) on growth performance, and the weights of organs and the gastrointestinal tract of broiler chickens. Three extracts (LenE, TreE and AstE) were supplemented at inclusion rates of 0.5, 1, 2, 3 and 4 G/kg from 7 to 14 days of age and compared with an antibiotic treatment group (20 mg/kg), virginiamycin (VRG) as well as a group of non-supplemented birds. Body weight gain, feed intake and feed conversion ratio of the extract-supplemented groups were not significantly different from those of the antibiotic group. The birds fed the extracts showed better growth performance than the non-supplemented birds, but were not significantly different from those fed VRG. Among the three extracts, LenE appeared to be a potential growth promoter.

Lee *et al.* (2003) conducted the experiment to describe the effects of thymol, cinnamaldehyde and a commercial preparation of essential oil components (CRINA Poultry), in female broilers. Feed and water were provided for *ad libitum* consumption. Feed intake, weight gain and feed: gain ratio was not different among the treatments. Water intake was significantly lowered by cinnamaldehyde. Relative liver weight percentage was highest in birds given thymol, but this was seen only at the age of 21 days. Patterns of digestive enzymes in pancreatic tissue were similar for the four treatments. Thus, the results showed no effect of essential oil constituents on growth performance in female broiler chickens, but it cannot be excluded that positive effects would have been observed under less hygienic environmental conditions or when using a less digestible diet.

Sirvydis *et al.* (2003) discussed the use of phytobiotics in broiler feeds, and their effects on productivity and physiology. The use of

phytobiotics intensified the metabolism of proteins, fats and carbohydrates in broilers influencing their growth. Live weight gain and feed conversion efficiency improved with phytobiotics.

Demir *et al.* (2003) investigated the effect of five herbal natural feed additives as alternatives for an antimicrobial growth promoter on the growth performance and some plasma and intestinal traits in broiler chickens. 72 female broiler chicks (one-day-old) were randomly assigned to six group each containing 12 chicks. Body weight gains of broilers at 14 days of age given supplemented diets with garlic were higher than those given Du-Sacch ($P<0.05$). The supplements had no effect on body weight gain, feed intake and feed: gain ratio ($P>0.05$). However, the chickens from 0 to 14 days of age which received quiponin, garlic or thyme gained 3.5, 5.48 or 4.13% more body weight than the supplemented chickens with antibiotic, respectively. Feed: gain was not significantly affected by treatments from 0 to 14 or 0 to 42 days of age. Plasma cholesterol level was not altered by the supplements. However, plasma triglyceride level in broilers given the diet supplemented with quiponin was significantly higher than those given oregano. The experiment indicated that there was a reduction in crypt depth in the ileum of broilers given dietary natural growth promoters such as garlic and thyme. The natural feed additives may be used as natural herbal growth promoters for broilers.

Denli *et al.* (2003) found that liver weight, intestinal PH, and abdominal fat weight were unaffected significantly ($P>0.05$) by probiotic, antibiotic, and organic acid treatment.

Modirsanei *et al.* (2003) found that there were no statistically difference among treatment groups in carcass yield when fed the diet

supplemented with Farmagulator (2.5g/kg) and Protexin (1.5g/kg) to broilers.

Priyankarage *et al.* (2003) found that no indication of any advantages conferred by addition of probiotics on dressing percentage and fat /meat ratio.

Sultan (2003) investigated the effect of *Curcuma longa* (Turmeric ) feed additive on overall performance of broiler chickens. The implication of different diet inclusion levels (0.25, 0.5 and 1.0%) of Turmeric on body weight gain, feed conversion; carcass analysis, lymphoid organ weight index and blood cell count of broilers were tested comparing to untreated control birds. The higher body weight gain (1344.5 g) was observed in birds fed diet containing Turmeric at level of 0.5% followed by birds receiving Turmeric at level of 0.25% (1329.8), 1% (1306) and control (1268.2). Moreover, the feed conversion ratio of birds receiving 0.5% Turmeric in their diets was the best (2.08) as compared to control (2.47) and other treated groups (2.27 and 2.31). Regarding carcass analysis, the protein percent of breast and thigh muscles of birds in different treated and control groups were found nearly the same. The lower fat percentage (1.0%) was recorded in carcasses of birds receiving 1.0% Turmeric followed by 0.5, control and 0.25%. On the other hand, higher bursa and thymus weight indices were detected in birds receiving diet containing 0.5% Turmeric, while the higher spleen weight index was observed in birds receiving feed containing 1.0% Turmeric. The results of organoleptic test revealed that Turmeric did not induce any abnormal flavour, colour or smell. The higher levels of Turmeric inclusion (0.5 and 1.0%) increased both erythrocyte and total leukocyte count.

Tollba and Hasan (2003) Assigned three-hundred day-old Arbor Acres broiler chicks into three groups with 100 birds in each with two replicate floor pens, and were fed on a commercial diet enriched with ground Black Cumin or Garlic at 1% under normal conditions. At 35 days of age, each group was divided into two equal subgroups. The first was kept under normal condition at $24^0$C and the second was exposed to $38^0$C for three hours in six days from 35 to 40 days of age. It was shown that adding Black Cumin or Garlic as natural feed additives to broiler diets under normal temperature conditions increased ($P<0.05$) live body weight, live weight gain, feed conversion, total plasma protein, serum albumin, globulin, plasma glucose and triodothyronine (T3). Mortality rate, plasma cholesterol, plasma total lipids, creatinine, aspartate aminotransferase and alanine aminotransferase were reduced ($P<0.05$) by the feed additives. There were no significant effects of feed additives on the weights of the liver, spleen, bursa and intestine, but there were slight effects on the respiration rate, body temperature and a minimal increase in blood pH during heat exposure. Feed additives decreased ($P<0.05$) body weight, live weight gain, feed consumption, T3, plasma glucose and total proteins, while they increased ($P<0.05$) mortality rate, body temperature and respiration rate of broiler chicks, corresponding to high temperature conditions.

Spais *et al.* (2003) studied the effect of mannan oligosaccharide Bio-MOS on broiler chicken performance, after its incorporation in the starter diet. Results showed that chickens in the Bio-Mos fed group exhibited a significant ($P\leq0.05$) improvement in body weight compared to control at day 10 (295 vs. 254 g) and day 40 (2180 vs. 2017) of age. Feed intake per bird from day-old to day 40 of age showed a significant ($P\leq0.05$) increase in the Bio-Mos group compared to control (3647 vs.

3612 g), whereas feed conversion ratios also demonstrated a significant ($P \leq 0.05$) improvement for the Bio-MOS group (1.73 vs. 1.79). Mortality rate was lower in the Bio-MOS group compared to control (2.5 vs. 2.9%); however the difference was statistically non-significant.

Szucs-Peter *et al.* (2003) determined the effects of herbal tea mixtures in broiler rearing in order to promote greater growth, live weight gain, better feed conversion and better carcass quality and to improve nitrogen and phosphorus retention in order to reduce environment pollution caused by poultry faeces. Four treatments in four repetitions on 400 mixed-sex Ross 308 meat-hybrids were applied. It was shown that broilers drank tea (at an equivalent amount to their regular water consumption) instead of water. Herbal teas improved feed consumption, live weight gain and meat yield/carcass quality of broilers compared to those, which received only water. However, the difference were not significant. The appetite-promoting effects of the different types of tea did not correlate with better-feed conversion and live weight gain. Herbal tea mixtures are more beneficial than those with only tranquilizing or appetite-promoting effects.

Al-Harthi (2004) conducted a trial to study the efficiency of utilizing some spices and herbs with or without antibiotic supplementation on growth performance and carcass characteristics of broiler chicks. Black or hot pepper, canella, carnation, cardamom, cumin and green tea were fed at 0.1% without or with 40 G/ ton of amoxicillin. The chicks were fed with the experimental diets from 10 to 38 days of age, whereas at 38 days of age the spices and amoxicillin were withdrawn and all the experimental groups were fed with the control diet from 39-43 days of age. Data revealed that 0.15% cumin insignificantly enhanced

growth by 19.8% and FCR by 16.2% when compared with the control group and with similar growth and FCR to amoxicillin. It is concluded that 0.10% of cumin could serve as non-conventional feed additive in broiler diets.

Cross *et al.* (2004) studied antibacterial properties of aromatic plants in poultry diets. The five groups of birds were treated by adding oregano, morjorum, thyme, yarrow or rosemary as dried herb material to the basal diet. The concentration of the *Clostridium perfringens* in the caecum were lowest in birds fed diets containing supplements of thyme and yarrow and highest for control diets but at the same time birds fed with the control diet had a numerically lower concentration of caecal coliforms compared to those fed with the diets containing either yarrow or thyme.

Guo *et al.* (2004) used 720 female broiler chicks to test the effect of 4 dietary concentrations of a Chinese herbal medicine (CHM) formulation (0.25, 0.5, 1 and 2 G/kg), as an alternative for virginiamycin (VRG), on growth performance in broilers. The CHM dietary treatment produced increased body weight gain at 7 to 21 days of age but not at 21 to 28 days of age compared with the non-supplemented and VRG groups. The CHM groups had a higher feed intake and a better feed conversion ratio (FCR) than the VRG group between 21 and 28 days. It was concluded that the birds of the CHM group had better growth performance from day 7 to 21 but not thereafter.

Halle *et al.* (2004) conducted three studies with regard to the influence of herbs and essential oils on growth and carcass traits with male broilers over periods of 35 days (trials 1 and 2) and 84 days (trial 3), respectively. The effects of oregano and its essential oil, savoury, *Nigella*

*sativa* and cacao husks as feed supplements were investigated. Graded supplement of oregano (0, 2, 4, 10 and 20 g/kg) and its essential oil (0, 0.1, 0.2, 0.5 and 1.0 g/kg) reduced daily feed intake of broilers compared to control. Enrichment with essential oil significantly improved feed efficiency. Savoury, N. Sativa and cacao husks increased daily feed intake of broilers in trial 2. In comparison to control birds live weight at the end of the feeding period was significantly higher in all experimental groups of trial 2 (10 g cacao husks, 10 g cacao husks + 5 g *Nigella sativa*, 10 g N. Sativa and 50 g N. Sativa). N-balance analysis regarding protein accretion of broilers in the starter period did not show any differences between control birds and groups fed with a supplement of 10 g and 20 g savoury, 10 g cacao husks or 10 g N. Sativa, 5 g or 10 g of Savoury as feed additive improved daily feed intake over the entire feeding period in the long term trial (84 days). Up to the 35$^{th}$ day of life (trial 1) 10 g savoury in the feed lead to a significantly improved daily live weight gain compared to control group and the group fed with a supplement of 5 g savoury. At the end of trial 3, live weight of all birds was identical.

Hernandez *et al.* (2004) studied the influence of two plant extracts on performance, digestibility and digestive organ weights in broilers. There were four treatment groups, viz, control; 10 ppm avilamycin (AB); 200 ppm essential oil extract (EOE) from oregano, cinnamon and pepper; and 5,000 ppm Labiatae extract (LE) from sage, thyme, and rosemary. No differences in feed intake or feed conversion were observed. From 14 to 21 days of age, broilers fed the LE diet grew faster than the broilers fed the control or EOE feeds (68.8 vs. 63.9 and 61.6 g/day, respectively). Antibiotic and plant extract supplementation improved apparent whole-tract and ileal digestibility of the nutrients. For starter feed, LE

supplementation improved apparent fecal digestibility of DM ($P<0.01$) and all additives increased ether extract digestibility ($P<0.001$). However, no effect was detected for CP digestibility ($P>0.1$). At the ileal level, the AB, EOE and LE supplementation of the starter feed increased ($P<0.01$) DM and starch digestibility but not CP digestibility ($P>0.1$).

Kabir *et al.* (2004) observed significantly higher carcass yield and breast weight in broiler chicks fed with the probiotics (Protexin Boost) at 2g/10 litre drinking water at the age of 6 weeks than the control.

Lee *et al.* (2004) concluded that essential oils originating from plants have antimicrobial activity and have toxic effects in poultry only when administered at very high doses. Antioxidant activity and hypocholesterolemic effects have been reported in chickens. In various studies, but not all, a growth enhancing effect of essential oils has been found. The characteristic flavour of essential oils might play role in poultry performance, but this needs to be confirmed. Essential oils may stimulate the digestion process. It appears that individual compounds of an essential oil have a wide range of activities and may act in an additive, synergistic and antagonistic fashion. The effect of essential oils in poultry may not only be confined to the microflora, but may extend to animal metabolism. Knowing the activity and effects of individual compounds is useful to formulate mixtures of compounds so as to enhance efficacy. It was concluded that the, dietary essential oils may be used as alternatives to antibiotics, but whether their effects on growth performance are a consequence of anti-microbial activity needs to be studied further.

Pelicano *et al.* (2004) evaluated the effect of different probiotics and prebiotics on the performance of broilers. One-day-old male broiler chicks from the Cobb strain were randomly distributed in 3x3 factorial

arrangements, considering three probiotic and three prebiotic sources. Nine treatments with four replications and 35 birds per replicate were used. The results showed that there was no influence of treatment on feed intake at the different rearing phases. Better weight gain ($P<0.05$) was seen when diet was supplemented with the phosphorylated mannan oligosaccharide-based prebiotic (MOS) compared to diets without prebiotics. Feed conversion of birds fed diets with probiotics and prebiotics was better than feed conversion of birds not receiving such additives. Such better results were seen in the initial period (1 to 21 days), but not in the following period (1 to 42 days). Better rearing viability was seen when MOS was used together with organic acid when compared to the diets without prebiotic. Viability was worst when no probiotics or prebiotics were used. It was conducted that beneficial effects were seen in performance of birds at 21 days. When the growth promoters were used, but not at 42 days of age. Nevertheless, there was better growth and viability at 42 days of age when growth promoters were added.

Priudokiene and Gudaviciute (2004) analysed the effect of phytogenic preparation Biomin P.E.P. -1000 on the growth of Cross Hibro-G 300 chicken broilers at 1-42 days of age. The experiment was conducted on three groups of broilers containing 100 chickens. The chickens of the control group received antibiotic flavomycin -80 in their diet; antibiotic of second group was replaced by phytogenic preparation Biomin P.E.P. – 1000 in dry powder form and for third group in the liquid from. The results indicated that the live weight of chickens of the experimental groups was higher by 4.87-14.55%, compared with the control group.

Rekhate *et al.* (2004) conducted an experiment to assess the effect of Shatavari (*Asparagus racemosus* Wild.) root powder on the performance of 80 day-old broilers up to six weeks of age. The root powder of Shatavari was added over the basal ration at 0.5% level ($T_2$), 1% level ($T_3$), 1.5% level ($T_4$), where as the $T_1$ was control basal ration having CP 22% and ME 2900 kcal/kg of feed. The average body weights at sixth week of age for $T_1$, $T_2$, $T_3$ and $T_4$ were 1104.00±61.96, 1256.50±45.84, 1514.50±33.28 and 1560.50±38.43 g, respectively. The body weight gain and feed efficiency varied significantly ($P<0.01$) between the different treatments and found to be better with increasing level of Shatavari root powder. The DM and CP digestibility for $T_1$, $T_2$, $T_3$, $T_4$ was 64.77±0.67, 55.45±1.76, 65.59±0.53 and 59.16±1.62, 67.07±0.26 and 60.12±1.27, 67.17±0.87 and 60.52±1.25%, respectively. The blood biochemical profile revealed the significant ($P<0.01$) rise in haemoglobin, serum total protein and globulin.

Gaikwad (2005) conducted an experiment to study the effect of supplementation of garlic (*Allium sativum*) at different levels on the performance of broilers. 350 day-old-chicks were randomly divided into seven groups and were subjected to various levels of garlic treatment as follows; supplementation of garlic at 0%, 0.5%, 1%, 1.5%, 2%, 2.5%, 3% of the feed for period of five weeks. The average live weights at the end of the five weeks were 1370.1, 1347.74, 1431.0, 1346.73, 1366.78, 1356.6 and 1344.3 g respectively. The average live weights from group with 1% garlic supplementation were significantly higher ($P<0.05$) than control as well as other treatment groups. In terms of other parameters like gain in weight, feed consumption and feed conversion ratio the group with 1% garlic supplementation was much better than other groups.

Khaksefide and Rahimi (2005) reported that the leg and breast meat of probiotics fed broiler chickens were higher in moisture, protein and lower in fat as compared to the leg and breast meat of control group when the probiotics fed at 100 mg/kg diet with L. Acidophilus, L. Casei, Bifidobacterium bifidum. Aspergilus oryzae, Strepto, faecium and Torulopsis species.

Westendarp (2005) noted that essential oils are very complex mixtures of volatile, lipophilic compounds originating from plants. Due to their lipophility they posses a good intestinal and percutaneous absorption. Under external application essential oils demonstrate antiphlogistic or rubefacient to pro-inflammatory activities. On oral intake they stimulate the secretion of digestive enzymes and increase gastric and intestinal motility. Moreover they show spasmolytic, Expectorative and diuretic activities. Besides antimicrobial properties on bacteria and fungi have been observed in vitro and in vivo. Due to their various effects, essential oils increasingly gain attention in animal nutrition and are alternatives to antibiotic growth promoters. In some studies essential oils have been reported to reduce intestinal pathogens in broilers and piglets. However, the observed effects on growth performance are inconsistent among studies. Also, it was concluded that there are still some unanswered questions concerning the mode of action, metabolic pathway and optimal dosage of essential oils in different animal species.

Cormelison *et al.* (2006) evaluated the use of hops (*Humulus iupulus*) in broiler diets as a potential replacement for antibiotics. Broiler diets were prepared based on nutrient specifications of top broiler companies and supplemented with either 50 G/ton penicillin or hops at

0.5, 1.0, 1.5 and 2.0 lbs/ton of feed and compared to an unsupplemented control group. Each treatment was assigned to eight replicate groups of 45 male chicks of a commercial broiler strain. The diets were fed in pelleted form with starter diets fed as crumbles. Addition of 50 G/ton of penicillin resulted in significant improvements in body weight, feed conversion, and feed efficiency at all ages, as compared to those fed the negative control. The addition of hops at 0.5 lbs/ton also resulted in significant improvements in feed conversion and feed efficiency at all ages when compared to the negative control, and also significantly improved body weight at $14^{th}$ day as compared to those fed the negative control diet. At $42^{nd}$ day, the body weight of chicks fed 0.5 lbs of hops/ton was greater (P=0.09) than that chicks fed the negative control. Higher levels of hops feeding resulted in some improvements as compared to those fed the negative control; including fourteenth day body weight for those fed 1.0 lb/ton, and improved 1 to 42 day feed conversion and feed efficiency for those fed 1.5 lbs/ton. Results of the study suggested that inclusion of hops into diets at the rate of 0.5 lbs/ton for broiler chickens might result in improved growth rate and feed utilization in the absence of growth promoting antibiotics.

Esonu *et al.* (2006) conducted 12 weeks feeding trial to evaluate the effects of Neem (*Azadirachta indica*) leaf meal (NLM) on body weight gain, carcass and organ characteristics and haematological values of laying hens. The leaves were harvested, chopped to facilitate drying in the sun until they became crispy but still greenish in coloration. The Sun-dried leaves were milled using a hammer mill to produce the leaf meal. Four layers diets were formulated to contain the NLM at 0%, 5%, 10% and 15% dietary levels respectively and were used to feed 120 Shikka brown layers already ten months in lay. The birds were divided into four

groups of 30 each and randomly assigned to the four treatment diets in a completely randomized design (CRD). NLM did not show any appreciable difference in weight gain between the birds at 0% and those at 5%, 10% dietary levels. Carcass weight, dressed weight, liver, heart and gizzard weights were significantly ($P<0.05$) increased at 5% dietary level of NLM. There was no significant difference in Hb% and PCV between birds on 0% and 5% treatment diets. However, these differed significantly ($P<0.05$) from those of birds on 10% and 15% treatment diets. There were variations in the differential WBC count; marked lymphocytopenia adversely affected the total leucocyte counts in the birds on 5%, 10% and 15% treatment diets. The results of this study suggest that laying birds could tolerate 5% to 15% dietary levels of NLM without deleterious effects.

Westendarp, -H (2006) observed that additions of herbs to broiler diets result in improved performance data, no negative effects on feed intake and body weight. Furthermore, phytogenic substances in broiler feeds are reported to reduce pathogenic bacteria in the intestine and affect carcass qualities. Consequently phytogenic additives show useful properties that justify further scientific research.

Akotkar *et al.* (2007) conducted an experiment to study the effect of feed supplementation of Ashwagandha (*Withania somnifera*) root powder on the performance and haemo-immuno response in 180 broilers. Dietary treatments T1, T2, T3, T4 and T5 contained *Withania somnifera* at the rate of 0%, 0.5%, 0.75%, 1%, 1.25%, respectively. Haematological studies revealed significant ($P<0.01$) increase in PCV and haemoglobin % in Ashwagandha treated groups over untreated group. There was significant ($P<0.01$) increase in HI titres and skin thickness in-group fed with 1.25% Ashwagandha whereas significantly higher skin diameter

recorded in group fed with 0.75% Ashwagandha. 1% Ashwagandha fed birds had significantly improved body weights, feed efficiency and the immune status.

Bhujbal *et al.* (2007) evaluated the effect of phytobiotics on the performance of 4000 broilers. The overall results indicated that supplementation of various phytogenic blends @ 125g/ton (Blends 3, 4 and 7), @ 125 g/ton for the pre-starter and starter and @ 80g/ton for finisher (Blend 8) and @ 1000 g/ton (Blend 5 and 6) of feed throughout the experimental period was beneficial for improving production performance and returns obtained from the broilers. Thus, overall performance of the birds concluded that use of phytobiotics is beneficial for recording better growth responses by birds in terms of final live weights, better feed conversion ratio and higher net profits at the end of sixth week.

Shilpa *et al.* (2007) found that enhanced dressing percentage in supplemented with yeast @ 0.05 % over the control and Lactobacillus acidophilus supplemented diet.

Jo atteh *et al.* (2008) while evaluation of supplementary stevia (*Stevia rebaudiana*, bertoni) leaves and stevioside in broiler diets; Effects on feed intake, nutrient metabolism, blood parameters and growth performance concluded that both the stevia leaves and stevioside diets significantly increased abdominal fat content and also found that dietary enzyme growth promoters are beneficial to broilers only during the starter stage.

Pande *et al.* (2008) compare the choline chloride and Phytoconstituents in the broiler ration. They use 1400 ppm choline chloride and 300, 400 and 500 ppm phytoconstituents, respectively. The birds fed on phytoconstituents found to be more efficient in feed

utilization and overall performance as compare to birds offering choline chloride. So, they concluded that phytoconstituents are beneficial to overall performance of birds.

Ramnath *et al.* (2008) evaluated Brahma Rasayana (BR) supplementation on concentrations of certain oxidative stress markers associated with heat stress. A total of 48 egg type male chickens of local strain were divided into six groups (n=8) for the study. Three groups were fed with BR orally at the rate of 2 G/kg body weight daily for ten days prior to and during the period of experiment. Two of the four groups that were exposed to heat stress (HST i.e. to a temperature of $40\pm1^{0}C$ and relative humidity of 80±5% in an environmental chamber) for four hours daily for five or ten days, received BR orally. The other two groups remained as BR treated and untreated non-heat stressed (NHST) controls. There was a significant ($P<0.05$) increase in the activities of antioxidant enzymes in blood such as catalase (CAT) and superoxide dismutase (SOD), as well as liver CAT, glutathione peroxidase (GPX) and glutathione reductase (GR) in NHST-BR treated and HST-BR treated (both five and ten days) chickens when compared with untreated controls. A great deal of significant ($P<0.05$). Variations was seen in serum and liver reduced glutathione (GSH) concentration in NHST-BR treated and HST-BR treated (both five and ten days) chicken. Serum and liver lipid peroxidation levels were found to be significantly ($P<0.05$), higher in HST –untreated (both 5 and 10 days) chickens when compared with other groups. Thus, BR supplementation during HST brings about enhanced action of enzymatic and non-enzymatic antioxidants, which nullified the undesired side effects of free radicals that are generated during HST.

Williams *et al.* (2008) studied the effect of Fructo-oligosaccharides or whole wheat on the performance and digestive tract of broiler chickens

found that number of aerobic mesophilic bacteria in the ceca was reduced at 3 weeks with whole wheat, gizzard and pancreas weights were greater and the surfaces of the ileal crypts were larger.

Awad *et al.* (2009) evaluated the effect of dietary inclusion of probiotic and synbiotic on growth performance, organ weights, and intestinal histomorphology of broiler chickens found that dietary treatment influence measurements of small intestinal villi, the addition of either probiotic or synbiotic increased the villus height; crypts depth ratio and villus height in both duodenum and ileum, the duodenal crypt depth remained unaffected.

Janardana *et al.* (2009) observed the phytobiotics modulate immune responses in the gut associated lymphoid tissue of chickens concluded that the addition of prebiotics to diet resulted in a significant reduction in the proportion of B cell and in nitrogen responsiveness of lymphocytes in cecal tonsil. Further fructo-oligosaccharides treatment significantly enhanced the lgM and lgG antibody titre in plasma.

Erdogan *et al.* (2010) while studying the effect of dietary supplementation of synbiotics and on performance, caecal coliform population and some oxidant /antioxidant parameters of broilers found that dietary supplementation of synbiotic and phytobiotic improved the gut health by decreasing the caecal total coliform count, but growth performance was not affected by the supplementation.

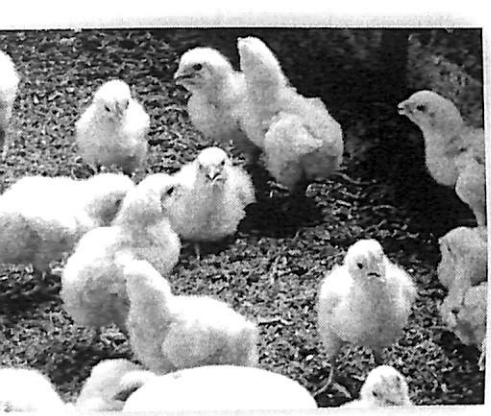
Hashemi *et al.* (2010) studied the herbal plant and their derivatives as growth and health promoters in animal nutrition, observed that gut microflora has significant effect on host nutrition, health and growth performance by interacting with nutrient utilisation and the development of gut system of the host and also promote intestinal mucus production.

Herawati (2010) studied the effect of feeding red ginger as phytobiotic on body weight gain, feed conversion and internal organs condition of broiler concluded that production performance of broiler fed supplemented with red ginger shows higher body weight, lower total feed intake and lowest changeover on the muscle, liver, kidney and proventriculus conditions.

Mokhtari *et al.* (2010) reported the effect of different growth promoters on performance and carcass characteristics of broiler chicken, probiotic and symbiotic was appeared to be superior compared to other growth promoters.

Thus, while reviewing the literature, it was found that phytobiotics which are compounds extracted from plants such as essential oils, different spices, herbs and non digestible polysaccharides have growth promoting as well as antibacterial effect on birds and thus have favourable effect on live weight, gain in weight, feed consumption and feed efficiency, thereby improving the production performance of the birds.

# CHAPTER-3
# MATERIALS AND METHODS



# MATERIALS AND METHODS

The experiment was conducted in the Department of Livestock Production & Management at Bihar Veterinary College, Patna – 800014 on 200 day old broiler chicks. The broiler chicks of 'Vencob' strain were purchased from M/s. Venkateshwara Hatcheries Pvt. Ltd., through local supplier. The trials were conducted for a period of six weeks. The objectives of the study were;

1. To study the effect of Phytobiotics supplementation on growth Performance of broilers.
2. To study the effect of phytobiotics supplementation on the carcass characteristics of broiler chicken.
3. To estimate the economics of broiler production by using phytobiotics supplementation.

**Experimental Design :**

The trial was conducted on 200 broiler birds for a period of six weeks. The day old chicks were randomly divided into four equal groups of 50 birds each. Each group was having two replicates of 25 birds each. All the birds were reared on deep litter system under ideal and identical managemental and environmental conditions. The groups were subjected to the following treatments.

| Treatment | Number of Replicates | Number of birds in each replicates | Inclusion of phytobiotics gm/100 kg of feed. |
|---|---|---|---|
| $T_1$ | 2 | 25 | 0 |
| $T_2$ | 2 | 25 | 25 |
| $T_3$ | 2 | 25 | 50 |
| $T_4$ | 2 | 25 | 75 |

- **Phytobiotics used in the trail was "Nutribion"(Nobel agrovet pvt. Limited, Pune.)**

**Composition of Nutribion :**

Formulated by using different additive producing technologies with fructo-oligosaccharides, prebiotic substances and essential oils derived from the following plant parts. *Ricinus communius* (Castor oil, Erand oil), *Punica granatum* (Dalimb, Pomogranate), *Magnifera Indica* (Mango, Aam), *Azadirachta indica* (Neem), *Glyzyrrhiza glabra* (Leucorice, Mulati), Alfaalfa (*Wilayati gavat*, Lucerne), *Avena sativa* (Common oat, Jey), *Withania sominifera* (Ashwaganda).

**Feed :**

The required quantities of feed ingredients used in the present experiment were procured from M/s. Rakesh Poultry, Anisabad, Patna. The pre-starter mash was offered for first eight days of age, starter mash was offered up to end of the three weeks of age and finisher mash was offered thereafter up to six weeks of age.

**Proximate composition of experimental diets :**

The proximate analysis of the experimental mashes was carried out in the Department of Animal Nutrition, Bihar Veterinary College, Patna as per A.O.A.C. (1990). The percent proximate composition of prestarter, starter and finisher mashes is presented in Tables 1, 2 and 3 respectively.

**Table 1 : Proximate Composition (% DMB) of Pre-starter ration.**

| Ingredients | Experimental Ration | | | | |
|---|---|---|---|---|---|
| | Control | $T_1$ | $T_2$ | $T_3$ | $T_4$ |
| Dry matter | 87.21 | 86.79 | 86.23 | 87.12 | 86.24 |
| Crude protein | 23.15 | 22.12 | 23.74 | 22.84 | 23.36 |
| Ether Extract | 4.61 | 4.54 | 3.98 | 4.69 | 4.72 |
| Crude fiber | 4.46 | 4.40 | 4.68 | 4.92 | 4.72 |
| Nitrogen free extract | 61.27 | 61.62 | 62.20 | 61.76 | 61.60 |
| Total Ash | 6.58 | 6.43 | 6.82 | 6.79 | 6.79 |

**Table 2 : Proximate Composition (%DMB) of Starter ration.**

| Ingredients | Experimental Ration | | | | |
|---|---|---|---|---|---|
| | Control | $T_1$ | $T_2$ | $T_3$ | $T_4$ |
| Dry matter | 87.68 | 88.12 | 87.94 | 87.42 | 87.77 |
| Crude protein | 22.67 | 22.87 | 21.98 | 22.42 | 22.46 |
| Ether Extract | 4.12 | 4.72 | 4.78 | 4.74 | 4.10 |
| Crude fiber | 4.76 | 4.82 | 4.89 | 4.88 | 4.85 |
| Nitrogen free extract | 62.71 | 62.69 | 62.74 | 62.72 | 62.81 |
| Total Ash | 6.41 | 6.42 | 6.44 | 6.63 | 6.71 |

**Table 3 : Proximate Composition (%DMB) of Finisher ration.**

| Ingredients | Experimental Ration | | | | |
|---|---|---|---|---|---|
| | Control | $T_1$ | $T_2$ | $T_3$ | $T_4$ |
| Dry matter | 88.16 | 88.14 | 88.19 | 88.21 | 88.20 |
| Crude protein | 20.12 | 20.24 | 20.19 | 20.18 | 20.21 |
| Ether Extract | 6.44 | 6.32 | 6.34 | 6.38 | 6.42 |
| Crude fiber | 4.67 | 4.72 | 4.77 | 4.69 | 4.68 |
| Nitrogen free extract | 62.61 | 62.58 | 62.66 | 62.71 | 62.82 |
| Total Ash | 6.18 | 6.19 | 6.22 | 6.21 | 6.27 |

**Housing and management :**

The birds were reared on deep litter system of housing. The litter material of three-inch thickness was spread in each pen. All the groups were provided with similar environmental and managemental conditions

throughout the experimental period. An identical and adequate feeding and watering space was provided to all the birds throughout the experimental period. The brooding was carried out for first three weeks by using electric bulbs.

The group feeding practice was followed throughout the experimental period. Weighed quantity of feed was offered to each group. The group-wise refusal was weighed next day morning to arrive at actual daily feed consumption of each group. The birds were given free access to fresh, clean and wholesome drinking water throughout the experimental period.

**Medication and vaccination :**

Immediately after arrival, chicks were provided with anti-stress elements through drinking water. The immunization against Ranikhet Disease (*LaSota* strain) and Infectious Bursal Disease was carried out on $5^{th}$ and $9^{th}$ day, respectively followed by booster doses on $21^{st}$ day lasota and $24^{th}$ day IBD through drinking water.

**Parameters studied during experiment :**

1. Average weekly live weights.
2. Average weekly gain in weights.
3. Average weekly feed consumption.
4. Average weekly feed conversion ratios.
5. Weekly mortality.
6. Carcass characteristics.
7. Economics of production at the end of $6^{th}$ week.

The live weights of day-old chicks were recorded on arrival and thereafter at weekly intervals. From these data, average weekly live

weights and average weekly gain in weights were calculated for each group. The records maintained for daily feed consumption were used to calculate average weekly feed consumption. The week wise and overall feed conversion ratios of various groups were also calculated using gain in weights and feed consumption of these groups. The daily record of mortality, if any, during the experimental period was also maintained.

**CARCASS STUDY :**

At the end of six weeks period, four birds from each dietary treatment group were randomly selected for slaughter and processing. The birds (to be slaughtered) were not offered any feed for 24 hours prior to slaughter except water ad-libitum. Each bird was weighed immediately before slaughter. The difference between live weight immediately before slaughter was recorded as shrinkage and was calculated as percentage of live weight. The birds were bled by clean incision at the base of ear lobes and allowed to bleed and weighed. The weight loss before and after slaughter were recorded as blood loss.

The birds were immersed in hot water ($70^0$C) for 30 seconds (hard scalding). The scalded birds were hand plucked to remove body feathers perfectly, dried and the weights were recorded which reflected the feathers loss. The head was removed by severing the cervical at the base of the occipital bone and weighted. The feet and shanks were cut at the tibio-tarsal joints, wing tips were removed and dressed weight of the carcass was recorded. Thus the dressed weight consisted of fasted weight minus the blood, feather, head, feet and shanks, wing tips together keeping the viscera intact.

The birds were then eviscerated by removing the crop, gullet, trachea and viscera. The lungs were scrapped off. The giblets (heart, liver

and gizzard) were removed from the viscera. The weight of the carcass was recorded and the difference between the dressed and giblet weights reflected the offal weight. Gall bladder was removed from the liver with care to avoid puncture and was discarded. Gizzard was opened, the contents were washed out and the lining was pulled off and the weight was recorded. The heart was freed from blood clots and adhering vessels. The weight of the carcass along with giblet was recorded as eviscerated weight.

The dressing percentage and eviscerated percentage were calculated on the basis of preslaughter live weight at $6^{th}$ week of age. The neck of four carcasses from each group were removed from the clavicles as closely as possible. Weight of neck and giblets were recorded separately. The ready to cook weight was calculated by subtracting the weight of neck and giblets from the eviscerated weight of the carcass. Samples of breast and thigh muscles were taken from carcasses of each group, with a scissors and sharp knife. The sample were wrapped in polythene bag and kept in deep freezer for proximate analysis.

For the determination of meat + skin: bone ratio, the carcasses were then cooked in enamelled tray for 1.5 hours in an oven at $163^0$C (Dawson *et al.* 1957). After every 25 minutes the chicks were turned up, so that each chick was cooked uniformly at every position. Boiling was completed by cooking the carcass until the internal temperature of breast muscles reached $94^0$C. After boiling, the carcass along with trays were removed from the oven and individually weighed to obtain the cooked weight of the carcass. For meat and bone ratio, the skin of chicken were removed before boiling. Edible meat and bone were separated manually. The bones were dried in hot air oven to constant temperature at $80^0$C. The

weight of the dried bone was recorded and this weight was deducted from the ready to cook weight. The difference constituted the raw edible meat. The meat + skin: bone ratio was calculated by dividing the weight of the raw edible meat with the weight of the bone.

**Meat + Skin : Bone Ratio** = Ready to cook weight – Weight of oven dried bones /Weight of oven dried bones.

Similarly, meat : bone ratio was calculated in which the weight of skin was not included.

**Methods of Analysis :**

The moisture content of breast and thigh muscles were determined by drying 7g samples in oven at $80^0$C for 18 hours. For ether extract and protein determination, the samples were grinded in glass pestle and mortar and representatives samples were taken for determining nitrogen and ether extract as outlined by AOAC (1990).

**Economics of production :**

The economics of broiler production was calculated at the end of $6^{th}$ week considering feed cost as the only variable. The feed cost per kilogram was calculated by considering the prevailing prices of the feed ingredients. The sale price was considered as Rs. 80/- per kg live weight.

**Statistical analysis :**

All the data obtained were subjected to statistical analysis as per Snedecor and Cochran (1994) using Randomized Block Design or completely Randomized Design, depending upon the parameter.

# CHAPTER-4
# RESULTS AND DISCUSSION

# RESULTS AND DISCUSSION

The present experiments were conducted to evaluate the effects of phytobiotics on the performance of broilers. Trial was conducted on 200 day-old 'Vencob' broiler chicks for the period of six weeks. Day-old broiler chicks were randomly divided into four equal groups viz. A, B, C & D. The group A was maintained as control. Birds from group B, C & D received diet containing, control with addition of phytobiotics @ 25 gm/100 kg of feed, 50 gm/100 kg of feed and 75 gm/100 kg of feed respectively throughout the experimental period. The performance of the birds from different groups was compared with respect to growth and other parameters.

**Live Weight :**

The data for average weekly live weights of the birds from different groups are presented in Table 4. It is seen from the table that the average live weights of birds at day-old stage were 43.76, 42.74, 43.10 and 42.82 g for groups A to D, respectively. The corresponding average live weights at the end of sixth week were 1878.98, 1991.89, 2056.94 and 2087.85 g for groups A to D, respectively. From the data it is revealed that birds from group D receiving diet supplemented with Nutribion 75gm / 100 kg of feed recorded highest live weights at the end of sixth week. This indicated that the phytobiotic product used in the experiment at different dose rates has beneficial effects in terms of improving the live weight of birds. Further it has also revealed that use of the phytobiotic product also helped the birds to record higher live weights at the end of six weeks. However, use of the product at 75 gm/100 kg of feed

throughout the experimental period was found to be more useful than its usage at 25 gm/100 kg and 50 gm/100 kg.

The addition of phytobiotic product at 25 gm/100 kg of feed, 50 gm/100 kg of feed, 75 gm /100 kg of feed throughout the experimental period helped the birds to record 4.78%, 4.69% and 4.98%, higher live weights than control respectively.

Thus, it may be concluded that the phytobiotic used in the experiment has helped in recording higher live weights by the birds at the end of six weeks than control.

The data pertaining to average weekly live weights of birds from the replicates within the groups were compared. It was noted that the differences within the replicates were statistically non-significant. Hence, the data from the replicates were pooled and then subjected to statistical analysis. The results of the same are presented in Table 5. The statistical analysis of the data revealed that, difference among the average weekly live weights of the birds from different groups were statistically non-significant.

This is in agreement with the findings of Vaiva Priudokiene *et al.* (2004), who found that the effect of phytogenic preparations on live weight of chickens from the experimental groups was higher by 4.87-14.55%, compared with the control group receiving antibiotic flavomycin-80. Similarly, Alcicek *et al.* (2003) observed significant positive effects of essential oil combination, derived from selected herbs growing wild in Turkey on broiler live weights.

## Table 4 : Average weekly live weights (g) of birds.

| weeks | Group A | Group B | Group C | Group D |
|---|---|---|---|---|
| Day old | 43.76 | 42.74 | 43.10 | 42.82 |
| 1st | 141.74 | 147.17 | 147.61 | 140.19 |
| 2nd | 345.18 | 346.10 | 346.00 | 347.96 |
| 3rd | 690.70 | 701.58 | 696.06 | 700.56 |
| 4th | 1157.75 | 1141.48 | 1160.72 | 1209.31 |
| 5th | 1587.96 | 1630.46 | 1654.50 | 1691.63 |
| 6th | 1878.98 | 1991.89 | 2056.94 | 2087.85 |

## Table 5 : ANOVA for live weights

| Sources | DF | SS | MS | F |
|---|---|---|---|---|
| Groups | 3 | 3215.94 | 1071.98 | 1.98 NS |
| Weeks | 5 | 13907623 | 2317937.16 | 4291.91 ** |
| Error | 15 | 9721.40 | 540.07 | |
| Total | 23 | 13920560.34 | | |

NS : Non Significant
** : Significant at 1% level.

**Gain in Weight :**

The average weekly gain in weights data for birds from day-old to sixth week is presented in Table 6. The average total gains in weights of birds were 2002.33, 2084.65, 2109.08 and 2147.59 g for groups A to D, respectively. Similar trend as that for live weights was observed with respect to average gain in weights of birds. From the data it is revealed that, the birds from group D receiving diet with addition of phytobiotics @ 75 gm/100 kg of feed recorded highest gain in weight at the end of sixth week.

From the table it is evident that birds from group B receiving diet with addition of phytobiotics @ 25 gm/100 kg of feed recorded 4.11% higher gain in weights than the birds from control group at the end of sixth week. Similarly, the birds from group C and D recorded 5.33% and 7.25% higher gain in weights than the birds from control group at the end of sixth week. This suggested that, similar to live weights, the use of phytobiotic product helped the birds in recording higher weekly and total gain in weights.

The data pertaining to average weekly gain in weights of birds from the replicates within the groups were compared. It was noted that the differences within the replicates were statistically non-significant. Hence, the data from replicates were pooled and then subjected to statistical analysis. The results of the same are presented in Table 7. The statistical analysis of the data revealed that differences among the average weekly gain in weights of the birds from different groups were statistically non-significant.

Therefore, it is concluded that the use of phytobiotics is for numerical improvement in the gain in weights of the birds at the end of sixth week.

Gendi *et al.* ( 1994) observed improved weight gain with cocaine and Lomoton dietary supplementation as herbal growth promoters on productive performance in broilers. Hong *et al.* (2001) observed improved weight gain of male broiler chicks with supplementation of herbal products (Miracle 20 or M20). Similar trend was observed in present trial with phytobiotics. The results of the present experiment are also in accordance with Mishra and Singh (2000) who found no significant difference between the weight gains in control and treatment groups fed with Ashwagandha (*Withania somnifera*) root powder. Gole (2001) found no significant difference between gain in weight of the broilers fed with herbal preparation with Tulsi as compared to control diet. Demir *et al.* (2003) found that garlic supplementation had no significant effect on weight gains of chickens from 0 to 14 days of age as compared to the control group. However, Shafey *et al.* (2001) reported that Bio-Mos did not influence body weight gain. Herawati (2010) observed higher body weight gain with supplementation of red ginger.

**Table 6 : Average weekly gain in weight (g) of birds**

| weeks | Group A | Group B | Group C | Group D |
|---|---|---|---|---|
| 1st | 97.98 | 98.43 | 104.51 | 97.37 |
| 2nd | 203.44 | 201.93 | 198.39 | 207.77 |
| 3rd | 345.52 | 358.48 | 350.06 | 352.60 |
| 4th | 467.05 | 439.9 | 464.66 | 508.75 |
| 5th | 430.21 | 488.98 | 493.78 | 482.32 |
| 6th | 458.13 | 496.93 | 497.68 | 498.78 |
| Total | 2002.33 | 2084.65 | 2109.08 | 2147.59 |
| Mean | 333.72 | 347.44 | 351.51 | 357.93 |

**Fig. 1 : Total gain in weight (G)**

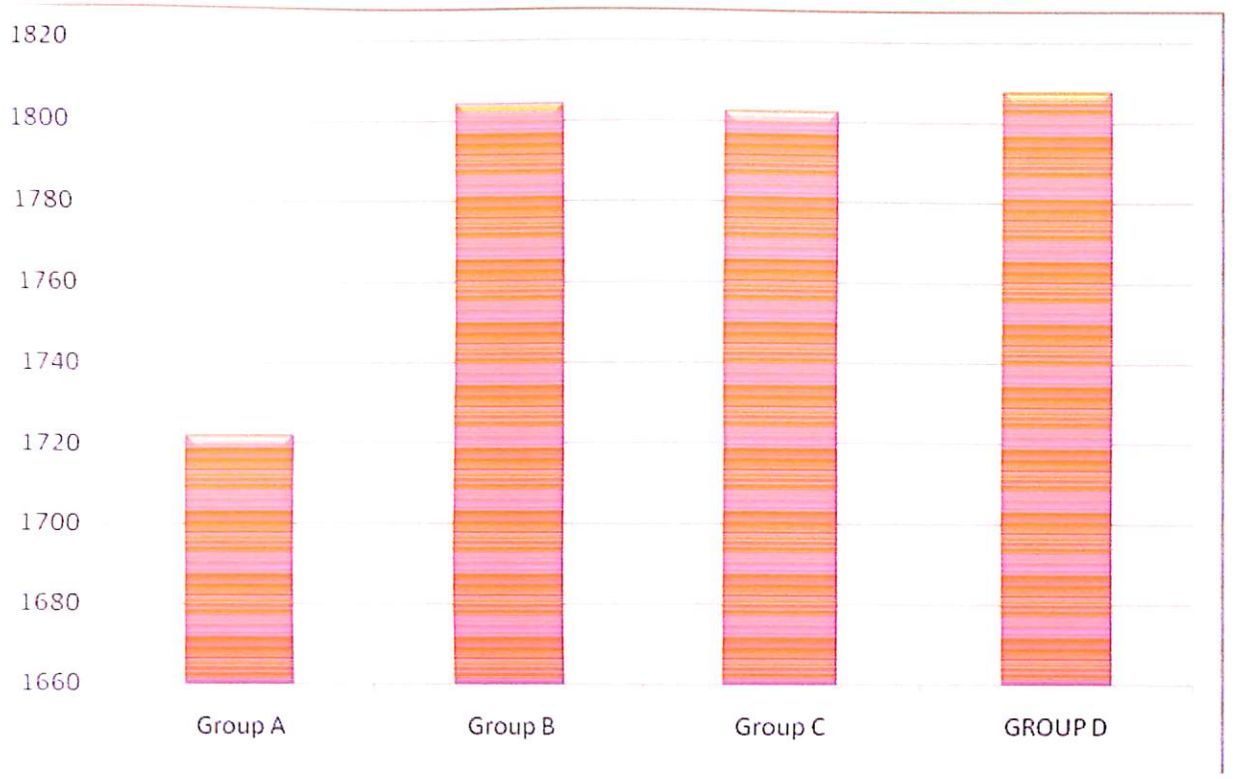
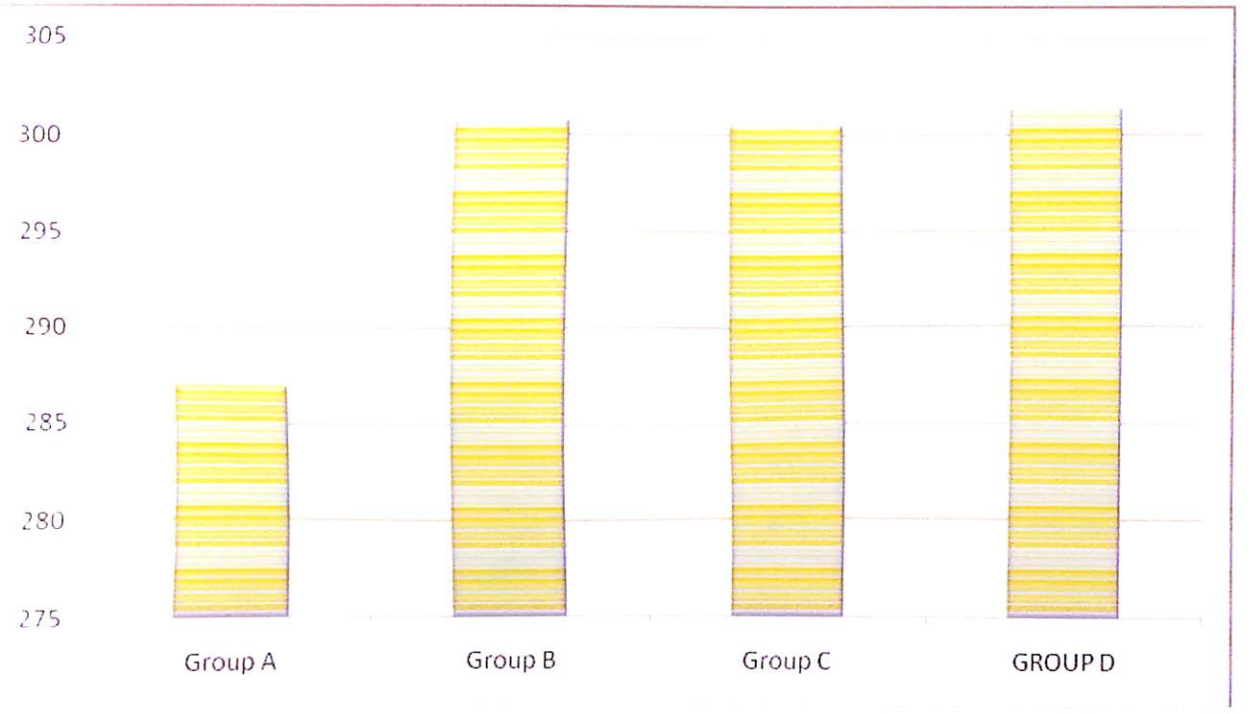



**Fig. 2 : Average weekly gain in weight (G)**



## Table 7 : ANOVA for gain in weight

| Sources | DF | SS | MS | F |
|---|---|---|---|---|
| Groups | 3 | 1003.12 | 334.37 | $0.60^{NS}$ |
| Weeks | 5 | 775437.20 | 155087.44 | $279.91^{**}$ |
| Error | 15 | 8311.02 | 554.06 | |
| Total | 23 | 784751.34 | | |

NS : Non Significant
** : Significant at 1% level.

**Feed Consumption :**

The average weekly feed consumption data for the birds from day-old to sixth week of age from different groups are presented in Table 8. The total feed consumption per bird during the entire trial period for groups A to D was 4118.18, 4280.45, 4138.62 and 4231.10, respectively. The corresponding average weekly feed consumption per bird was 686.36, 713.41, 689.77 and 705.18 g, for groups A to D, respectively. It is noticed that highest feed consumption was recorded by the birds from group B.

Birds from all other groups receiving the product recorded higher feed consumption than the control group.

The data pertaining to average weekly feed consumption of birds from the replicates within the groups were compared. It was noted that the difference within the replicates were statistically non-significant. Hence, the data from the replicates were pooled and subjected to

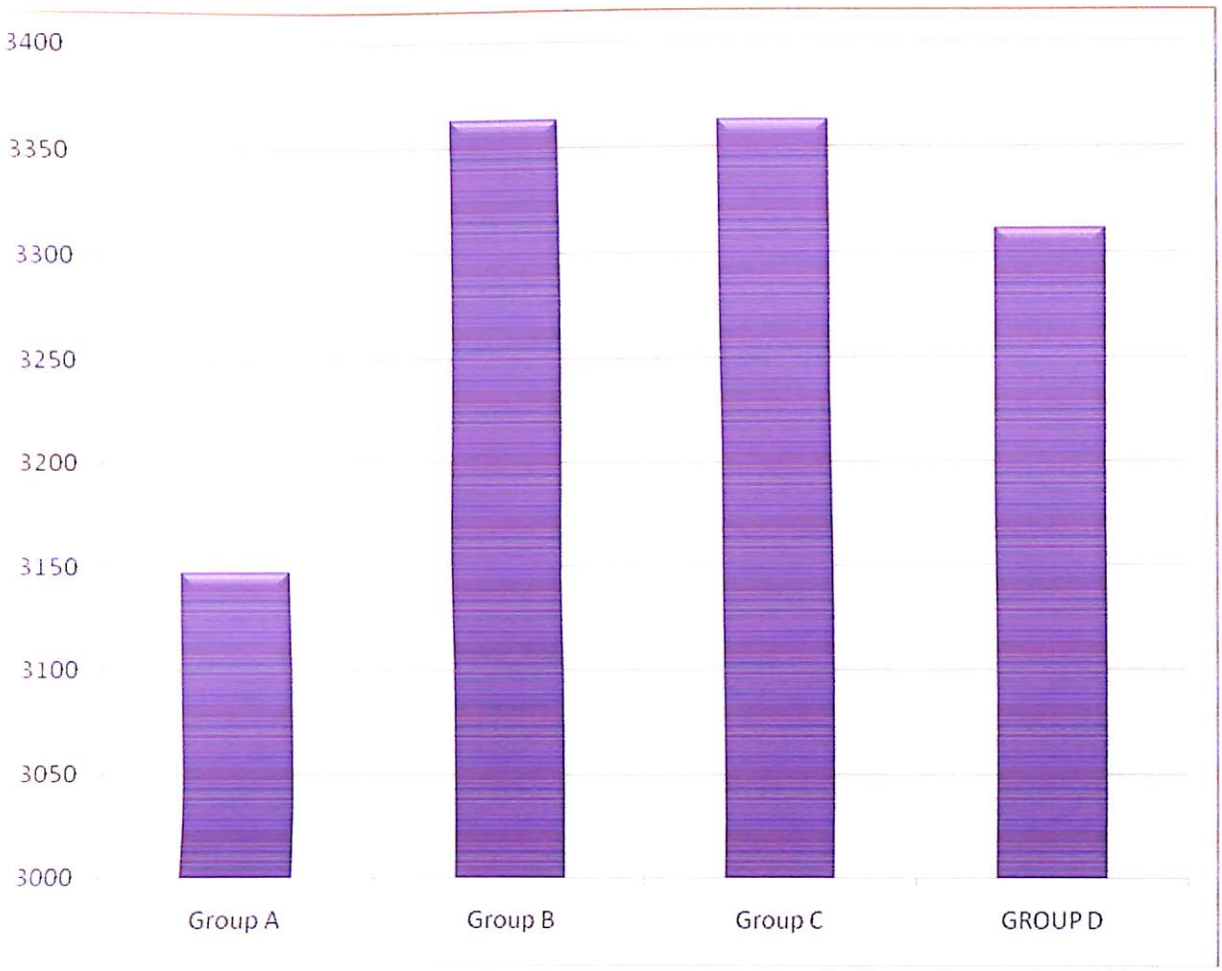
statistical analysis. The results of the same are presented in Table 9. It is observed from the table that the differences among average feed consumption of birds from different groups were statistically non-significant.

Jinturkar (1989) studied the effect of different growth promoters in 300 day-old Hubbard broilers to compare the efficiency of four commercially available growth promoters and concluded that different growth promoters when used in broilers improved the feed consumption. Spais *et al.* (2003) observed that feed intake per bird from day-old to 40 days of age showed a significant ($P \leq 0.05$) increase in the Bio-Mos group compared to control group. These results are accordance with the results of the present study.

**Table 8: Average weekly feed consumption (g) of birds**

| Weeks | Group A | Group B | Group C | Group D |
|---|---|---|---|---|
| 1st | 155.2 | 156.02 | 149.76 | 149.00 |
| 2nd | 340.7 | 364.89 | 339.3 | 353.35 |
| 3rd | 678.2 | 641.45 | 639.44 | 686.81 |
| 4th | 946.07 | 961.5 | 944.67 | 952.37 |
| 5th | 989.12 | 1061.86 | 991.24 | 1002.01 |
| 6th | 1008.89 | 1094.73 | 1074.21 | 1087.56 |
| Total | 4118.18 | 4280.45 | 4138.62 | 4231.1 |
| Mean | 686.36 | 713.41 | 689.77 | 705.18 |

**Fig. 3 : Average total feed consumption**



The data pertaining to the average weekly feed conversion ratios of birds from the replicates within the groups were compared statistically. It is noted that the differences within the replicates were statistically non-significant. Hence, the data from the replicates were pooled and subjected to statistical analysis. The results of the same are presented in Table 11. It is observed from the table that, the different treatments had no significant effect on average weekly feed conversion ratios of the birds.

The results of the present experiment are in accordance with work of Demir *et al.* (2003) who found no significant difference in feed conversion ratio when broilers were fed with herbal feed additives like garlic. Gole (2001) found no significant differences between FCR in broilers were fed with herbal preparation of Tulsi when compared with control diet. However, Tollba and Hasan (2003) found significantly improved FCR in broilers fed with garlic. Gaikwad (2005) found significantly better FCR with 1% garlic supplementation in broilers.

**Table 10 : Average weekly feed conversion ratio of birds**

| Weeks | Group A | Group B | Group C | Group D |
|---|---|---|---|---|
| 1st | 1.58 | 1.58 | 1.43 | 1.53 |
| 2nd | 1.67 | 1.80 | 1.71 | 1.70 |
| 3rd | 1.96 | 1.79 | 1.82 | 1.94 |
| 4th | 2.03 | 2.18 | 2.03 | 1.87 |
| 5th | 2.29 | 2.17 | 2.00 | 2.07 |
| 6th | 2.69 | 2.20 | 2.31 | 2.16 |
| Mean | 2.03 | 1.95 | 1.88 | 1.87 |

## Table 11 : ANOVA for feed conversion ratio

| Sources | DF | SS | MS | F |
|---|---|---|---|---|
| Groups | 3 | 0.110 | 0.03 | 3.75NS |
| Weeks | 5 | 1.12 | 0.22 | 27.5** |
| Error | 15 | 0.12 | 0.008 | |
| Total | 23 | 1.35 | | |

NS : Non Significant
** : Significant at 1% level.

**Mortality :**

The data pertaining to mortality during the entire experimental period from all the groups are presented in Table 12. From the table, it is observed that mortality percentage for groups A to D were 4, 2, 4 and 4%, respectively. From the data it was revealed that, mortality in all the treatment groups was well within limits. Thus, the phytobiotics did not have any ill effect on health of the birds.

## Table 12 : Weekly mortality of birds (No.)

| Weeks | Group A | Group B | Group C | Group D |
|---|---|---|---|---|
| 1st | 2 | 0 | 1 | 1 |
| 2nd | 0 | 1 | 1 | 1 |
| 3rd | 0 | 0 | 0 | 0 |
| 4th | 0 | 0 | 0 | 0 |
| 5th | 0 | 0 | 0 | 0 |
| 6th | 0 | 0 | 0 | 0 |
| Total | 2 | 1 | 2 | 2 |
| Mortality (%) | 4 | 2 | 4 | 4 |

## CARCASS CHARACTERISTICS :

The data on carcass characteristics with respect to different parameters are given in Table 13 and their analysis of variance in Table 14 respectively. Data of the slaughter traits mentioned in percentages were transformed to angles corresponding to percentages (Angles = Arcsin $\sqrt{}$ Percentage ) as given by C.I. Bliss, before analysis of variance.

**Processing Parameters :**

The shrinkage percentage expressed as percentage of live weight, ranged from 10.04±0.51 to 10.52±0.83 was not influenced significantly ($P<0.05$) by different dietary Treatments. The shrinkage percentage were observed in chicks fed diet supplemented with phytobiotic (Nutribion) 25 gm, 50 gm & 75gm/100 kg of feed was 10.04, 10.52 & 10.26% respectively. However, in control group, shrinkage percentage was 10.20%. The blood loss percentage and feather loss percentage expressed as percentage of preslaughter weight, were not significantly ($P<0.05$) affected by different dietary treatments. Blood loss percentage and feather loss percentage ranged from 11.68 to 11.77 and 12.55 to 12.68, respectively. Though the amount of blood and feather was found to be more in phytobiotic (Nutribion) supplemented groups them control group. Heavier birds in phytobiotic (Nutribion) supplemented groups showed higher loss in terms of amounts which testified the fact that heavier birds had higher losses.

**Table 13 : Effect of feeding phytobiotics on Carcass traits at the end of experimental periods.**

| | | | | As % of preslaughter weight | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Treatment** | **Live wt. (g)** | **Pre-slaughter wt. (g)** | **Shrinkage %** | **Blood loss %** | **Feather loss %** | **Dressing %** | **Eviscerated %** | **Head %** | **Neck %** | **Giblet %** |
| $T_1$ | 1878.98 ± 18.23 | 1686.32 ± 16.02 | 10.20 ± 0.35 | 11.72 ± 0.16 | 12.58 ± 0.18 | 65.34 ± 0.58 | 58.33 ± 0.21 | 11.42 ± 0.23 | 12.86 ± 0.26 | 14.57 ± 0.24 |
| $T_2$ | 1991.89± 29.66 | 1791.90 ± 28.25 | 10.04 ± 0.51 | 11.68 ± 0.23 | 12.61 ± 0.22 | 65.87 ± 0.68 | 58.38 ± 0.29 | 11.35 ± 0.25 | 12.93 ± 0.34 | 14.43 ± 0.48 |
| $T_3$ | 2056.94± 16.32 | 1840.54 ± 26.13 | 10.52 ± 0.83 | 11.70 ± 0.13 | 12.55 ± 0.33 | 65.91 ± 0.43 | 58.25 ± 0.38 | 11.38 ± 0.14 | 12.98 ± 0.17 | 14.62 ± 0.55 |
| $T_4$ | 2087.85 ± 15.68 | 1873.63 ± 13.58 | 10.26 ± 0.68 | 11.77 ± 0.15 | 12.68 ± 0.28 | 66.09 ± 0.41 | 59.19 ± 0.28 | 11.50 ± 0.19 | 13.03 ± 0.19 | 14.26 ± 0.69 |
| C.D. ($P<0.05$) | 115.64 | 111.32 | NS | NS | NS | NS | NS | NS | NS | NS |

Each value is mean of four observations.

NS : Non-significant.

**periods. :**

| Source of variation | Live Weight | | | Shrinkage % | | | Blood Loss % | | | Feather Loss % | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | D.f. | Mean sq. | F. | D.f. | Mean sq. | F. | D.f. | Mean sq. | F. | D.f. | Mean sq. | F. |
| Between treatments | 3 | 28987.423 | 7.12* | 3 | 0.0352 | $0.1632^{NS}$ | 3 | 0.0052 | $0.129^{NS}$ | 3 | 0.0086 | $0.1898^{NS}$ |
| Error | 12 | 4071.289 | | 12 | 0.2156 | | 12 | 0.0403 | | 12 | 0.0453 | |
| **Source of variation** | **Pre-slaughter Weight** | | | **Dressing %** | | | **Eviscerated %** | | | **Head %** | | |
| | D.f. | Mean sq. | F. | D.f. | Mean sq. | F. | D.f. | Mean sq. | F. | D.f. | Mean sq. | F. |
| Between treatments | 3 | 28459.236 | 6.88* | 3 | 0.1416 | $0.2439^{NS}$ | 3 | 0.2574 | $2.2598^{NS}$ | 3 | 0.0140 | $0.3076^{NS}$ |
| Error | 12 | 4136.526 | | 12 | 0.5804 | | 12 | 0.1139 | | 12 | 0.0456 | |
| **Source of variation** | **Neck %** | | | **Giblet %** | | | **Meat : Bone Ratio** | | | | | |
| | D.f. | Mean sq. | F. | D.f. | Mean sq. | F. | D.f. | Mean sq. | F. | | | |
| Between treatments | 3 | 0.0158 | $0.1538^{NS}$ | 3 | 0.0668 | $1.0705^{NS}$ | 3 | 0.021 | $0.477^{NS}$ | | | |
| Error | 12 | 0.1027 | | 12 | 0.0624 | | 12 | 0.044 | | | | |

* Significant at $P<0.05$

NS: Non-significant

NB : Data of the slaughter traits mentioned in percentages were transformed to angles corresponding to percentages (Angles = Arcsin $\sqrt{\text{Percentage}}$ ) as given by C.I. Bliss, before analysis of variance.

**Dressing and Eviscerated Percentage :**

Dietary treatments had no significantly ($P<0.05$) effect on dressing and eviscerated percentage, which ranged from 65.34 to 66.09 and 58.25 to 59.19, respectively. Phytobiotic supplemented groups showed numerically higher dressing percentage than control group. However, phytobiotic supplemented with 75 g/100 kg of feed shows highest dressing percentage among all supplemented group. The eviscerated percentage of chicks fed, diet supplemented with phytobiotic showed higher value than control groups. Chicks fed diet supplemented with 25 gm/100 kg of feed and 50 gm/100 kg of feed shows lower value than chicks fed with 75 gm/100 kg of feed but higher value than control groups.

**Giblet Yield and Other Organ cuts**

The giblet yield expressed as percentage of preslaughter weight was not significantly ($P<0.05$) influenced by different dietary treatments and ranged from 14.26 to 14.62. However, the weight of giblet in phytobiotic supplemented group was found to be numerically less than control group. The trend in giblet percentage of different dietary treatments cannot be differentiated and were not clear. The head percentage and neck percentage were ranged from 11.35 to 11.50 % and 12.86 to 13.03% respectively of their body weight and also not significantly affected by dietary treatments.

**Meat and Bone Ratio :**

The data related to meat and bone ratio and meat and skin to bone ratio are presented in Table 15 and their analysis of variance in Table 14 respectively.

Fig 6. Effect of different dietary treatments on Meat + Skin : Bone Ratio and Meat : Bone Ratio.

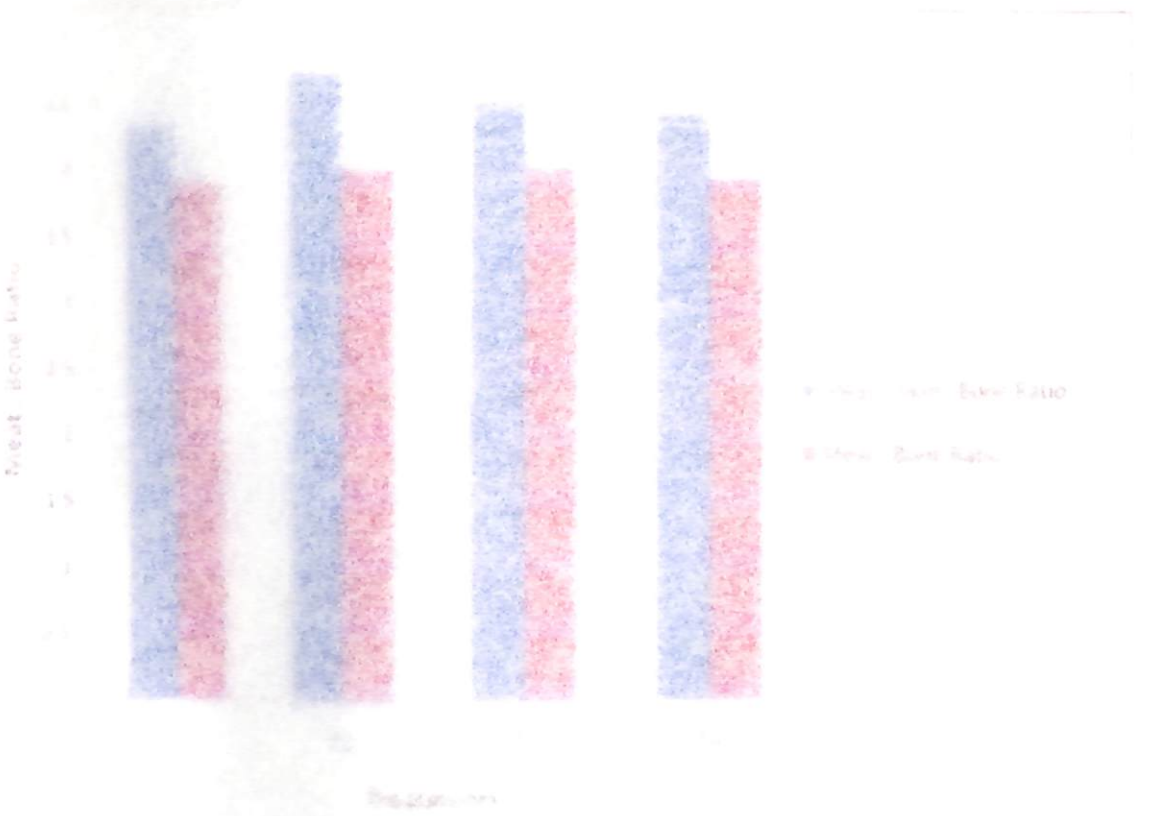
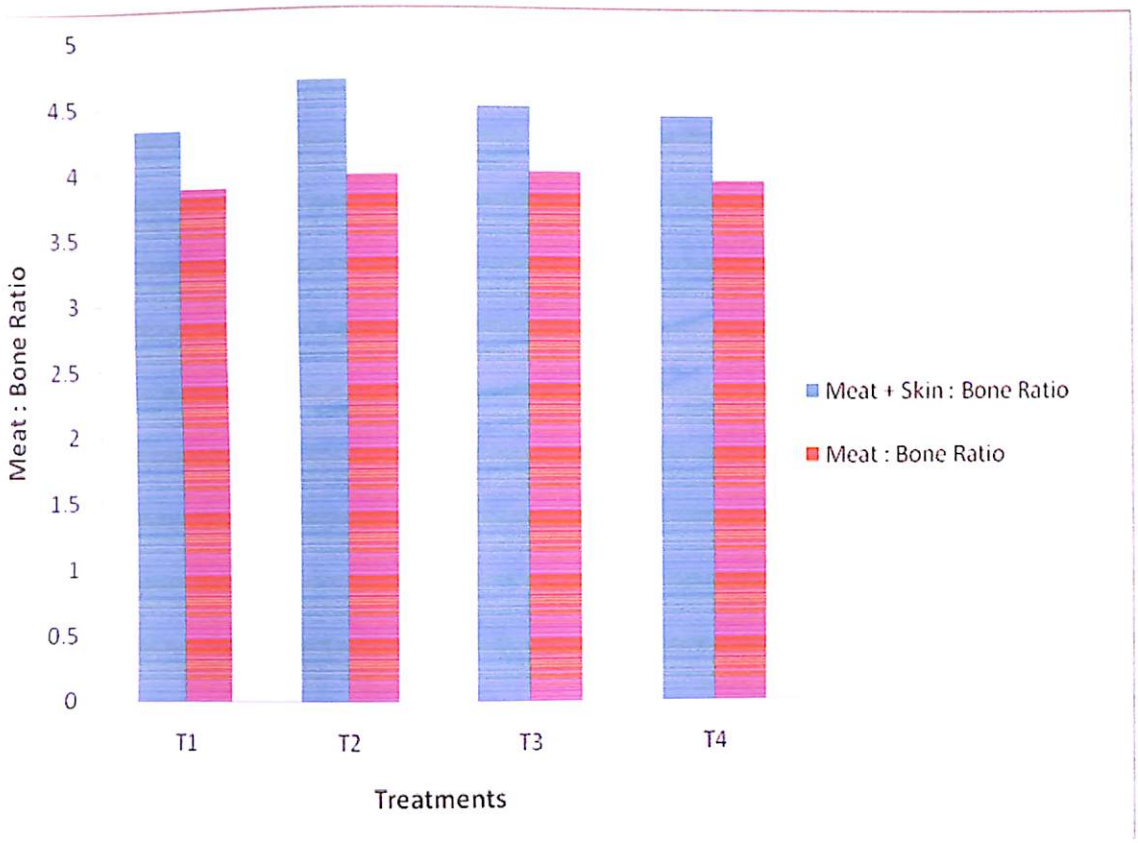


**Fig 6 : Effect of different dietary treatments on Meat + Skin : Bone Ratio and Meat : Bone Ratio.**



The meat and bone ratio ranging from 3.88 to 3.98 and meat + skin and bone ratio ranging from 4.41 to 4.68 were not significantly influenced by dietary treatments. Birds fed diet supplemented with phytobiotics tended to have higher ratios in comparison to the birds fed unsupplemented diets (fig. 6).

Results suggested that the heavier birds had higher degree of fleshing in comparison to bone due to the fact that the muscles in comparison to bone have higher content of protein, reflecting better utilization of nitrogen of diet by phytobiotic supplemented groups (T2, T3 and T4). Several reports also indicated a non significant effect on carcass characteristics of birds fed diet supplemented with probiotics (Gohain and Sapcota, 1998). Yadav *et al.* (1994) studied the effect of dietary supplementation of Live Baker's yeast on carcass quality showed that the processing shrinkage, dressing percentage, giblet yield, neck percentage were not significantly affected by the graded level of supplemental yeast. Takalikar *et al.* (1992 a, b) also did not find any significant difference in carcass characteristics, though probiotic supplemented group showed superior carcass characteristics.

**Table 15 : Effect of different dietary treatments on Meat + Skin : Bone Ratio and Meat : Bone Ratio.**

| Treatment | Meat + Skin : Bone Ratio | Meat : Bone Ratio |
|---|---|---|
| $T_1$ | 4.32±0.16 | 3.88±0.18 |
| $T_2$ | 4.68±0.14 | 3.97±0.24 |
| $T_3$ | 4.48±0.13 | 3.98±0.08 |
| $T_4$ | 4.41±0.18 | 3.92±0.15 |
| C.D. (P<0.05) | NS | NS |

NS : Non-significant.

**Table 16 : Effect of different dietary treatments on Chemical Composition of Thigh and Breast Muscles.**

| Treat -ment | Thigh Muscles | | | Breast Muscles | | |
|---|---|---|---|---|---|---|
| | Moisture % | Protein % | Ether Extract % | Moisture % | Protein % | Ether Extract % |
| $T_1$ | 73.34 ±0.24 | 20.45 ±0.32 | $6.28^a$ ±0.16 | 73.87 ±0.49 | 23.15 ±0.34 | $3.58^a$ ±0.39 |
| $T_2$ | 73.11 ±0.33 | 20.59 ±0.56 | $6.02^b$ ±0.13 | 74.23 ±0.68 | 23.31 ±0.47 | $3.16^b$ ±0.43 |
| $T_3$ | 73.01 ±0.28 | 20.75 ±0.15 | $6.33^a$ ±0.28 | 73.55 ±0.31 | 23.22 ±0.38 | $3.42^a$ ±0.69 |
| $T_4$ | 73.18 ±0.49 | 20.83 ±0.38 | $5.95^b$ ±0.18 | 73.98 ±0.65 | 23.19 ±0.65 | $3.45^a$ ±0.60 |

Means with different superscripts differ significantly ($P<0.05$).

**Carcass Composition :**

Data pertaining to thigh and breast muscles composition in terms of moisture, protein and ether extract are given in Table 16 and their analysis of variance in Table 17, respectively.

**Fig 7 : Effect of different dietary treatments on Chemical Composition of Thigh Muscles**

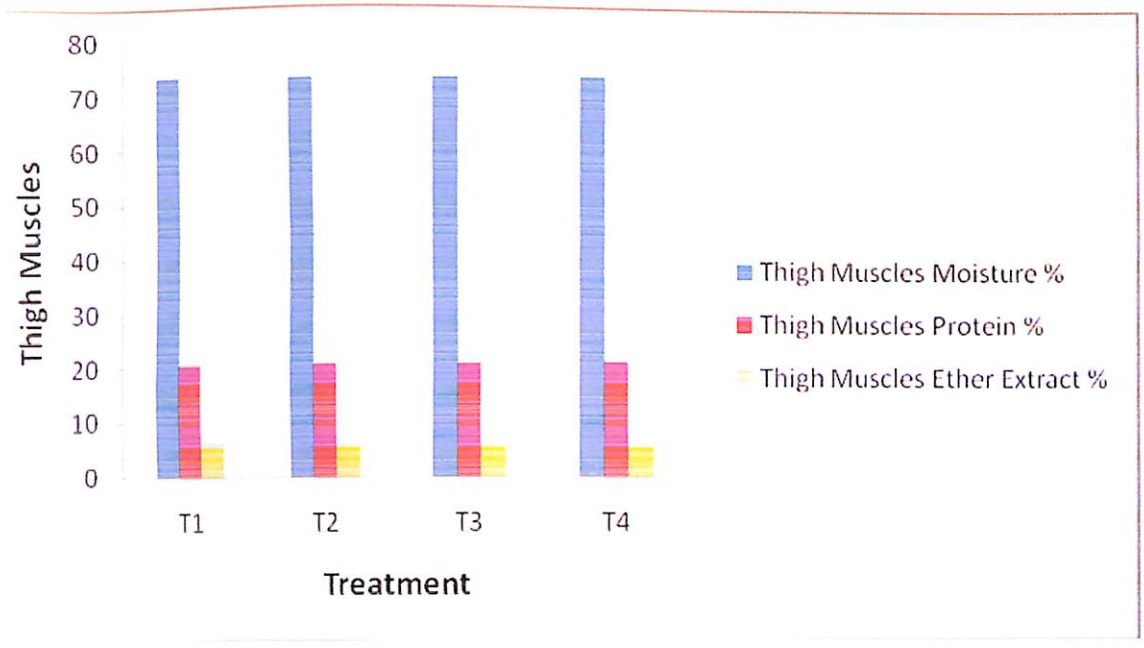



**Fig 8 : Effect of different dietary treatments on Chemical Composition of Breast Muscles**

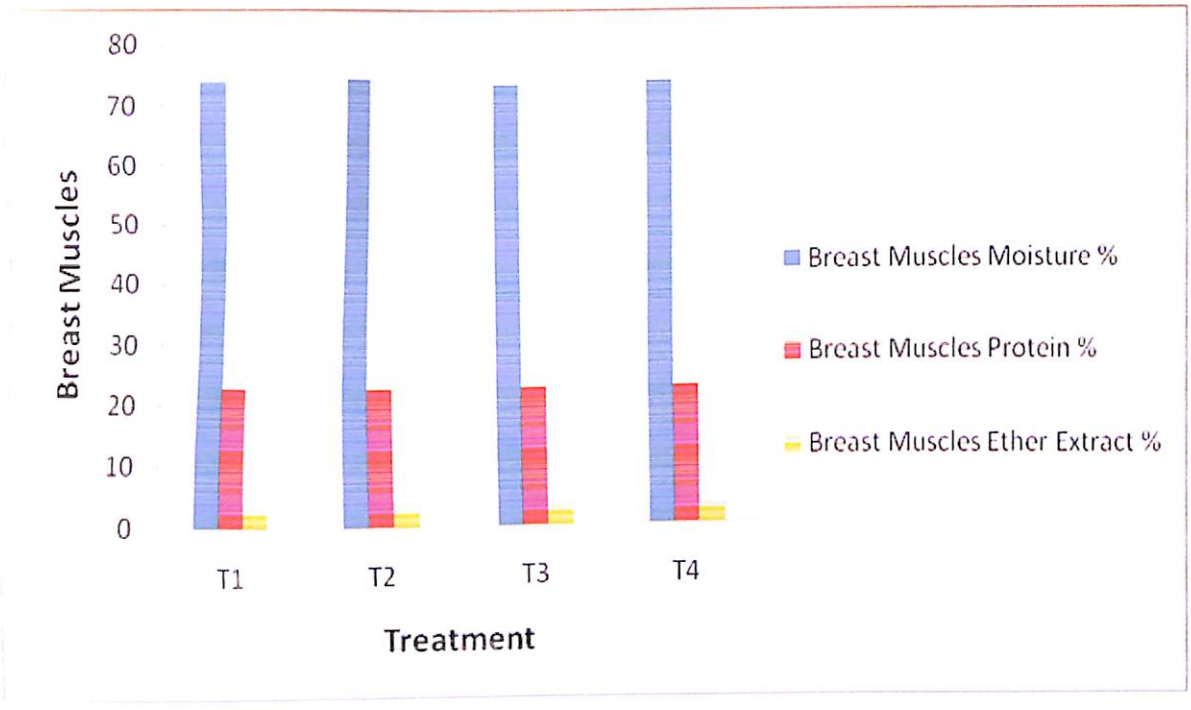


**Table 17 : Analysis of Variance showing the effects of phytobiotics on composition of Thigh and Breast Muscles.**

| Source of variation | Thigh Muscle | | | Breast Muscle | | |
|---|---|---|---|---|---|---|
| | D.f. | Mean sq. | F | D.f. | Mean sq. | F |
| **Moisture** | | | | | | |
| Between treatments | 3 | 0.0394 | $0.1868^{NS}$ | 3 | 0.1393 | $0.8525^{NS}$ |
| Error | 12 | 0.2109 | | 12 | 0.1634 | |
| **Protein** | | | | | | |
| Between treatments | 3 | 0.0558 | $2.5596^{NS}$ | 3 | 0.0091 | $0.1037^{NS}$ |
| Error | 12 | 0.0218 | | 12 | 0.0877 | |
| **Ether Extract** | | | | | | |
| Between treatments | 3 | 0.2042 | 11.281** | 3 | 0.3152 | 24.625** |
| Error | 12 | 0.0181 | | 12 | 0.0128 | |

NS : Non-significant

** : significant (P<0.01)

The percentage moisture, crude protein and ether extract contents of thigh muscles ranged from 73.01 to 73.34, 20.45 to 20.83 and 5.95 to 6.33 while the corresponding figure for breast muscles were 73.55 to 74.23, 23.15 to 23.31 and 3.16 to 3.58, respectively.

The percentage chemical composition of thigh and breast muscles was not significantly (P<0.05) affected by dietary treatments, while comparing thigh and breast muscles, the moisture percentage and protein percentage in breast muscles were found to be more than thigh muscles but reverse trends was obtained in ether extract percentage. The thigh

muscles had higher ether extract percentage than breast muscles. The thigh muscles of phytobiotics supplemented group reflected somewhat marginal improvement in protein percentage than unsupplemented control group (Fig. 7).

No clear cut trend in protein percentage of breast muscles was seen between phytobiotic supplemented and unsupplemented group (Fig. 8). Breast muscles contained high protein and low fat level than thigh muscles was also reported by Hudspeth and May (1967). Comparison to this data with those of body weight gain indicated that the heavier bird had higher degree of fleshing but lower muscular fat, which was reflected in meat composition.

**Economics of Production :**

During this study, the economics of broiler production from different groups was calculated. The same is presented in Table 13. The economics of broiler production of the trial was worked out considering the prevailing prices of input and output in the market.

The cost of day-old chick, feed, medication, vaccination, labour and overheads were considered while calculating the cost of production. From the table it is observed that total cost of production per bird was Rs. 95.15, 99.27, 99.27 and 98.28 for groups A, B, C and D, respectively. The broilers were sold at Rs. 80/- per kg on live weight basis. The net profit per bird was Rs. 46.7, 49.41, 48.73 and 50.72 for groups A to D, respectively. The corresponding net profit per kg was Rs. 26.45, 26.76, 26.41 and 27.17 for groups A to D respectively. The group D recorded highest net profit per kg followed by group B, A and C respectively.

In general, it is noticed that the birds receiving phytobiotic helped in gaining higher body weights and thereby increasing the profit margin as compared to the control group used in the present experiment.

## Table 18 : Economics of production of broilers

| Particulars | T1 | T2 | T3 | T4 |
|---|---|---|---|---|
| Final live body weight (g) | 1765.5 | 1846.76 | 1845.62 | 1850.32 |
| Starter feed intake/bird (g) | 762.20 | 772.40 | 782.40 | 780.10 |
| Finisher feed intake/bird (g) | 2380.20 | 2590.40 | 2580.21 | 2530.40 |
| Starter feed cost/ kg feed (Rs.) | 19.50 | 19.50 | 19.50 | 19.50 |
| Finisher feed cost/kg feed (Rs.) | 19.0 | 19.0 | 19.0 | 19.0 |
| Total starter feed cost (Rs.) | 14.93 | 15.06 | 15.25 | 15.21 |
| Total finisher feed cost (Rs.) | 45.22 | 49.21 | 49.02 | 48.07 |
| Total feed cost (Rs.) | 60.15 | 62.09 | 62.37 | 63.28 |
| Chick cost (Rs.) | 32.00 | 32.00 | 32.00 | 32.00 |
| Miscellaneous cost (Rs.) | 3.00 | 3.00 | 3.00 | 3.00 |
| Total cost of production (Rs./bird) | 95.15 | 99.27 | 99.27 | 98.28 |
| Return from bird sale @ Rs. 80.00 / kg) | 141.20 | 147.68 | 147.0 | 148.0 |
| Return from manure sale (Rs.)/kg. | 1.00 | 1.00 | 1.00 | 1.00 |
| Total return (Rs.) | 142.2 | 148.68 | 148.0 | 149.00 |
| Net profit per bird (Rs.) | 46.7 | 49.41 | 48.73 | 50.72 |
| Net profit/kg body weight, Rs. | 26.45 | 26.76 | 26.41 | 27.17 |

**Overall Performance :**

The overall performance of broilers from different groups during the trial is presented in Table 14. The overall results of the trial indicated that the birds from all the treatment groups B to D receiving phytobiotics recorded better weight gain with respect to the growth parameters as compared to the birds from control group. It is also revealed that, use of phytobiotics helped the birds in recording higher net profit per kg, as compared to the birds from control group. Overall, final weight gain was highest in group D followed by group B, C and A showing that addition of phytobiotic has better effect on gaining body weight gain in comparison to control group.

Average body weight gain was also higher in group D, followed by group B, C and A. Overall feed conversion ratio was highest in group D. The net profit (per bird) was also highest in group D, followed by group B, C and A.

Hence, it is concluded that the supplementation of phytobiotics helped the birds to record better growth and performance with respect to growth parameters and net returns.

Further, it is concluded that phytobiotic used in the experiment not only helps the birds in improving the production performance upon its usage in normal feed, but, also helps the birds to record better performance, feed conversion ratio and body weight gain.

## Table 19: Overall performances of birds

| Parameters | Group A | Group B | Group C | GROUP D |
|---|---|---|---|---|
| Initial weight (G) | 43.76 | 42.74 | 43.10 | 42.82 |
| Final weight (G) | 1765.5 | 1846.76 | 1845.62 | 1850.32 |
| Total gain in weight (G) | 1721.74 | 1804.02 | 1802.52 | 1807.5 |
| Average weekly gain in weight (G) | 286.95 | 300.67 | 300.42 | 301.25 |
| Average total feed consumption (G) | 3146.4 | 3362.8 | 3362.6 | 3310.5 |
| Average feed conversion ratio | 1.82 | 1.86 | 1.86 | 1.81 |
| Total mortality (No.) | 2 | 2 | 2 | 1 |
| Mortality (%) | 4 | 4 | 4 | 2 |
| Net profit per bird (Rs.) | 46.7 | 49.41 | 48.73 | 50.72 |
| Net profit per kg (Rs.) | 26.45 | 26.76 | 26.41 | 27.17 |

**Fig. 4 : Net profit per bird (Rs.)**

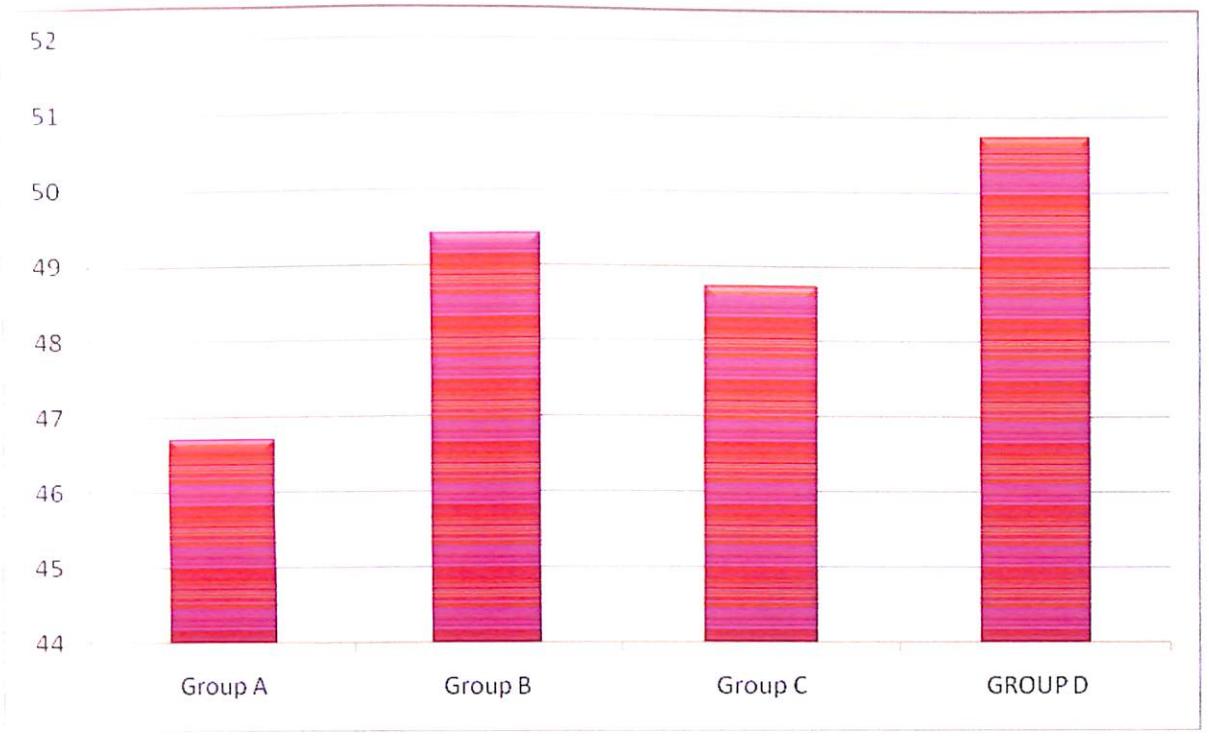
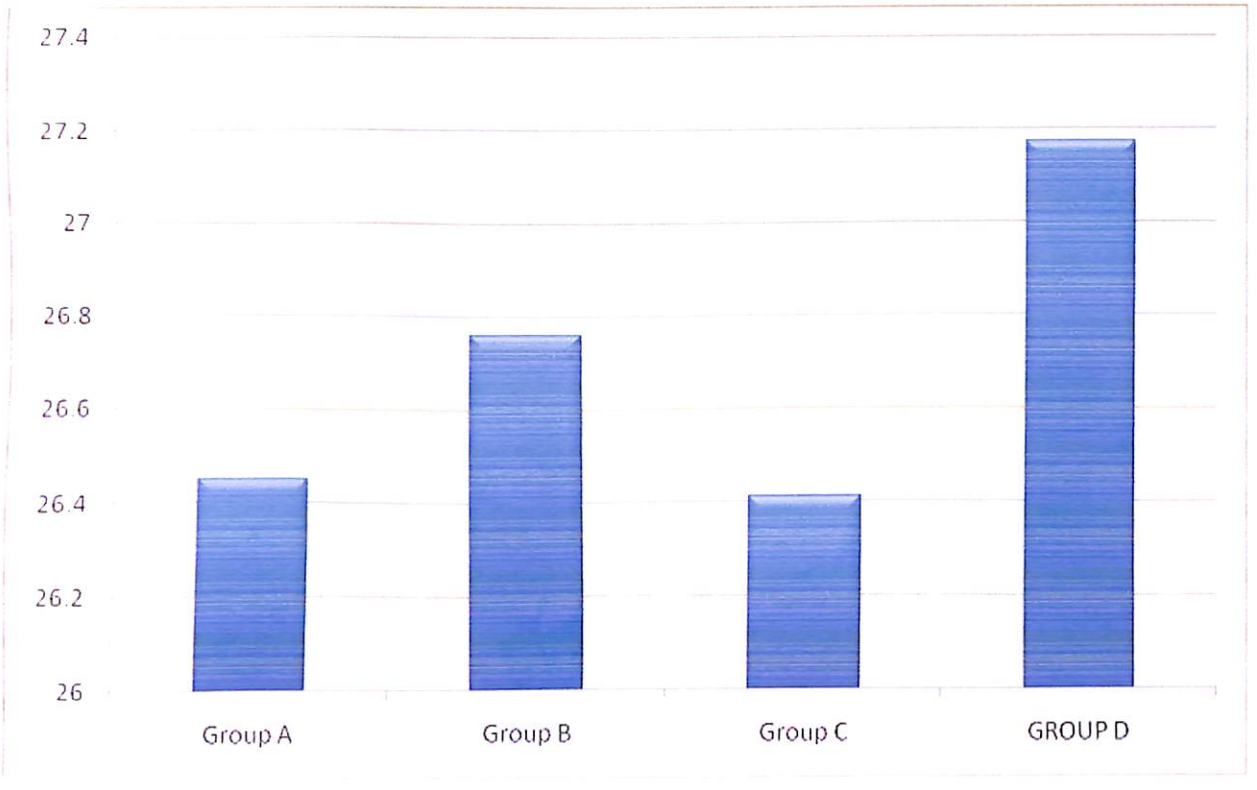
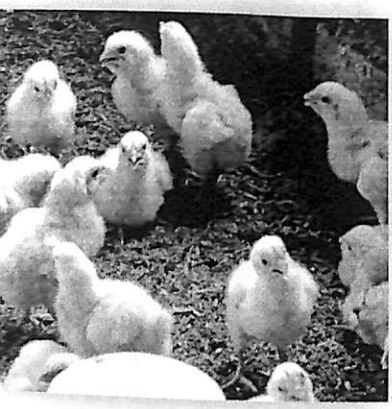



**Fig 5 : Net profit per Kg.(Rs.)**



# CHAPTER-5
# SUMMARY AND CONCLUSION



# SUMMARY AND CONCLUSIONS

The present experiment was conducted to evaluate the effects of phytobiotics on the performance of broilers. Trial was conducted on 200 day-old 'Vencob' Broiler chicks for the period of six weeks. Day-old broiler chicks were randomly divided into four equal groups viz. A, B, C and D. The group A was maintained as control. Birds from groups B to D received diet containing control with addition of phytobiotics @ 25 gm/100 kg of feed, 50 gm/100 kg of feed and 75 gm/100 kg of feed throughout the experimental period, respectively.

The observations were recorded for weekly feed consumption, weekly live weights and mortality, if any. From these observations, average weekly feed consumption, average weekly gain in weights and feed conversion ratios were calculated.

The average initial live weights of birds at day-old stage were 43.76, 42.74, 43.10 and 42.82 g for groups A to D respectively. The corresponding average live weights at the end of sixth week were 1878.98, 1991.89, 2056.94 and 2087.85 g. The addition of phytobiotics product at 25 gm/100 kg of feed, 50 gm/100 kg of feed and 75 gm/100 kg of feed throughout the experimental period helped the birds to record 6.00%, 9.47% and 11.12% higher live weights than control respectively. The statistical analysis of the data revealed that different treatments had significant effect on average live weights of the birds.

The average total gain in weights of birds from groups A to D were 2002.33, 2084.65, 2109.08 and 2147.59 g. respectively. It is evident that birds from group B receiving diet with addition of phytobiotics @ 25 gm/100 kg of feed recorded 4.11% higher gain in weights than the birds

from control group at the end of sixth week. Similarly, The birds from groups C & D recorded 5.33% and 7.25% higher gain in weights than the birds from control group at the end of sixth week. The statistical analysis of data indicated that different treatments had non-significant effect on average gain in weights of birds.

Total feed consumption per bird during six weeks period for groups A to D, were 4118.18, 4280.45, 4138.62 and 4231.1g respectively. The corresponding average weekly feed consumption per bird was 686.36, 713.41, 689.77 and 705.18 g, for groups A to D, respectively. It is noticed that highest feed consumption was recorded by the birds from group B. The statistical analysis of the data revealed that various feed treatments had non-significant effect on feed consumption.

The average weekly feed conversion ratios in terms of feed intake per unit gain in weight for the birds from groups A to D were 2.03, 1.95, 1.88 and 1.87, respectively. It is observed that birds from group D receiving diet supplemented with phytobiotics @ 75 gm/100 kg of feed throughout the experimental period were most efficient in feed utilization followed by birds from group C fed with phytobiotics supplementation @ 50 gm/100 kg of feed throughout experimental period. Group B shows better feed conversion ratios, fed with phytobiotics supplementation @ 25 gm/100 kg of feed. Birds of group D receiving phytobiotics @ 75 gm/100 kg of feed throughout the experimental period has shows higher feed conversion ratio followed by group B, C and control group respectively. It is observed from the table that, the different treatments had no significant effect on average weekly feed conversion ratios of the birds.

Mortality percentage for groups A to D was 4, 2, 4 & 4 %; respectively. From the data it was revealed that, mortality in all the treatment groups was well within limits. Thus the phytobiotics did not have any ill effect on health of the birds.

## CARCASS CHARACTERISTICS

The processing parameters with respect to shrinkage percentage, blood loss percentage and feather loss percentage were not significantly affected by dietary treatments, though phytobiotic supplemented group showed higher values of these parameters than unsupplemented groups. However, the percentage losses were within the normal range.

Dressing and Eviscerated percentage

Dietary treatments had no significant effect on dressing and eviscerated % which ranged from 65.34 to 66.09 and 58.25 to 59.19 respectively. Phytobiotic supplemented groups showed numerically higher dressing percentage than control, while phytobiotic supplemented group showed higher eviscerated percentage than other groups.

Giblet yield :

The giblet yield expressed as percentage of pre-slaughter weight could not influenced by different dietary treatments and did not show any definite trend.

Meat : Bone Ratio and Meat + Skin : Bone ratio :

The meat and bone ratio ranging from 3.88 to 3.98 as well as meat + skin : bone ratio (4.41 to 4.68) were not significantly influenced by dietary treatments, however birds fed diet supplemented with phytobiotic reflected higher ratio than unsupplemented group.

Carcass Characteristic :

Carcass characteristic in terms of moisture, crude protein and ether extract % of thigh and breast muscles were not significantly affected by dietary treatments. In general, breast muscles contained higher moisture and protein percentage, while thigh muscles showed higher ether extract percentage. No clear cut trend on the effect of supplementation of phytobiotics was seen in the carcass composition.

Considering the selling price of broilers @ Rs. 80/- per kg live weight. The profit obtained per bird was Rs. 46.7, 49.41, 48.73 and 50.72 for groups A to D, respectively. The corresponding net profit per kg was Rs. 26.45, 26.76, 26.41 and 27.17. This indicated that supplementation of different phytobiotics combinations in broiler diets helped to fetch more profits.

The overall results of the trial indicated that the birds from all the treatment groups B to D receiving phytobiotics recorded better weight gain with respect to the growth parameters as compared to the birds from control group. It is also revealed that, use of phytobiotics helped the birds in recording higher net profit per kg, as compared to the birds from control group. Overall final weight gain was highest in group D followed by group B, C and A, showing that addition of phytobiotic has better effect on body weight gain in compression to control group.

**The following conclusions are drawn on the basis of results obtained during the study.**

1. Use of phytobiotic helped in recording higher live weights by the birds at the end of six weeks when used Nutribion @ 25 gm/100 kg of feed, 50 gm/100 kg of feed and 75 gm/100 kg of feed respectively than control group.

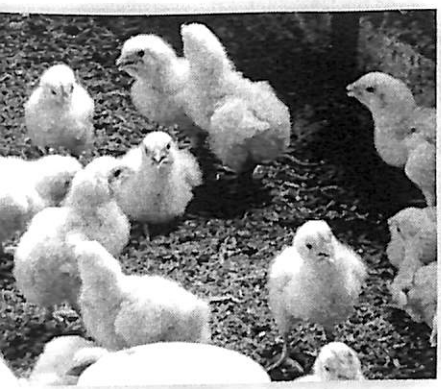
2. Use of phytobiotic product Nutribion helped the birds in recording higher weekly and total gain in weights when used in the feed.
3. Addition of Nutribion used in the present study was beneficial for use in broiler diets with respect to feed conversion ratio.
4. Broilers fed phytobiotics supplemented diet, utilized feed more efficiently than unsupplemented diet.
5. Carcass traits with respect to processing parameters as well as dressing percentage, eviscerated percentage and giblet percentage could not has marked influence by supplementation of phytobiotics.
6. Use of phytobiotics did not have any ill effect on health of the birds.
7. Use of phytobiotics helped in gaining higher body weights and thereby increasing the profit margin as compared to the control group used in the present experiment.

Thus, overall performance of the birds during the experiment revealed that use of phytobiotics is beneficial for recording better growth response by birds in terms of final live weights, gain in weights, better feed conversion ratio and higher net profits at the end of sixth week.

Hence, it is concluded that the supplementation of phytobiotics helped the birds to record better growth and performance with respect to growth parameters and net returns.

Thus, the results of the present study revealed that phytobiotics not only helps the birds in improving the production performance upon its usage in normal feed, but also helps the birds to record better performance and profitability.

# CHAPTER-6
# LITERATURE CITED



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