EFFECT OF CERTAIN FEED ADDITIVES ON BROILER PERFORMANCE

By

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THESIS

Submitted in Partial fulfilment
of the requirement for the degree

MASTER OF VETERINARY SCIENCE

Faculty of Veterinary and Animal Sciences
Kerala Agricultural University

Department of Poultry Science
COLLEGE OF VETERINARY & ANIMAL SCIENCES
MANNUTHY - TRICHUR

1976

DECLARATION

I hereby declare that this thesis entitled "Effect of Certain Feed Additives on Broiler Performance" is a bonafide record of research work done by me during the course of research and that the thesis has not previously formed the basis for the award to me of any degree, diploma, associateship, fellowship, or other similar title, of any other University or Society.

Place: Mannuthy

Date: 04.10.76

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C E R T I F I C A T E

Certified that this thesis, entitled "EFFECT OF CERTAIN FEED ADDITIVES ON BROILER PERFORMANCE" is a record of research work done independently by Shri. R. Sabarinathan Nair under my guidance and supervision and that it has not previously formed the basis for the award of any degree, fellowship, or associateship to him.

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ACKNOWLEDGEMENTS

I wish to express my gratitude and thanks to

Dr. A. Ramakrishnan, Professor, Department of Poultry Science and Major Adviser for his inspiring guidance, generous help and co-operation,

Drs. A.K.K. Unni and C.K. Venugopalan, Assistant Professors, Department of Poultry Science for invaluable help, advice, personal interest and encouragement,

Dr. M. Krishnan Nair, Professor, Department of Pathology for invaluable help and guidance and placing the facilities of the Department of Pathology at my disposal for histopathological work,

Dr.(Mrs.) K.I.Mariamma, Assistant Professor, Department of Pathology for valuable help and assistance,

Dr. P.U.Surendran, Professor, Department of Statistics, for advice and suggestions in statistical analysis of the data,

Mr. P. Govindankutty Menon for typing the thesis,

Mr. G. Gopinathan Nair, Artist-Photographer, for the preparation of graphsand plates,

M/s. Pfizer Ltd., Smithkline and French Ltd., and Hoechst Pharmaceuticals for supplying the additives free of cost.

I am grateful to Dr. P.G. Nair, Dean of the Faculty of Veterinary and Animal Sciences for permission to underta this study. I place on record my gratitude to the Kerala Agricultural University for granting leave to enable me to pursue this work.

I appreciate the understanding and encouragement of my wife and children during the entire period of study.

R. SABARINATHAN NAIR.

TABLE OF CONTENTS

INTRODUCTION

INTRODUCTION

A new trend emerging in Indian Poultry industry is the increasing awareness of raising chickens for meat. Broilers are young chickens raised specifically for meat production. As broilers are ready for the market at about 8 weeks from the day they hatch out, a farmer can raise five crops a year ensuring quick return on investment. Hitherto, broiler raising has been only a side line to egg farming in India. With the establishment of commercial hatcheries and ready availability of superior broiler chicks, broiler production is gaining momentum. Increased consumer awareness to quality meat and quick returns on investment are attracting many to raise broiler especially in and around cosmopolitan cities. With all the inputs readily available, the country is poised for a significant breakthrough in broiler production. It is expected to become the major segment of poultry business, as in the developed countries.

The biggest single item of cost in broiler production is feed, accounting for over 70% of the total cost of production. Higher gain, lesser mortality and better feed efficiency are factors that spell the difference between profits and loss in broiler farming. With a view to obtain maximum gain, a number of chemical substances are added to broiler rations. These chemical substances when employed as feed

additives are believed to bring about growth promotion and improved feed conversion. Some of these are chiefly nutrients, some are chiefly medicaments and some are added for their physiological and chemical characteristics. The most common feed additives incorporated in broiler rations in India are antibiotics, arsenicals and nitrofurans.

Though the poultry feed business is not a gigantic one compared to advanced countries, it is poised for a big breakthrough. It is assumed that at least 90% of the broiler feed produced in the country today contain one or more feed additives. This being so, quite a big amount of additive incorporated feed will be marketed in our country commensurate with the fast expanding broiler industry.

It is generally agreed at present that it is commercially profitable to allow concentrations of specific feed additives to be added to animal feeds. Observations that certain feed additives in animal feeds produce resistant organisms and some with transferable resistance prompted many countries to impose severe restrictions on their use. Constant vigilence is exercised because of the possibility of public health problems arising out of the use of such additives in meat productic

The lack of any restriction on the use of feed additives and the varied effects of these additives entail

systematic evaluations. Hence there is scope for further investigations on the role of these additives vis-a-vis broiler performance in our country.

A feed additive when incorporated in broiler rations should bring about desired gains economically. It should be least harmful to consumers of products from such additive fed animals and birds. Periodic systematic evaluations are necessary to assess the usefulness of these additives in broiler production.

In view of the extensive use of feed additives by the Indian Poultry Industry, the present study was planned and undertaken to evaluate the influence of an antibiotic, an arsenic and a nitrofuran upon certain traits of economic importance in broiler production.

REVIEW OF LITERATURE

REVIEW OF LITERATURE

Antibiotics

Moore et.al. (1946) were the first to report growth stimulation in chicks from dietary antibiotics. Since then a number of ingestigators have shown that the inclusion of an antibiotic or a combination of antibiotics either in the crude or pure form in the rations of young chicks and or turkey poults results in improved growth. (Almquist and Merritt,1951., Atkinson and Couch, 1950, 1952, Branion and Hill, 1951., Heuser and Norris, 1952., Heywang, 1952 and McGinnis, 1951.).

All antibiotics do not bring about this growth response. (Branion and Hill, 1951.,Stern et.al., 1952). There is some disagreement as to the comparative value of these antibiotics which usually do give a response. (Bird et al. 1952.,Davis and Briggs, 1951., and Hill et.al. 1952., Combs and Bossard, 1963).

Davis and Briggs (1951) reported growth stimulation in most of the cases, but not in all, when a practical corn-soyabean ration was supplemented with aureomycin,procaine penicillin and bacitracin and terramycin. Steptomycin, though stimulatory was not active as the other antibiotics. Chicks and poults showed improved feed efficiency when the diet was

supplemented with an antibiotic. The authors concluded that there was no indication that growth stimulation occurred as a simple manifestation of increased feed consumption. Braude et al. (1953) found that aureomycin, bacitracin, penicillin andterramycin were equally active as growth promoters and fully effective at levels as low as 1 - 2 g per ton of feed. According to the authors, the response to an antibiotic depends chiefly on the antibiotics used and the composition of the diet. Frölich (1953) after studying with antibiotics as supplements to complete rations stated that byproducts of known residual antibiotic value were more effective as growth stimulants than were pure "Animal Protein Factor" products. In the experiments, medicinal standard procaine penicillin and aureomycin were used, the bacitracin andterramycin were relatively impure concentrates guaranteed to have 11 g antibiotic per kg. The per cent increase in weight gain to 4 weeks of age and percentage of saving of feed per unit gain for different amounts of antibiotics ranged from zero to 25 per cent. There was no evidence of tissue injury. Results differed from one experimental room to another and over 9 months showed remarkable rise in the amount of antibiotics required to give a response.

Morimoto et al. (1953) reported that chicken's on a ration containing fish meal with a supplement of terramycin or a ration without fish meal with an animal protein factor

supplement showed higher levels of vitamin B_{12} in the liver than those on the unsupplemented rations. Muller (1953) studied the effect of the addition of antibiotic preparations to a commercial fattening meal for cockrels. The antibiotics tried in this study were terramycin, penicillin, aureomycin, terramycin and penicillin, aureomycin and penicillin. All the antibiotics were shown to improve growth rate and feed efficiency. Terramycin gave the best results. Fuller et al. (1952) comparing Vitamin B_{12} fish solubles and whey in the growth of chicks, stated that since terramycin did not alter the growth response tested, no sparing action by the antibiotic of such factors could be postulated. According to Heuser and Norris (1952), though growth stimulation has been obtained with a number of different antibiotics, variability was apparent for the same antibiotic in different experiments. They also observed that greatest relative growth stimulation due to antibiotic was found to occur during the first four weeks. Considerable variation was also observed in feed efficiency. The trend however was that less feed was required to produce a pound of gain with antibiotics. Kramke and Fritz (1951) reported that aureomycin, penicillin, bacitracin and terramycin all gave essentially optimum growth stimulation when used at the rates of 10 g per ton of feed. Maximum percentage of gain was observed at 4 weeks of age. Studies with white leghorn chicks fed graded levels of vitamin B_{12} alone and in combination with

terramycin indicated that the Vitamin B_{12} requirement for maximum growth might have been increased by terramycin supplementation.(McGinnis, 1951). McGinnis et al. (1952) opined that a combination of terramycin with whey and liver L brought about a greater growth response than any of the supplements alone. After studies with turkey poults Branion and Hill (1951) observed that aureomycin, penicillin, terramycin and streptomycin when added at a level of 25 mgm per kilogramme of a diet containing 15 per cent animal protein supplements or an all plant protein diet supplemented with crystelline vitamin B_{12} resulted in growth response to 8 weeks of age. Feed efficiency was improved on the all plant protein diet but not with animal protein diet by the addition of the antibiotic.

Rosenberg et al. (1952) reported that increasing concentrations of terramycine, stimulated growth rate and improved efficiency of feed utilisation of chicks. The microflora detectable by the techniques used was not eliminated or even significantly reduced the number, even when 16 times the recommended amount of terramycin was fed. Waibel et al. (1954) first described the disappearance of growth stimulating effects of dietary antibiotics in an old environment. Morrison et al. (1954) studied the influence of environment on the response of chicks to growth stimulants and reported growth stimulation in an old

environment with penicillin. West (1956) observed disappearance and reappearance of antibiotic response without apparant reasons, in a series of trials.

Biely and March (1959) after studying the response of chicks to several antibiotics in different diets and environments recorded that growth response of chicks to oleandomycin, chlortetracycline, penicillin and oxytetracycline at levels of 5, 10, 2.5, and 10 mgm per pound of diet respectively, produced a variable response. Oleandomycin promoted faster growth than others irrespective of diet or environment.

Edwards et al. (1960) observed that chickens grown in an experimental laboratory immediately after cleaning and fumigation with formalin and potassium permanganate grew at a faster rate than chickens grown in the same laboratory with older chicks present from the start of the experiment. The results suggested that the requirements of the chicks for certain nutrients may be much greater when chicks are grown in contaminated quarters as compared with chicks grown in fumigated quarters. Heth and Bird (1962) conducted research throughout a 10 year period with antibiotic feed supplements and concluded that there was no long term change in the growth response of chicks though the response varied from

trial to trial. Heuser (1956) stated that feeding of low levels of antibiotics resulted only in marginal increase in market weight and reduced mortality only slightly. Feed efficiency was not improved. He further observed that high levels of antibiotics (50 or 100 g of chlortetracycline or 100 g of oxytetracycline per ton of feed) increased weight, improved feed efficiency and decreased mortality. The time required to bring the birds to market size was also decreas March and Biely (1967) made a reassessment of the mode of action of growth stimulating properties of antibiotics. They concluded that although the growth of chicks may be stimulated when an antibiotic is added to a diet deficient in one or more B-complex vitamins, the growth stimulation does not necessarily result from an increase in the levels of vitamins available to the chicks from enhanced bacterial synthesis in the intestine. They also postulated that an increase in the absorptive capacity of the intestine appear to offer a more consistant explanation for the "Vit-Sparing' effect of dietary antibiotic. King (1968) recorded no signi fi cant difference between groups in body weight or weight of liver, gizzard, small intestine or caeca per 100 g body weight after an 8 week trial on ducklings fed a proprietary mash with or without 45 g Oxytetracycline per ton.

Fellegiova' et al. (1968) evaluating the hygenic and

economic criteria in poultry given antibiotics like zinc bacitracin, oxytetracycline, oleandomycin and chlortetracycline, in the feed observed that residues of antibiotics were found only after giving chlortetracycline, and after omitting it from the diet, residues persisted in bones. Vitamin B_{12} was significantly less in those groups given chlortetracycline than in those given noantibiotic.

In a practical evaluation of five food additives commonly used as growth promoters, Foster (1972) reported that the antibiotics tested failed to produce results economically superior to the control diet. Menge (1973) recorded lack of growth response to 8 week old broilers to certain antibiotics. He presented data to show that low levels of chlortetracycline, bacitracin, oxytetracycline and penicillin in a diet containing animal protein had no effect on growth of broilers to 8 weeks in trials on floor pens.

Arsenicals

Arsenical compounds were first used in poultry feeding as antiparasitic drugs. The pioneering work of Morehouse and Mayfield (1946) showed that 3-nitro 4-hydroxy phenylarsonic acid stimulated the growth of chickens and turkeys when given in drinking water at sucoccidiostatic levels. This observation was confimed by Bird et al. (1948, 1949). Further work by

Morehouse (1949) indicated that the growth rate of chickens and turkeys and the feed efficiency of turkeys receiving this arsonic acid derivative were greater than the controls. Wharton and Fritz (1953) obtained no significant growth response, although feed efficiency was already improved, when parahydroxy phenyl arsonic acid was added to the diets of immature chickens at the rate of 45.4 g per ton. The work of Carlson et al. (1954) showed that sodium arsenite, arsanilic acid or 3-nitro-4 hydroxy phenyl arsonic acid improved growth of chicks fed practical diet or diets containing 10 ppm of selenium. No indication was presented on the effect of these compounds upon feed efficiency. Scot and Glista (1950) indicated little or no beneficial effect upon broiler for 3-nitro-4-hydroxy phenyl arsonic acid singly or in combination with an antibiotic. Tarver et al. (1954) made similar observations employing growth, feed efficiency, feathering, general appearance, carcass grade, fleshing and dressing percentage as comparative criteria.

Frost (1953) reviewed the discovery of the phenomenon that chick growth response to arsenicals and antibiotics was approximately equal. This review showed that poultry have a high degree of tolerance to arsanilic acid. Following the first descriptions of Waibel et al. (1954) of the disappearance of the growth stimulating effects of dietary antibiotics in

an old environment, Libby and Schiable (1955 a) observed similar effects for arsonic compoumds also. Morrison et al. (1954) studying the influence of environment on the response of chicks to growth stimulants, obtained growth stimulation in chicks in an old environment with penicillin and with 3-nitro-4-hydroxy phenyl arsonic acid. In a new environment growth stimulation was observed only with penicillin. No growth response to arsanilic acid was observed in either treatment. Libby et al. (1955 b) reporting on the effect of long time feeding of contain arsonic acids to chickens observed early growth stimulation and improved feed efficiency in broiler fed either of the two arsonic acids or penicillin, but the effects were not additive. The findings of Anderson et al. (1952) with poults, Elam et al. (1953) and Abbot et al. (1954) with chicks were suggestive that the mechanism for growth stimulation might well be the same for arsonic compounds and antibiotics. West (1956) reported that the greatest growth stimulation effect and feed efficiency was observed when the arsonic compound was added to the basal diet containing no antibiotic, the percentage of increase being of the order of 8 per cent. Definite and rather consistant improvements were observed by him when arsonic compound was added to rations with "low" levels of antibiotics. Disappearance and reappearance of antibiotic responses were observed during the trials but there was no concurrent disappearance of the response to the arsonic

compound. Livability, uniformity of body weight and the extent of the yellow pigment deposition apparently were unaffected by the addition of the arsonic compound and he also presented evidence to show that arsonic compounds produce an additional response when added to broiler rations that contain antibiotics.

Sah (1971 a) studying the effect of 3-nitro-4-hydroxy phenyl arsonic acid alone or in combination with antibiotic observed that arsonic compound had no effect on growth and feed efficiency when given alone but had an additive effect on growth and feed efficiency when added to broiler rations containing low levelof antibiotics. Sah (1971 b) observed that supplementation of arsonic compound alone or in combination with antibiotic increases growth significantly at 1 per cent level in male chicks. In the female chicks supplementatic did not show significant growth response and arsonic acid supplemented group showed poor growth response. Feed efficiency was found to be superior but not significant.

Overby and Frost (1962) studied the non-retention by the chicks of the arsenic in tissues and observed that after feeding pig liver from swine,fed arsanilic acid 5 times the recommended dose, residual arsenic from pig liver seemed to be removed from blood by kidney and liver and little appeared in muscle. Neither form of arsenic was cumulative in chickens.

Amounts in tissues were lower than in many natural foods and differences would not have been detectable by ordinary chemical methods. McDonald (1955) reported that arsanilic acid failed to produce a significant increase in growth and only a slight improvement in feed efficiency. Arsanilic acid and penicillin together were no better than penicillin alone. The failure of arsanilic acid under conditionswere penicillin is capable of producing a response, suggests that there are fundamental differences between the mechanism of growth stimulation. According to Milligan et al. (1955), supplementation of 0.005 per cent of arsonic acid in commercial type broiler diets containing effective feeding levels of antibiotics elicited an improvement of final body weights, market grades, and very slight if any, improvement in feed efficiency. Foster (1972) in a practical evaluation of antibiotics, nitrofuran and arsenicals commonly employed as food additives in broiler rations observed that only one treatment, one of the arsenicals,produced results economically superior to control diet.

Nitrofurans

Collins (1956) recommended that poultry feeds may contain 0.0056 and 0.0112 per cent of nitrofurazone for prevention and control of coccidiosis. The use of Neftin furazolidone in broiler feeds had been reported to be effective in stimulating

growth rate, improve feed conversion and reduce death losses. Libby and Schiable (1955) demonstrated improved growth rate and feed efficiency in growing chickens when furazolidone was incorporated at low levels in the feed. Alikaev (1961) also made similar observations. Pope and Schiable (1958) studying the interrelationship of furazolidone and other feed additives, postulated that there was no consistant improvement of growth of broiler chicks reared in clean shavings in closed pens, when small amounts of furazolidone, penicillin or arsanilic acid were added to the ration. Significant growth responses were observed by them when furazolidone was combined with penicillin or penicillin and 3-nitro-4-hydroxy phenyl arsonic acid. On the experimental rations, efficiency of feed utilisation was, in general, slightly though not significantly better than on the control ration.

McDonald and Beilharz (1961) found highly significant increase in weight when furazolidone was administered to chicks in the diet at 0.02 per cent level. Mellen and Waller (1954) observed increase in growth rate when the diet was supplemented with 100 g of furazolidone per ton of diet. Francis and Shaffner (1955) conducted studies using levels of 0.0055 to 0.022 per cent furazolidone or nitrofurazone to evaluate the safety of these compounds for chickens. They reported that the drug produced smalldifferences in most glands which were not significant except for the decrease in thyroid

size. Body weight was significantly reduced when either 0.0165 or 0.022 per cent nitrofurazone was fed. The feeding of nitrofurans did not change the effect of thiouracil on body weight and thyroid size. Foster (1972) observed that nitrofuran derivative employed in a practical evaluation failed to produce results economically superior to control diet. Lal and Verma (1968) studying the interrelationship of antibiotics and coccidiostats on the growth of White Plymouth Rock chicks observed that body weight was significantly decreased by nitrofurazone and furazolidone alone. Chlotetracycline with nitrofurazone and furazolidone significantly increased body weight above that of the coccidiostats alone. Efficiency of feed conversion was not affected.

Coates and Harrison (1959) studied the effect on chick growth of inactivated penicillin, mineral sulphates or furazolidone supplements and observed significantly increased live weight gain with furazolidone at 7.5 mg per kg of diet.

Onet (1962) reporting on the effect of Vitaurome (a preparation containing chlortetracycline, Vitamin B_{12}, protein, fat and minerals) or furazolidone or both with basal diet observed weight gains upto 21.86 per cent greater than controls. Losses in trial groupswere lowerthan controls.

Gowda et al.(1975) observed a greater but non-signficant

weight gain for chicks fed diets supplemented with Neftin furazolidone over control group. Feed efficiency was also improved in treatments. They also reported an extra return of 25 and 30 paise per bird in treatment groups after deducting the cost of Neftin and concluded that the extra profit obtained by the supplementation of Neftin in the diet was found to be mainly due to the improved body weight and feed efficiency.

MATERIALS AND METHODS

MATERIALS AND METHODS

A feeding trial of 8 weeks duration was carried out at the Department of Poultry Science, College of Veterinary and Animal Sciences, Mannuthy, to evaluate the comparative effects of three commonly used feed additives on broiler performance. One-hundred and four one-day old commercial broiler chicks constituted the experimental subjects. All the chicks were of the same hatch and were raised to 8 weeks of age under identical conditions of housing and management.

The chicks were wing banded, weighed individually and randomly allotted to four groups of 26 chicks each and raised on litter floor. Basal starter and finisher rations were computed as per ISI (1967) specifications. The ingredient composition of starter and finisher diets is shown in Table 1. The chicks were fed on starter rations from 0 - 6 weeks and on finisher diet from 7 - 8 weeks. The basal diet with no feed additive was used as control while the other three diets contained the basal ration plus a feed additive as detailed in table 2. The diets were randomly allotted to the four groups. Feed and water were provided ad libitum throughout the experimental period. Normal managemental practices were carried out for the whole period of the study. All the chicks were debeaked on 10th day of starting the experiment with a view to avoid pecking and feed wastage.

Table 1. Composition of Basal Diet

Sl. No.	Ingredients	Broiler starter (Parts/100 kg)	Broiler Finisher (Parts/100 kg)
1	Yellow Maize	30	40
2	Groundnut cake	25	20
3	Gingely oil cake	10	5
4	Rice polish	23	23
5	Fish meal	10	10
6	Salt	0.5	0.5
7	Mineral mixture*	1.5	1.5

Added to 100 kg of diet

Vit.A + D3 + B2 (Vitablend**) 15 g

*Eggomin, a product of SQUIBB contained phosphorin-5%, Calcium - 28%, Sodium Chloride 18%, Iron-3500 ppm, Cobalt - 50 ppm., Zinc-1100 ppm, Iodine-33 ppm, Copper - 130 ppm, Manganese-2500 ppm, Magnesium not less than 800 ppm.

**Vitablend (Glaxo Ltd) contained Vitamin A, Vitamin B2 and Vitamin D3 at 40,000 I.U., 25 mg and 600 I.U. per g respectively.

The experiment was started on 1-6-1976 and terminated on 27-7-1976 on completion of 8 weeks.

Weekly weights were recorded to the nearest 5 g and weekly gains were calculated. Weekly feed consumption data were collected and feed conversion efficiency was worked out. Final weights were recorded on 27-7-1976. On the same day 8 birds from each group were randomly selected and subjected to slaughter studies. The birds were fasted for 3 hours prior to slaughter. Water was provided ad libitum during the fasting period. The birds were slaughtered by the outer cut method described by Kotula and Helbacka (1965). A bleeding time of 2 minutes was allowed after killing and the weight of the drained blood was recorded. The birds were then scalded at a temperature of 56°C for approximately 45 seconds. The defeathering was done on a mechanical feather plucker and finished off by hand. The defeathered birds were examined for pin feathers and the same were removed with a pinning knife. After the pinning operation, the birds were singed to remove hairs by a blow lamp. The birds were weighed at this stage to calculate dressing losses. The carcasses were washed thoroughly prior to evisceration.

The head was cut off with a cleaver. The shanks were removed by cutting through the large joints. The skin on

Table 2. Types and levels of additives used

Treatment Groups	Diet	Levels of active ingredient per 100 kg of diet
I	Basal + TM-5(1)	10 g
II	Basal + Neftin-50(2)	5 g
III	Basal only	nil
IV	Basal + 3 Nitro(3)- Hoechst	5 g

(1) TM-5 (Pfizer Ltd) contained guaranteed equivalent of 5 g Oxytetracycline activity per 500 g.

(2) Each Kg of Neftin-50 (Smith Kline and French (India) Ltd. contained 50 g Neftin furazolidone.

(3) 3-Nitro Hoechst 5% Premix (Hoechst Pharmaceuticals Ltd) each gramme contained 50 mg 3-nitro-4-hydroxyphenyl arsonic acid.

the back of the neck was cut from the point where the head was severed, to a point in line with the base of the neck, and the skin was then pulled down to the shoulder. The gullet, crops and wind pipe were removed by pulling them away from the neck skin and then cut off at the point nearest to entrance to the body cavity. The neck was cut from the body at the beginning of the back. The oil sack was removed by cutting under the sac to the back bone and up towards the tail. The entails were then removed. An incision was made below the end of the breast bone (Keel) down to and around the Vent. The gizzard was pulled through the opening together with the liver, heart and intestinal tract. The lungs were then removed. The carcass was washed inside and out, drained and weighed.

The gizzard, liver and heart were then removed from the viscera. The gizzard was split lengthwise, through the thick muscle. The lining and contents were carefully pealed out. The gallbladder was carefully removed from the liver. The heart was trimmed and washed free of blood. The giblets (gizzard, heart and liver) from individual birds were washed, drained and weighed along with the carcass to calculate the ready to cook yield. The intestine was split lengthwise, washed off faeces and weighed.

Representative samples of heart, liver, spleen, kidney

and intestine from each bird were collected in 7% formalin and processed by routine paraffin embedding technique for histopathological studies. Sections were stained with haemotoxyln and eosin and examined for tissue damage, if any

Data pertaining to growth, feed efficiency, final gain at 8 weeks, dressing losses, carcass yields and weight of intestine were subjected to statistical analysis (Snedecor and Cochram, 1967). Economics of additive incorporation was evaluated.

R E S U L T S

RESULTS

Growth

The mean body weights of the four treatment groups pertaining to the third, sixth and eighth weeks of age are presented in table 3. Mean total gain in weight of all the four treatment groups are presented in table 4. The data pertaining to the mean body weight at third, sixth and eighth weeks of age were subjected to statistical analysis (Table 3a). It was found that the treatments did not differ significantly in their mean body weight at third week of their age and also at the eighth weeks of age. Nevertheless, treatment II resulted in significantly higher body weight than treatment I and III at the sixth week of age, though this did not differ significantly from treatment IV. Treatment II produced maximum body weight at eighth week of age, though this was not statistically significant.

The mean total gain in weight of the four treatments did not indicate any statistical significance (Table 4a). However, treatment II had 981.7 g mean gain in weight during the entire experimental period and this was the highest recorded for any group. The percent improvement in mean final weight over the control group for the three treatments were 0.42 per cent, 6.48 per cent and 5.96 per cent respectively.

The rate of growth from start to the completion of the experiment of the four treatments is graphically represented.

Table 5. Mean body weight of treatments at 3rd, 6th and 8th weeks.

Treatment	3rd week Mean wt. (g)	S.E.	6th week Mean wt. (g)	S.E.	8th week Mean wt. (g)	S.E.
I	297.7[a]	±8.5	716.1[b]	±22.85	959.5[a]	±34.24
II	306.3[a]	±8.5	779.4[a]	±21.87	1017.7[a]	±32.78
III	289.4[a]	±8.2	683.1[b]	±21.87	955.4[a]	±33.49
IV	297.8[a]	±8.3	720.6[ab]	±21.87	1012.4[a]	±33.49

Means for body weight carrying atleast one similar superscript do not differ significantly (P 0.05).

The mean weekly gain in weight of the four treatments are presented in table 6. It is apparent that the maximum gain was observed in the fifth week for all the treatments. The rate of gain was linear for the four treatments upto the fifth week and thereafter it showed a decline.

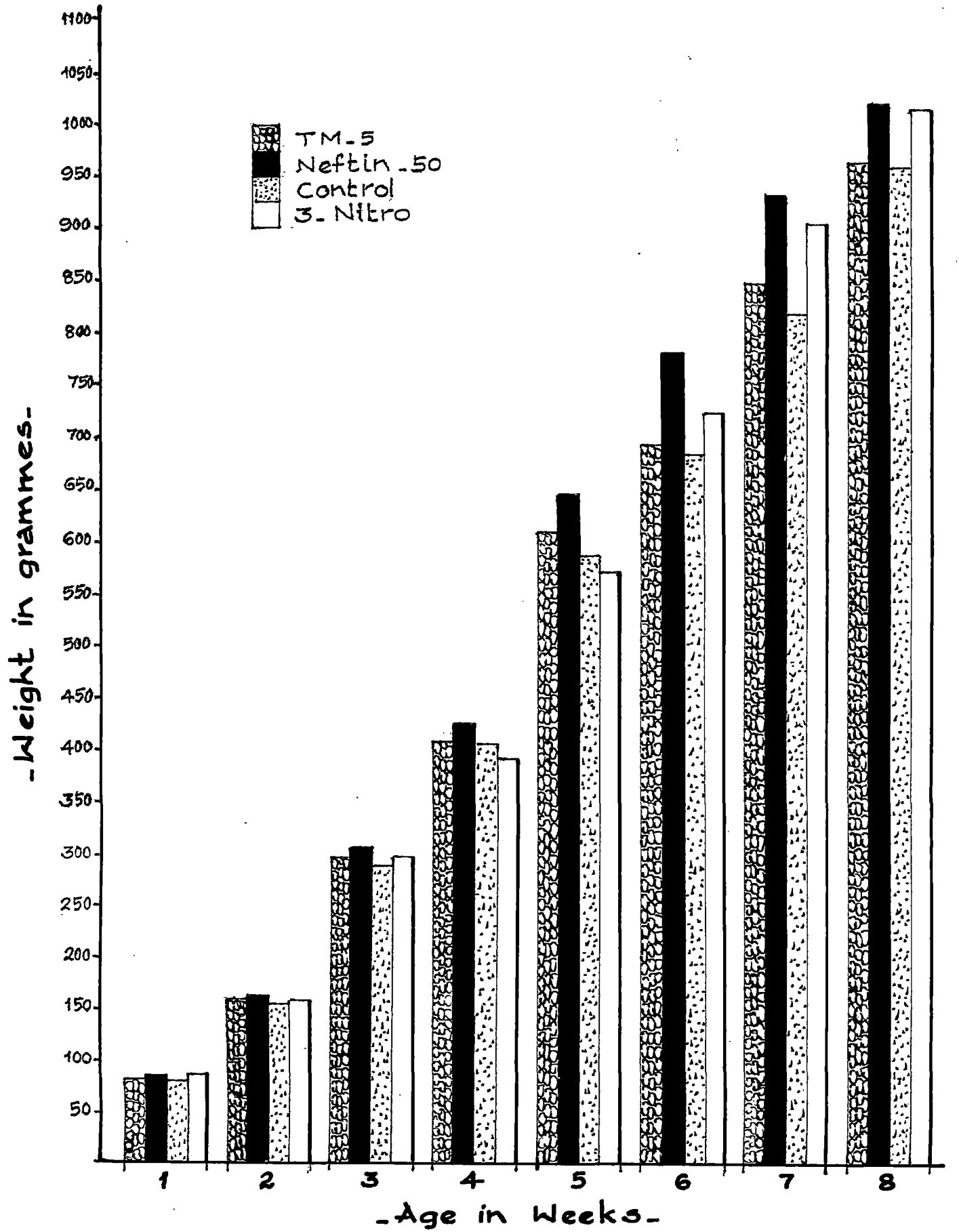

TM-5
Neftin-50
Control
3-Nitro
-Weight in grammes-
1100
1050
1000
950
900
850
800
750
700
650
600
550
500
450
400
350
300
250
200
150
100
50
1
2
3
4
5
6
7
8
-Age in Weeks-

Table 3a. Analysis of variance of body weights at 3rd, 6th and 8th weeks of age.

Source	df	SS	MSS	F
Treatments	3	3535.4	1178.5	0.68^{ns}
Error	95	164031.8	1726.6	
Total	98	167567.2		

Source	df	SS	MSS	F
Treatment	3	115231.6	38410.5	3.34*
Error	90	1034418.4	11493.5	
Total	93	1149650.0		

Source	df	SS	MSS	F
Treatments	3	76958.4	25652.8	0.994^{ns}
Error	88	2270233.7	25798.1	
Total	91	2347192.1		

ns - Not significant.

* Significant ($P < 0.05$).

Table 4. Mean total gain in weight.

Treatments	Mean gain in weight (g) Mean weight	S.E.
I	923.2	±40.24
II	981.7	±38.53
III	919.4	±39.36
IV	976.3	±38.53

Table 4a. Analysis of variance of total gain in weight.

Source	df	SS	MSS	F
Treatments	3	58130.9	19376.97	0.54^{ns}
Error	89	3170892.2	35628.00	
Total	92	3229023.1		

ns - Not significant.

Table 5. Mortality and causes.

Treatments	Total Number of birds	Total mortality	Causes of mortality
I	26	4	2 - Omphalitis 2 - Coccidiosis
II	26	2	1 - Aspergillosis 1 - Omphalitis
III	26	3	3 - Coccidiosis
IV	26	3	1 - Gout 1 - Choking and asphyxiation 1 - Coccidiosis

Feed Efficiency

The overall feed efficiency is presented in table 7. Treatment II exhibited the best efficiency of 2.8. Treatment IV had an efficiency of 2.9, and treatments III and IV had an efficiency of 3.5.

The best efficiency was exhibited by treatment II and IV.

Mortality

The details of mortality are given in table 5. It is to be pointed out that all the birds belonging to the four treatments had a mild course of coccidiosis during the sixth week of age. All the four treatments were given medication with sulphaquinoxaline for a period of three consecutive days. The number of deaths due to coccidiosis was 2, 0, 3 and 1 for the four treatment groups respectively.

Carcass Yield and Losses

Shrinkage.

The data pertaining to per cent shrinkage after angular transformation are given in table 8. On statistical analysis it was found that the four treatments did not differ significantly (Table 8a). The mean percent shrinkage for the four treatments were 4.7, 4.8, 5.4 and 4.3 respectively. (Appendix 5 - 8).

Dressing Losses.

The data pertaining to dressing losses after angular transformation is given in table 9. Statistical analysis of the data presented in table 9a exhibited significant differences among treatments. The mean dressing losses

Table 6. Mean initial weight and weekly rate of gain in grammes

Treatment	Initial weight	WEEKS 1	2	3	4	5	6	7	8
I	36.25	47.08	78.75	135.42	111.88	202.71	109.32	130.00	113.41
II	36.04	50.80	80.83	138.75	124.58	219.37	133.33	150.62	87.71
III	35.96	44.61	75.96	133.26	117.69	178.28	101.04	127.39	139.56
IV	36.00	52.69	71.54	137.12	93.60	177.80	153.75	174.13	111.09

Table 7. Effect of feed additives on quantitative evaluation of broilers fed for 8 weeks.

Diets	Average final body weight	*Feed efficiency	Ready to cook yield %	**Feed conversion efficiency	Cost of diet per kg (Paise)	Cost of feed to 1 kg live weight Rs. ps.	Cost of feed to 1 kg ready to cook yield Rs. ps.
I	959.54	3.5	66.68	5.0	118.4	4.14	5.92
II	1017.71	2.8	67.57	3.9	122.5	3.43	4.78
III	955.43	3.5	64.15	5.7	117.0	4.10	6.67
IV	1012.39	2.9	69.30	3.9	119.0	3.45	4.64

* Feed efficiency = $\frac{\text{Feed consumed (g)}}{\text{Final Body weight (g)}}$

** Feed conversion efficiency = $\frac{\text{Feed intake (g)}}{\text{Eviscerated weight (g)}}$

Table 8. Per cent shrinkage*.

Nos.	Treatments I	II	III	IV
1	16.22	15.23	14.89	10.94
2	9.46	14.30	11.54	11.24
3	9.98	12.79	14.42	12.11
4	11.83	11.09	14.18	11.97
5	12.25	11.24	16.11	12.92
6	13.94	12.92	9.98	10.78
7	13.31	8.53	15.68	7.49
8	11.68	14.18	6.80	15.89
Total	98.67	100.28	103.60	93.34
MEAN	12.33	12.53	12.95	11.66

*Angular transformed data.

Table 8a. Analysis of variance of per cent shrinkage.

Source	df	SS	MSS	F
Treatments	3	6.87	2.29	0.359^{ns}
Error	28	178.37	6.37	
Total	31	185.24		

ns - Not significant.

for the four treatments were 11.7, 10.2, 12.1 and 9.5 respectively (Appendix 9). Treatment IV had the least dressing losses at 9.5 per cent and this was significantly different from treatment I and III. Treatment II was also significantly different from treatment I and III. There was no significant difference between treatments II and IV.

Intestine.

The mean weight of the intestines in the four treatment was 70.6, 78, 67.5 and 78 g respectively. The per cent weight of intestines were calculated and the data after angular transformation are presented in table 10. The transformed data on analysis of variance indicated no significant difference between the treatments (Table 10a).

Giblet.

The mean weights of giblet (heart, liver and gizzard) were 67.5, 64.1, 61.2 and 66.6. (Appendix 10 - 13). These data were subjected to statistical analysis after angular transformation. The analysis variance indicated no statistically significant difference between treatments. (Table 11a).

Table 9. Per cent dressing losses*

Nos.	TREATMENTS I	II	III	IV
1	19.64	18.63	20.18	14.54
2	21.22	17.16	19.91	17.56
3	21.22	17.26	19.46	17.26
4	20.44	18.72	21.81	16.43
5	18.44	20.44	20.18	17.26
6	19.09	20.18	19.82	20.79
7	19.64	17.85	20.70	20.88
8	20.35	18.63	20.96	18.34
Total	160.05	148.87	163.02	143.06
MEAN	20.01	18.61	20.37	17.88

*Angular transformed data.

Table 9a. Analysis of variance of per cent dressing loss

Source	df	SS	MSS	F
Treatments	3	32.96	10.98	5.809*
Error	28	52.89	1.89	
Total	31	85.85		

*Significant at 5 per cent level ($P < 0.05$)
Critical difference = 0.96.

Table 10. Per cent Intestinal weight*

Nos.	TREATMENTS I	II	III	IV
1	14.18	14.18	15.56	16.95
2	14.54	16.22	14.77	15.00
3	14.18	15.68	14.42	15.23
4	14.54	16.43	14.77	16.00
5	15.56	14.89	15.05	16.32
6	15.45	18.34	15.34	16.54
7	15.89	16.54	15.68	15.00
8	15.34	14.65	17.56	14.42
Total	119.68	126.95	123.55	125.46
MEAN	14.96	15.87	15.44	15.68

*Angular transformed data.

Table 10a. Analysis of variance of intestinal weight.

Source	df	SS	MSS	F
Treatments	3	3.70	1.23	1.248^{ns}
Error	28	27.60	0.985	
Total	31	31.30		

ns - Not significant.

Table 11. Per cent giblet weight*

Nos.	TREATMENTS I	II	III	IV
1	13.69	13.94	13.56	15.68
2	14.54	13.69	14.77	13.94
3	15.34	14.89	14.42	15.23
4	15.23	16.43	14.18	14.77
5	15.12	15.00	14.77	14.65
6	15.23	14.42	14.18	14.42
7	14.65	13.81	15.12	13.81
8	14.42	12.11	16.11	13.44
Total	118.22	114.29	117.11	115.94
MEAN	14.77	14.28	14.64	14.49

*Angular transformed data.

Table 11a. Analysis of variance of per cent giblet weight.

Source	df	SS	MSS	F
Treatments	3	1.05	.35	.486^{ns}
Error	28	20.16	0.72	
Total	31	21.21		

ns - Not significant.

Ready to cook yield.

The mean per cent ready to cook yields were 66.80, 67.57, 64.15 and 69.30 respectively for treatment I - IV. The differences between treatments were found to be significant (Table 12 and 12a). Treatment IV yielded 69.3 per cent which was the highest and this was found to be significantly better than treatment I and III. However the differences between treatments II and IV were non-significant. Likewise, treatment I and II did not differ from each other significantly as far as the ready to cook yield is concerned. The differences observed between treatment II and III were also found to be significant.

Economics

The cost of one kg of basal diet worked out to be Rs.1.17 (Table 6). The cost per kg of additive incorporated feed worked out were paise 118.4 for TM-5, paise 122.5 for Neftin-50, and paise 119 for 3-nitro Hoechst. Taking cognisance of the feed conversion efficiency the cost of producing 1 kg of liveweight for the four treatments were Rs.4.14, Rs.3.43, Rs.4.10 and Rs.3.45 respectively. The cost of feed for 1 kg ready to cook yield worked out to be Rs.5.92, Rs.4.78, Rs.6.67 and Rs.4.64 for the four treatments respectively (Table 7).

Table 12. Per cent ready to cook yield.

Nos.	TREATMENTS I	II	III	IV
1	64.0	66.7	63.9	68.2
2	69.1	64.0	62.1	68.9
3	66.0	65.7	68.7	66.3
4	66.8	70.1	62.0	68.1
5	67.3	68.1	64.3	65.5
6	66.5	67.1	66.6	68.2
7	67.1	72.1	61.5	77.1
8	66.7	66.8	64.1	72.1
Total	553.5	540.6	513.2	554.4
MEAN	66.68	67.57	64.15	69.30

Table 12a. Analysis of variance of per cent ready to cook yield

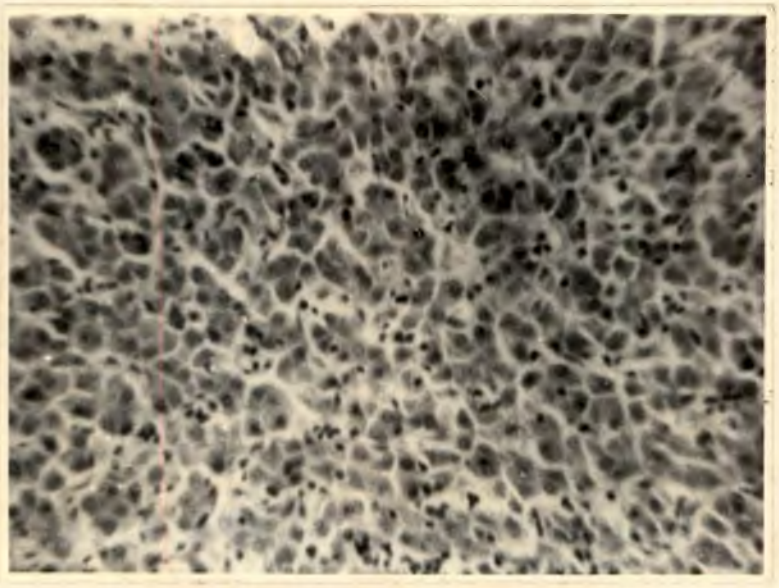
Source	df	SS	MSS	F
Treatments	3	110.56	36.85	5.21*
Error	28	197.91	7.07	
Total	31	308.47		

* Significant (P 0.05)

Critical difference = 2.6

Histopathological studies

Histopathological examination of representative samples of liver,kidney, intestines, pancreas, spleen and heart did not reveal any demonstrable tissue injury (Plate I & II, Fig 1, 2,3 and 4).



H & E 400X

Fig. 1. LIVER, TREATMENT - II

H & E 90X

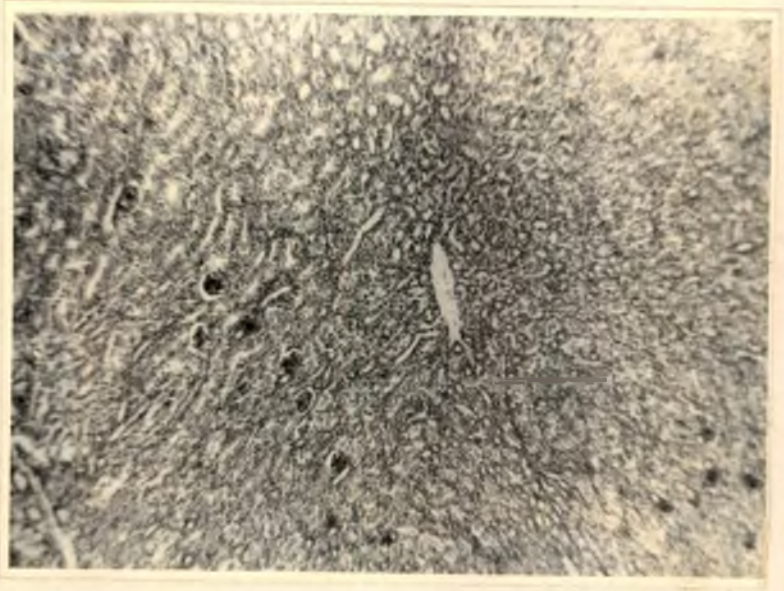
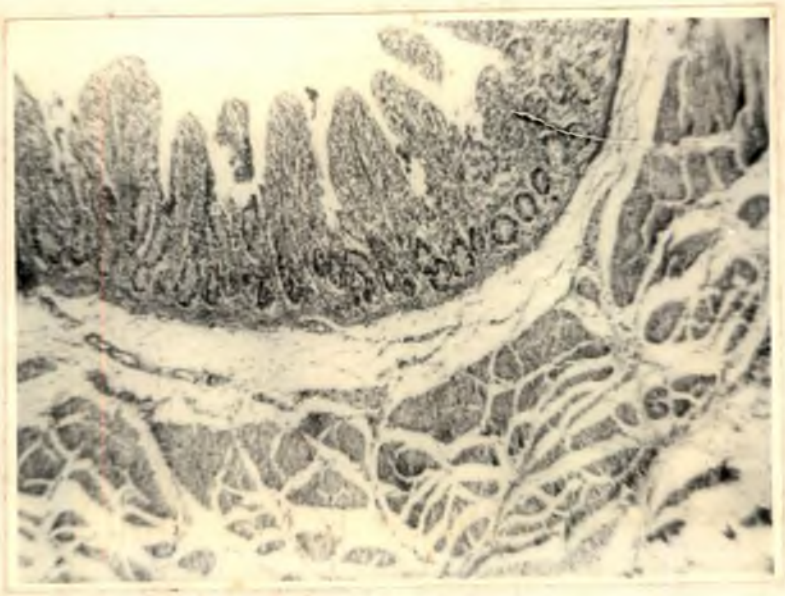


Fig. 2. KIDNEY, TREATMENT - II



H & E. 90 X

Fig. 3. INTESTINE, TREATMENT. I

H & E 90 X

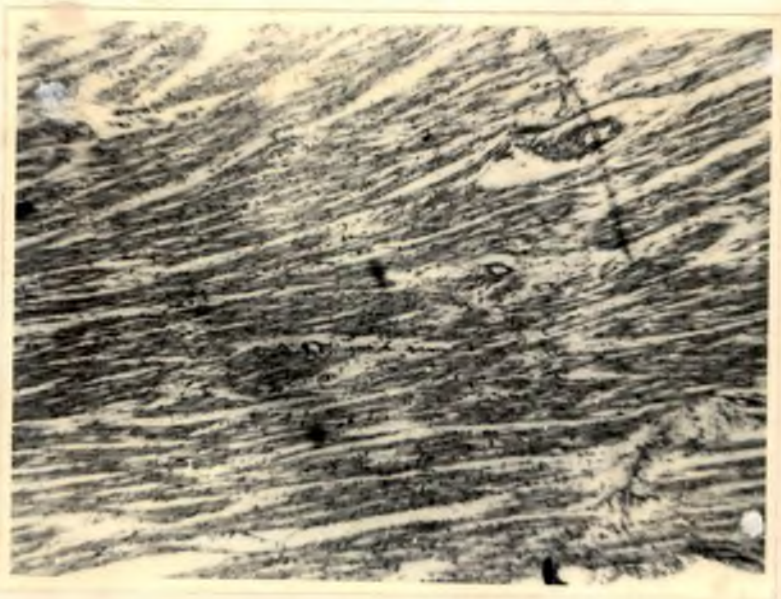


Fig. 4. MYOCARDIUM, TREATMENT. I

DISCUSSION

DISCUSSION

Growth

Results of the study indicated that the additives used were not effective in promoting growth of broilers under farm conditions. It may be seen from the results that final body weights were not significantly different among the various treatments groups. However, diets supplemented with Neftin furazolidone and 3-nitro-4-hydroxy-phenylarsonic acid, appeared superior to the basal diet and that supplemented with oxytetracycline, since the final body weights in these groups were better though not at a statistically significant level. Body weights at different stages of growth were also of a similar nature, but the sixth week weights were decidedly in favour of furazolidone and arsonic acid, as these two additive supplemented diets were superior to the control diet and the one supplemented with oxytetracycline. This observation might interest broiler-men, specially those who are engaged in the production of light weight broilers catering to special markets.

The mean weekly gain in weight among the different treatment groups indicated that the highest gain was achieved during the fifth week irrespective of the treatment. This finding is in partial agreement with those reported by Heuser and Norris (1952). The per cent improvement in the

mean final live weight for the terramycin, furazolidone and arsonic acid fed groups over the control groups were 0.42, 6.48 and 5.96 respectively. Similar conclusions were drawn by West (1956) for arsonic compounds, Libby and Schiable (1955) and Gowda et al (1975) and Mellen and Waller (1954) for furazolidone. The relatively poor final mean body weights for all the groups might possibly be due to the stress imposed on all treatments groups by the mild coccidial infection suffered by them during the sixth week of age. The furazolidone and arsonic acid fed groups exhibited a significant difference in their sixth-week body weight in comparison to the terramycin and control groups. Neverthless, the final body weights among the treatment groups did not differ significantly eventhough furazolidone fed group showed an apparently increased weight. The normal trend at finish was not kept up from the sixth week by any of treatment groups and this might possibly be due to the mild coccidial infection and subsequent therapy with sulphaquinoxaline.

Feed efficiency

The results of the present investigation revealed that the terramycin group had a conversion efficiency of 3.5 which was just comparable with that of the control. This finding is in full agreement with those reported by Foster (1972)

and Menge (1973) but is in contrast to that reported by Heuser (1956). The observation made in the present study is in partial agreement with those of Biely and March (1959). Among the four treatment groups furazolidone group exhibited the best efficiency of 2.8. Improved feed efficiency for furazolidone was also reported by Libby and Schiable (1955), Alikaev (1961) and Gowda et al. (1975). However, Foster (1972) reported results contrary to the present finding. The arsonic acid fed group also exhibited a higher feed efficiency of 2.9 which was much higher than the control group and compared well with the furazolidone fed group. The improved feed efficiency for broilers was also reported by West (1956) and Libby et al. (1955). Sah (1971 b) also reported superior feed efficiency for male white leghorn chicks when arsonic compound was incorporated in chick rations. The observations pertaining to feed efficiency, however, are not in agreement with those of Scot and Glista (1950).

Mortality

Deaths in the four treatment groups were 4, 2, 3 and 3 respectively. This evidently showed that the additives had not exerted any appreciable influence on the livability of the chicks. The higher rate of mortality in the present study was due to an attack of coccidiosis which all the treatment groups suffered during the sixth week of age.

The number of deaths due to coccidiosis were 2, 0, 3 and 1 respectively for the four treatment groups. A coccidiostat was intentionally not incorporated in the basal diet with a view to avoid the risk of its possible interference on the action of the feed additives usedin the present study. It may be seen that all the treatment groups except that supplemented with Neftin furazolidone had suffered loss due to coccidiosis. The absence of death in this group indicated the possibility of a probable coccidiostatic activity of furazolidone. This factor, by alleviating the stress due to coccidiosis might have also to some extent contributed towards better conversion leading to comparatively higher final body weights in this group.

Carcass yield and losses

Shrinkage.

Per cent shrinkage due to 3-hour fasting prior to slaughter were 4.7, 4.8, 5.4 and 4.3 respectively. The difference in shrinkage among various treatment groups did not differ significantly, showing that this parameter had no relation with additives in broiler ration. The average shrinkage observed in this study was lower than those reported by Ranganathan *et al.* (1967) and Prabhakaran and Ranganathan (1971). However, these workers had used white leghorn, Rhode Island

Red, Desi and White Plymouth Rock chicks for their experiments. They had also employed a longer fasting period. However, Mountney (1966) reported lower shrinkage values for broilers than those obtained in the present study. A 3-hour fasting period prior to slaughter followed in this experiment appeared quite efficient in emptying the crop and the intestines to a highly satisfactory point. Therefore, the conventional fasting periods of 6 hours and above followed hitherto may have to be reviewed in the light of this observation.

Dressing Losses.

Dressing losses (blood and feather) in the four treatment groups were 11.7,10.2, 12.1 and 9.5 respectively. It was observed that birds fed arsonic acid and furazolidone had significantly higher dressed yields than those on basal diet and diet supplemented with oxytetracycline. This observation indicated that arsonic acid and furazolidone exerted an influence which improved dressing yields while oxytetracycline appeared similar to control diet and was not beneficial in this regard. The average dressing losses in all the treatment groups varied from 9.5 to 12.1 and followed the standard figures already reported and was not greatly influenced by the feed additives.

Ready to cook yield.

The average ready to cook yield including giblets on fresh dressed weight basis in the four treatment groups were 66.80, 67.57, 64.15, and 69.30 per cent respectively. The losses due to evisceration was highest in the control group, followed by the group received oxytetracycline and furazolidone in the diet. The group on arsonic acid supplementation had the highest ready to cook yield. Arsonic acid therefore appeared to exert a positive influence on carcass yields than other treatments. However, the difference between arsonic acid and furazolidone in this respect was not statistically significant. Similarly furazolidone and oxytetracycline did not differ significantly in this regard.

All the additives exerted a beneficial effect in improving the eviscerated yields of broilers. Generally the carcasses of birds fed additives had a better degree of finish and good covering of fat compared to those in the control group. This may probably be due to their effect on feed utilisation for better conversion into edible parts. Since the supplementation increased carcass yields, there is scope for exploitation of this finding with further detailed studies.

Average weight of intestines and giblets were not

significantly different in the four treatment groups and therefore appeared not to have been influenced by the additives. This observation is in agreement with the findings of King (1968).

Economics

It may be observed from table 7, that the feed efficiency and feed conversion efficiency were highest for the furazolidone supplemented group followed by the group on arsonic acid. The birds fed the basal diet and the group supplemented with oxytetracycline had lower feed efficiency, these groups being almost similar in their performance with regard to feed intake and body weights. However, the diet supplemented with oxytetracycline had a comparatively higher feed conversion efficiency than the basal diet. Economic evaluation demonstrated higher return from the group fed furazolidone closely followed by arsonic acid fed group on the basis of the final liveweight. This is in agreement with the findings of Gowda et al. (1975) and West (1956) and Foster (1972). On the same basis the oxytetracycline supplemented group returned lesser than the control group, and therefore, appeared uneconomic as an additive for promoting broiler growth. Mange (1973) also had reported lack of growth response with oxytetracycline. The margin of difference between kg of liveweight of birds fed furazolidone

and arsonic acid compared to control group and the oxytetracycline supplemented group, appeared substantial as evidenced from the results of this study. Therefore, it may be concluded that the addition of furazolidone and arsonic acid in broiler rations is economic and worth consideration. It was also evident from the study that the beneficial effects of these additives are due to an improved feed efficiency.

Feed costs on the basis of ready to cook yields drew similar results with a difference that the antibiotic oxytetracycline also appeared superior to the basal diet, bringing about better returns per kg of edible yield. This advantage of oxytetraocycline is due to its higher feed conversion efficiency compared to the control diet. Therefore, on a feed cost per kg of eviscerated yield basis, it may be seen that all the three feed additives tried in this study were advantageous over the control diet. Neverthless, the saving in feed cost is lesser in the case of oxytetracycline when compared with furazolidone and arsonic acid.

Histopathological studies

As shown by the results of light microscopical examination of organ tissues, no evidence of tissue injury attributable to the additives could be observed. This finding is

in agreement with those of Frolich (1953). Whether the additives at the concentrations used caused any metabolic damage or interfered with any cellular enzyme system could not be ascertained from this study. This requires further histochemical investigation.

In general, the results of the present study indicated that the additives, specially the neftin furazolidone and 3-nitro-4-hydroxy phenyl arsonic acid were beneficial in broiler rations through improved feed efficiency. Terramycin was not of advantage in bringing about gains in body weight, but was found economical in view of increased edible yields as compared to control. Hence continuous low level feeding of additives specially Neftin furazolidone and 3-nitro-4-hydroxy phenyl arsonic acid may be justified as evidenced from the results of this study, subject to further detailed studies to rule out the possibility of residues in meat at harmful levels.

SUMMARY

SUMMARY

A feeding trial designed to study the effects of three feed additives on broiler traits of economic importance is detailed in this thesis.

One-hundred and four one-day old commercial broiler chicks raised on litter floor were allotted to the following dietary treatments at random.

Treatment I	Basal diet Plus Oxytetracycline (TM-5) at 10 g per 100 kg of diet.
Treatment II	Basal diet plus Neftin furazolidone (Neftin 50) at 5 g per 100 kg of diet.
Treatment III	Basal diet only.
Treatment IV	Basal diet plus 3-nitro-4-hydroxy phenyl arsonic acid (3-nitro Hoechst) at 5 g per 100 kg of diet.

Weekly body weights, weekly feed consumption and feed conversion efficiency were recorded. The final body weights at 8 weeks of age were also recorded. Eight birds from each group were randomly selected and subjected to slaughter studies. Then birds were fasted 3 hours

prior to slaughter and during fasting water was provided ad libitum. Data pertaining to shrinkage, dressing losses, giblet, intestine and ready to cost yield were collected. The economics involved in the incorporation of the three additives were also worked out. Histopathological studies were conducted to assess tissue injuries, if any, that could be attributed to the additives.

The following conclusions were drawn from the study:-

(1) The additives used did not bring about a significant improvement in growth of broilers to 8 weeks. However, furazolidone and arsonic acid supplemented groups registered better final body weight when compared to the terramycin and control groups.

(2) The maximum per cent improvement in the mean final live weight over the control group was 6.48 for furazolidone group.

(3) The best feed efficiency registered in the present study was 2.8 for the Neftin furazolidone group. The feed efficiency recorded for arsonic acid, terramycin, and the control groups were 2.9, 3.5 and 3.5 respectively.

(4) The additives tested did not appreciably enhance the livability of chicks.

(5) The differences in shrinkage observed between the treatment groups were not significant. A 3-hour pre-slaughter starving was found to be quite sufficient in emptying the crop and intestines to a satisfactory level.

(6) A significant finding is that Neftin furazolidone and arsonic acid groups registered higher dressed yields than the terramycin and control groups.

(7) The additives tested did not influence the average weight of giblet and intestines.

(8) The additives tested were effective in significantly improving the ready-to-cook yield in comparison to the control.

(9) The economic evaluation of the additives decidedly indicated that the addition of furazolidone and arsonic acid was economical in broiler production. A saving of 67 paise and 65 paise could be obtained in producing one kg live-weight in respect of furazolidone and arsonic acid respectively. Terramycin was found to be uneconomic in this regard.

(10) The cost of feed to produce 1 kg ready to cook yield worked out to Rupees 5.92, 4.78, 6.67 and 4.64 for the four treatments respectively. The terramycin group returned a difference of 75 paise whereas Neftin furazolidone and arsonic groups returned Rs. 1.89 and Rs. 2.03 respectively in comparison to the control.

(11) No demonstrable histopathological alteration was seen in any of the tissues examined in this study.

On the basis of this finding it could be reasonably concluded that incorporation of Neftin furazolidone and 3-nitro-4-hydroxy phenyl arsonic acid would be economical in broiler production under practical conditions of farm management. It is also concluded that the incorporation of terramycin as a feed additive would not be economical in promoting broiler growth. Nevertheless, the beneficial effect of terramycin in bringing about higher carcass yield is worthy of consideration. The lack of any histopathological alteration in the tissues examined suggests that the additives at the levels used did not bring about any tissue damage. However, the possible presence of the residues of these additives in the meat has to be ruled out through controlled experiments before these additives are regularly incorporated on a commercial scale.

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A P P E N D I C E S

Appendix 1. Third week body weight in grammes

TREATMENTS			
I	II	III	IV
300	245	250	210
230	340	240	330
345	250	365	310
340	310	325	280
280	270	290	260
345	390	310	335
330	215	305	335
265	285	250	365
380	345	275	215
290	310	170	270
280	310	310	285
265	300	330	315
305	345	345	270
340	285	260	350
345	310	300	285
260	290	355	340
265	315	330	280
320	355	260	260
210	305	270	305
270	340	295	280
290	310	270	325
245	305	235	345
345	285	240	275
300	335	310	280
...	...	325	340
...	...	310	...
Nos. 24	24	26	25
Total 7145	7350	7525	7445
MEAN 297.71	306.25	289.42	297.80

Appendix 2. Sixth body weight in grammes

TREATMENTS			
I	II	III	IV
700	750	540	650
540	720	530	870
840	630	840	850
670	770	600	560
975	660	750	570
560	1020	560	970
800	520	650	750
660	740	680	690
710	760	450	700
650	850	780	650
690	780	870	800
800	815	810	660
930	860	670	720
630	740	740	710
720	800	710	630
710	700	560	750
650	830	810	700
700	940	685	770
580	820	640	760
690	620	580	760
850	940	660	750
700	740	730	665
...	750	750	660
...	950	800	700
Nos. 22	24	24	24
Total 15755	18705	16395	17295
MEAN 716.14	779.38	683.12	720.62

Appendix 3. Eighth week body weight in grammes

TREATMENTS			
I	II	III	IV
970	1050	840	750
600	870	910	1200
1100	860	1150	1250
900	970	950	910
1100	840	865	1400
860	1250	710	985
1200	585	1000	1010
940	940	1010	900
1050	920	660	920
500	1040	960	1030
890	1040	990	820
960	1060	1200	970
1400	1100	1000	925
920	1060	900	970
1150	1150	1010	1010
1010	1030	1080	1030
940	1150	1100	1040
870	990	840	1200
730	1150	870	1080
1040	805	900	1050
1200	1350	990	1000
780	1015	1090	860
...	1000	950	975
...	1200	...	...
Nos. 22	24	23	23
Total 21110	24425	21975	23285
MEAN 959.5	1017.7	955.4	1012.4

Appendix 4. Total gain in weight in grammes

TREATMENTS			
I	II	III	IV
935	1015	805	715
565	835	875	1160
1060	825	1110	1215
865	935	915	875
1065	805	830	1360
825	1210	670	950
1160	550	965	975
905	905	975	865
1015	885	625	885
465	1000	925	995
845	1005	955	785
920	1025	1165	935
1365	1065	960	885
885	1025	865	930
1115	1115	970	975
975	990	1040	995
910	1115	1065	1005
830	955	805	1165
690	1115	835	1045
1005	770	865	1015
1165	1310	955	960
745	980	1055	825
...	965	915	940
...	1160	...	...
Nos. 22	24	23	24
Total 20310	23560	21145	22455
MEAN 923.2	981.7	919.4	976.3

Appendix 5. Treatment I - Slaughter data

Weights and percentages

Number	Final body weight (g)	Shrinkage		Blood		Feathers		Giblet		Intestine		Ready to cook yield	
		g	%	g	%	g	%	g	%	g	%	g	%
1	1150	90	7.83	55	4.78	75	6.52	65	5.65	70	6.08	735	64.0
2	1100	30	2.73	50	4.55	90	8.18	70	6.36	70	6.36	760	69.1
3	500	15	3.00	25	5.00	40	8.00	35	7.00	30	6.00	330	66.0
4	940	40	4.26	40	4.26	70	7.45	65	6.91	60	6.37	640	66.8
5	1100	50	4.55	50	4.55	55	5.00	75	6.81	80	7.27	740	67.3
6	940	55	5.85	40	4.26	55	5.85	65	6.91	65	7.12	625	66.5
7	1400	75	5.36	50	3.57	100	7.14	90	6.42	105	7.50	940	67.1
8	1200	50	4.17	30	2.50	110	9.17	75	6.25	85	7.08	800	66.7
MEAN	1041.25	50.63	4.72	42.5	4.18	74.37	7.15	67.5	6.53	6.53	70.63	6.72	66.6

Appendix 6. Treatment II - Slaughter data

Weights and percentages

Number	Final body weight (g)	Shrinkage		Blood		Feathers		Giblet		Intestine		Ready to cook yield	
		g	%	g	%	g	%	g	%	g	%	g	%
1	1150	80	6.95	40	3.41	70	6.08	67	5.82	70	6.08	767	66.7
2	1150	70	6.08	40	3.41	55	4.80	65	5.65	90	7.83	735	64.0
3	1015	50	4.92	40	3.58	45	4.43	67	6.65	75	7.38	667	65.7
4	805	30	3.73	40	4.96	40	4.96	65	8.07	65	8.07	565	70.1
5	1060	40	3.77	50	4.71	75	7.07	72	6.79	70	6.63	722	68.1
6	990	50	5.05	50	5.95	60	6.06	62	6.26	90	9.90	662	67.1
7	1040	30	2.22	40	3.51	55	5.28	60	5.76	85	8.17	750	72.1
8	1250	75	6.00	50	4.00	70	5.60	55	4.40	80	6.40	835	66.8
MEAN	1057.5	53.12	4.84	43.75	4.08	58.75	5.53	64.12	6.17	78.12	7.55	712.87	67.5

Appendix 7. Treatment III - Slaughter data

Weights and percentages

Number	Final body weight (g)	Shrinkage		Blood		Fathers		Giblet		Intestine		Ready to cook yield	
		g	%	g	%	g	%	g	%	g	%	g	%
1	900	60	6.67	40	4.44	60	6.67	50	5.55	65	7.22	575	63.9
2	990	40	4.04	45	4.54	65	6.56	65	6.56	65	6.56	615	62.1
3	1200	75	6.25	65	5.41	60	5.00	75	6.25	75	6.25	825	68.7
4	1000	60	6.00	50	5.00	80	8.00	60	6.00	65	6.50	620	62.0
5	910	70	7.69	40	4.39	60	6.60	60	6.60	65	7.14	585	64.3
6	990	30	3.03	50	5.05	60	6.06	60	6.06	70	7.07	660	66.6
7	950	70	7.37	45	4.73	65	6.84	65	6.84	70	7.37	585	61.5
8	710	10	1.41	40	5.63	50	7.04	55	7.74	65	9.15	455	64.1
MEAN	956.25	51.87	5.38	46.87	4.89	62.5	6.59	61.25	6.44	67.5	7.15	615	64.1

Appendix 8. Treatment IV - Slaughter data

Weights and percentages

Number	Final body weight (g)	Shrinkage		Blood		Feathers		Giblet		Intestine		Ready to cook yield	
		g	%	g	%	g	%	g	%	g	%	g	%
1	820	30	3.65	30	3.65	20	2.43	60	7.30	70	8.53	650	68.29
2	1030	40	3.88	40	3.88	50	4.85	60	5.82	70	6.79	710	68.93
3	1010	45	4.45	45	4.45	40	3.96	70	6.93	70	6.93	670	66.33
4	910	40	4.39	40	4.39	30	3.28	60	6.56	70	7.67	620	68.13
5	1200	60	5.00	40	3.33	60	5.00	77	6.41	95	7.92	787	65.58
6	985	35	3.55	50	5.07	70	7.10	62	6.29	80	8.12	672	68.22
7	1400	25	1.78	50	3.56	125	8.92	80	5.71	95	6.78	1080	77.14
8	1200	90	7.50	35	2.92	75	6.25	65	5.41	75	6.25	865	72.08
MEAN	1069.37	45.62	4.27	41.25	3.90	58.75	5.22	66.75	6.30	78.12	7.37	745.5	69.33

Appendix 9. Present dressing losses

Number	TREATMENTS I	II	III	IV
1	11.3	10.2	11.9	6.3
2	13.1	8.7	11.6	9.1
3	13.1	8.8	11.1	8.8
4	12.2	10.3	13.8	8.0
5	10.0	12.2	11.9	8.8
6	10.7	11.9	11.5	12.6
7	11.3	9.4	12.5	12.7
8	12.1	10.2	12.8	9.7
Total	93.8	81.7	97.1	76.2
MEAN	11.7	10.2	12.1	9.5

Appendix 10. Treatment I - Slaughter data

Weight in grammes

Sl. No.	Weight before fasting	Weight after fasting	Weight after bleeding	Weight after defeathering	Eviscerated weight	Giblet weight	Eviscerated weight plus giblet	Weight of intestine
1	1150	1060	1005	930	670	65	735	70
2	1100	1070	1020	930	690	70	760	70
3	500	485	460	420	295	35	330	30
4	940	900	850	790	575	65	640	60
5	1100	1050	1000	945	665	75	740	80
6	940	885	845	790	560	65	625	65
7	1400	1325	1275	1175	850	90	940	105
8	1200	1150	1120	1010	725	75	800	85
MEAN	1041.25	990.62	948.12	873.75	628.75	67.5	696.25	70.62

Appendix 11. Treatment II - Slaughter data

Weight in grammes

Sl. No.	Weight before fasting	Weight after fasting	Weight after bleeding	Weight after defeathering	Eviscerated weight	Giblet weight	Eviscerated weight plus giblet	Weight of intestine
1	1150	1070	1030	960	700	67	767	70
2	1150	1080	1040	985	670	65	735	90
3	1015	965	925	880	600	67	667	75
4	805	775	735	695	500	65	565	65
5	1060	1020	970	895	650	72	722	70
6	990	940	890	830	600	62	662	90
7	1040	1010	970	915	690	60	750	85
8	1250	1175	1125	1055	780	55	835	80
MEAN	1057.50	1004.37	960.62	901.87	648.75	64.12	609.54	78.125

Appendix 12. Treatment III - Slaughter data

Weight in grammes

Sl. No.	Weight before fasting	Weight after fasting	Weight after bleeding	Weight after defeathering	Eviscerated weight	Giblet weight	Eviscerated weight plus giblet	Weight of intestine
1	900	840	800	740	525	50	575	65
2	990	950	905	840	550	65	615	65
3	1200	1125	1060	1000	750	75	825	75
4	1000	940	890	810	560	60	620	65
5	910	840	800	740	525	60	585	65
6	990	960	910	850	600	60	660	70
7	950	880	835	770	520	65	585	70
8	710	700	660	610	400	55	455	65
MEAN	956.25	904.37	857.50	795.00	553.75	61.25	615.00	67.5

Appendix 13. Treatment IV - Slaughter data

Weight in grammes

Sl. No.	Weight before fasting	Weight after fasting	Weight after bleeding	Weight after defea-thering	Eviscera-ted weight	Giblet weight	Eviscera-ted weight plus giblet	Weight of intestine
1	820	790	760	740	500	60	560	70
2	1030	990	950	900	650	60	710	70
3	1010	965	920	880	600	70	670	70
4	910	870	830	800	560	60	620	70
5	1200	1140	1100	1040	710	77	787	95
6	985	950	900	830	610	62	672	80
7	1400	1375	1325	1200	1000	80	1080	95
8	1250	1160	1125	1050	800	65	865	75
MEAN	1075.62	1030	988.75	930	678.75	66.75	745.50	78.12

A B S T R A C T

EFFECT OF CERTAIN FEED ADDITIVES ON BROILER PERFORMANCE

B y
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ABSTRACT OF A THESIS

Submitted in partial fulfilment of
the requirement for the degree

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ABSTRACT

This thesis incorporates the findings of an investigation carried out to study the effect of terramycin, neftin furazolidone and arsonic acid on certain broiler traits of economic importance. Commercial broiler chicks were employed for the study, and were raised on litter floor. The chicks were fed broiler starter from 0 - 6 weeks and broiler finisher from 7 - 8 weeks. The additives were incorporated at levels recommended by the manufacturers and the duration of the study was for 8 weeks.

The additives used did not bring about any significant improvement on growth of broilers to 8 weeks of age. However, neftin furazolidone and arsonic acid groups exhibited a better performance than the terramycin and control groups. The maximum per cent improvement in the 8th week live weight over the control was 6.48 given by the neftin furazolidone group. The best feed efficiency recorded in this study was 2.8 and this again was by the same group. The feed efficiency of the arsonic acid group, terramycin group and the control were 2.9, 3.5 and 3.5 respectively. The mortality picture was not appreciably altered by the additives. A 3-hour- pre-slaughter fasting was found to be quite satisfactory

for emptying the crop and intestines. The neftin furazolidone and arsonic acid groups provided significantly higher dressed yields than the terramycin and control groups. The additives were effective in significantly improving the ready to cook yield in comparison to the controls. On an evaluation of the economics involved, it was found that a saving of 67 paise and 65 paise could be made in producing one kg live-weight in respect of neftin furazolidone and arsonic groups respectively. However, terramycin was found to be uneconomical in this regard. Histopathological examination of organ tissues revealed no injury. In the light of these findings, it was concluded that the incorporation of neftin furazolidone and arsonic acid to broiler starter and finisher diets would be economical under ordinary management practices. It was also concluded that the incorporation of terramycin to broiler diets would not be economical in promoting broiler growth. However, the possible presence of residues of these additives in broiler meat will have to be ruled out through controlled experiments before these additives are incorporated on a regular commercial basis.