EFFECTS OF TULSI LEAVES AND GINGER SOLUTION ON GROWTH PERFORMANCE AND HEMATOLOGICAL PROFILES OF BROILERS

A Thesis

By

MD. WASIM AKRAM
Registration No. 1305108
Semester: July- December, 2014
Session: 2013-14

MASTER OF SCIENCE (M.S.)

IN

PHARMACOLOGY

DEPARTMENT OF PHYSIOLOGY AND PHARMACOLOGY
HAJEE MOHAMMAD DANESH SCIENCE AND TECHNOLOGY UNIVERSITY, DINAJPUR-5200

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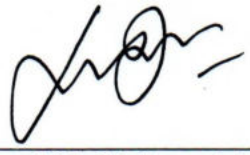

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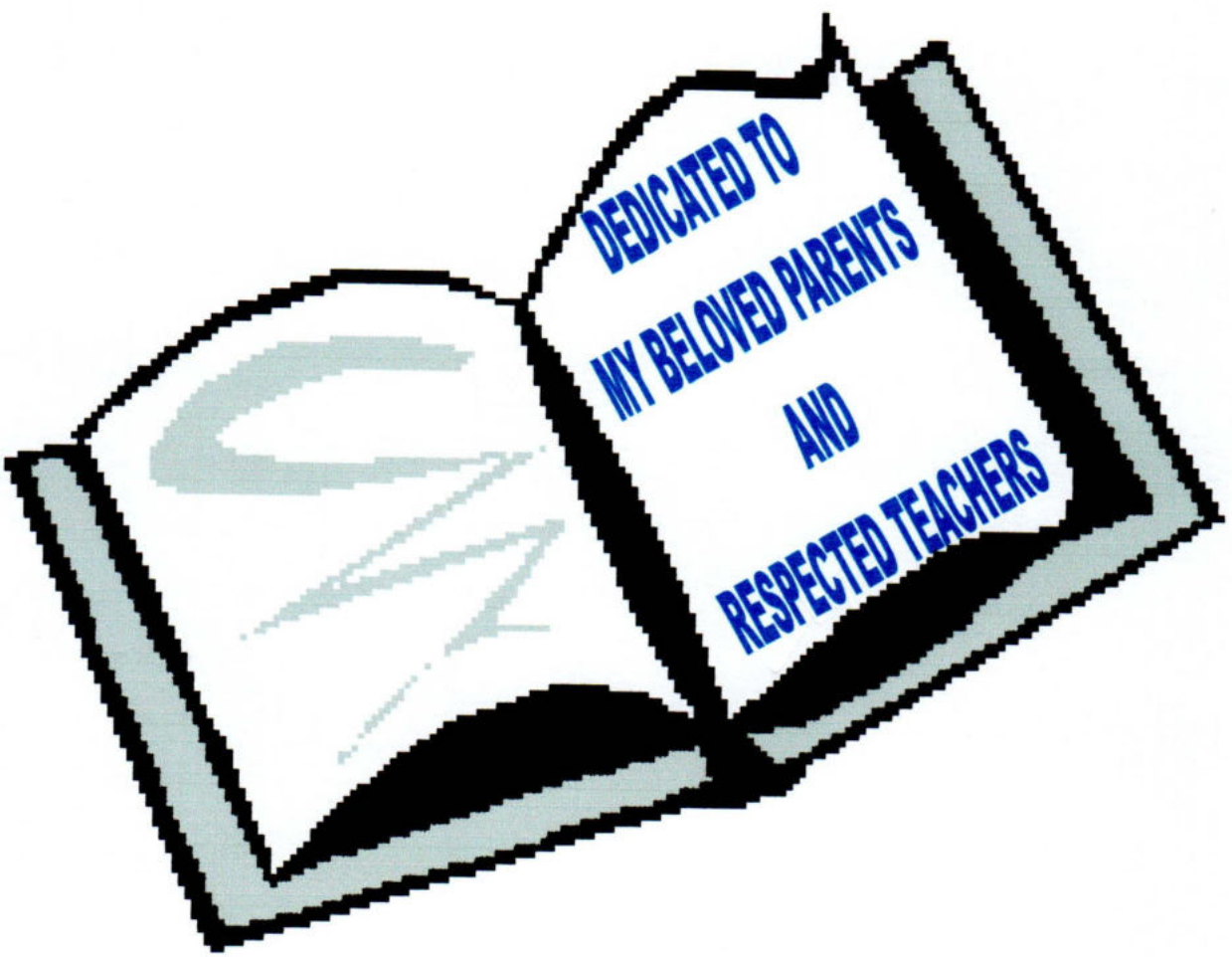
DEDICATED TO
MY BELOVED PARENTS
AND
RESPECTED TEACHERS

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ABSTRACT

This study was conducted to determine the efficacy of tulsi and ginger as a growth promoter in broilers. A total of thirty day old chicks (DOC) were purchased from CP Bangladesh Ltd. and after seven days divided into three groups (A), (B) and (C). No vaccination schedule was practiced and no antibiotics were added in ration. The (A) group was not supplemented with tulsi and ginger solution in drinking water. The (B) group was supplemented with tulsi solution @ 1ml/litre in drinking water and (C) group was supplemented with ginger solution @ 1 ml/litre in drinking water for consecutive 5 weeks started from 7^{th} day of experiment. Weekly observations were recorded for live body weight gain up to 6^{th} weeks and routine blood test was performed at 21^{st} and 42^{nd} days, to find out hematological changes between control and treatment groups. The FCR value of group (A) was 2.25, in group (B) was 1.99 and in group (C) was 1.90. From this initial study this may be concluded that production of broilers in by using tulsi and ginger was economic than control group. In Bangladesh broilers production is mainly organized by unemployed and its demand is very high because it supports marketing within 35 – 42 days. Short return of money but major problems is cost of production. The initial body weight of group (A), (B) and (C) on 7^{th} of day experiment were 168±8.54, 166±7.95 and 166±7.90 gm respectively and after 42^{nd} day of experiment final body weight were 1561±12.10, 1698±12.87 and 1763±13.28 gm respectively. The net body weight gain were 1393±11.07, 1533±11.98 and 1588±12.10 gm respectively and economics of production were analyzed and found that net profit per broiler was 18.82 , 36.13 and 42.53 Tk respectively. It is concluded that broiler production by using herbal extract may be profitable and suitable for human consumption.

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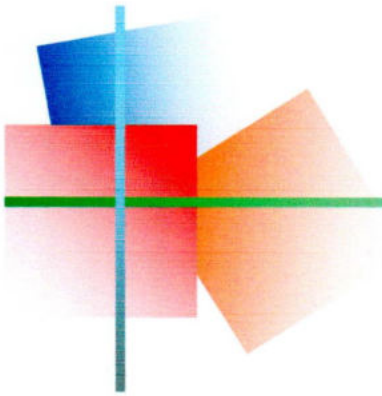
LIST OF ABBREVIATIONS

B. wt.	-	Body weight
Conc.	-	Concentration
Cu mm	-	Cubic millimeter
d.w.	-	Drinking water
DOC	-	Day old chick
ESR	-	Erythrocyte Sedimentation Rate
et al.	-	Associates
Fig.	-	Figure
gm/g	-	Gram
Hb	-	Hemoglobin
HSTU	-	Hajee Mohammad Danesh Science and Technology University.
i.e.	-	That is
J.	-	Journal
Kg	-	Kilogram
Lit/L	-	Litre
Ltd.	-	Limited
mg	-	Milligram
ml	-	Milliliter
mm3	-	Cubic millimeter
No.	-	Number
OS	-	*Ocimum sanctum*
PCV	-	Packed Cell Volume
PM	-	Population Mean

LIST OF ABBREVIATIONS (contd.)

SEM	-	Standard Error M
SM	-	Sample Mean
TEC	-	Total Erythrocyte Count
Vol.	-	Volume
µg	-	Microgram
%	-	Percent
&	-	And
@	-	At the rate of
<	-	Less than
>	-	Greater than
^{0}C	-	Degree centigrade
FCR	-	Feed Conversion Ratio
Tk.	-	Taka
NS	-	Non significant



CHAPTER 1

INTRODUCTION

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INTRODUCTION

Bangladesh is highly populated country and growth of population is increasing very fast in comparison to its land size, as a result huge pressure is created on people's basic need. Our national economy mainly depends on agriculture. Livestock plays an important role as the back-bone of agriculture. Poultry play important role in the national economy. Demand of protein of this vast population is a great threat for us. There are so many sources of protein but it is not possible to fulfill the demand without broiler. Because the duration of broiler rearing is very short and within 36-42 days it is ready for marketing and suitable for human consumption. It also brings very short time return to farmer. The meats of broiler are nutritious, tasty and contain less fat. It has no harmful effect on health and there is no religious restriction to consume. This factor favors producing poultry in Bangladesh.

According to our socio-economic situation, the knowledge of our farmer is very little because most of them are not properly trained for broilers production but unemployed young generation is coming in this business for short term return. Pharmaceutical companies take this advantage. They are convincing farmers for using antibiotics as a growth promoter or life savings for chicken. As a result, each and every broiler is a depot of antibiotics. When these broilers are consumed by human this antibiotic residue enters into human body and may cause serious human health hazards with drug residues (Kibria *et al.* 2009).

The poultry production systems have led to marked increase in the production of poultry meat and eggs throughout the world (Armstrong, 1986). It has triggered the discovery and widespread use of a number of 'feed additives'. The term 'feed additive' is applied in a broad sense, to all products other than those commonly called feedstuffs, which could be added to the ration with the purpose of obtaining some special effects (Feltwell and Fox, 1979) . The main objective of adding feed additives is to boost animal performance by increasing their growth rate, better-

feed conversion efficacy, greater livability and lowered mortality in poultry birds. These feed additives are termed as growth promoters and often called as non-nutrient feed additives (Shigh and Panda, 1992). Many synthetic drugs and growth promoters are supplemented to the broilers to effect rapid growth, but their use have shown many disadvantages like high cost, adverse side effect on health of birds and long residual properties etc. Growth promoters are chemical and biological substances, which are added to livestock food with the aim to improve the growth of chickens in fattening, improve the utilization of food and in this way realize better production and financial results. Positive effect can be expressed through better appetite, improved feed conversion, stimulation of the immune system and increased vitality, regulation of the intestinal micro-flora etc. In any case, expected results of the use of these additives are increased financial effects of production . Consequently there is considerable research interest in the possible use of natural products, such as essential oils and extracts of edible and medicinal plants, herbs and species for the development of new additives in animal feeding. So, scientists are again concentrating on the use of our ancient medicinal system.

Ocimum sanctum L. commonly known as "Tualsi" in Tamil and holy basil in English, has been claimed to be valuable against a wide variety of diseases. Indian Materia Medica describes the use of the plant in the treatment of a number of ailments like bronchitis, rheumatic fever and pyrexia (Nadkarni, 1976). Studies on the immunomodulatory effect of *Ocimum sanctum* have been reported for various animal species (Singh *et al.* 1996; Singh & Mojumder, 1997; Sadekar *et al.* 1998).

The use of natural resources e.g medicinal plants may prove to be useful approach towards the management of stress-linked mental health problems (Yoydim and Joseph, 2001). *Ocimum sanctum* (OS) (Family Lamiaceae) is commonly known as Tulsi or holy basil in India. This reputed medicinal plant has recently been shown to possess very interesting pharmacological properties relevant to the present study. Recent investigations have shown that different extracts of OS possess

significant anti-inflammatory (Singh *et al.* 1993) and antioxidant (Uma Devi and Ganasoundari, 1999) and anti-stress properties (Sood *et al.* 2006).

In tulsi biologically active compounds have been isolated from the leaves including ursolic acid, apigenin and luteolin that activates the cell mediated immune response and therefore, creates an enhanced response to any future challenges occurred by diseased organisms. So the feeding tulsi leaves to immunosuppressed birds increase their humoral and cell mediated immune responses. Low dose of tulsi leaves powder have an inhibitory action on wide spectrum of microorganisms (Devakumar and Suktt, 1993). Also Craig (1999) stated that several herbs could help providing some protection against bacteria and stimulate the immune system.

The efficacy of ginger is purported to be a result of its aromatic, carminative and absorbent properties (Govindarajan, 1982 a, b). Ginger is a widely used spice and functional food, for centuries ginger has been an important ingredient in Chinese, Ayurvedic and Tibb-Unani herbal medicine. The main constituents of ginger include volatile oil (β-bisabolene, cineol, phellandrene, citral, borned, citronellol, linalool, limonene, zingeberol, zingeberene, camphene), oleoresin (gingerol, shogoal), phenol (gingerol and gingerone), proteolytic enzymes (zingibain), vitamin B6, vitamin C and calcium, magnesium, phosphorus, potassium, linoleic acid (Kikuzaki *et al.* 1993). Also the pungency and aroma of ginger are because of the gingerol and volatile oil respectively (Kikuzaki *et al.* 1994). A recent study (Egwurugwu *et al.* 2007) observed that ginger had both prophylactic and therapeutic properties. Ginger powder 1g daily alleviated clinical nausea of diverse causes including postoperative nausea (Arfeen *et al.* 1995).

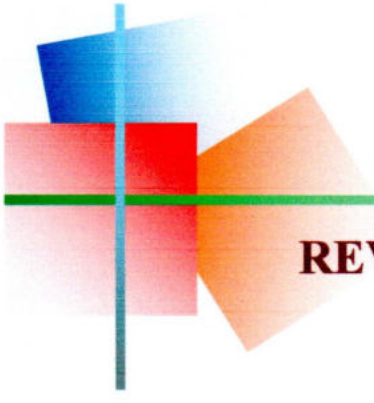
The active ingredients found in Zinger (Curcuma longa) are curamine, demethoxycurcumin, bisdemethoxycurcumine, (Wuthi-Udomler *et al.* 2000) and tetrahydrocurcuminoids (Osawa *et al.* 1995). Curcumine is the main important bioactive ingredient responsible for the biological activity of curcuma. Curcuma has been shown to have several biological effects, exhibiting anti-inflammatory

(Holt *et al.* 2005), antioxidant (Iqbal *et al.* 2003) and hypolipidaemic (Ramirez-Tortosa *et al.* 1999) activities. Curcumin has also been studied extensively as a chemopreventive agent in several cancers (Duvoix *et al.* 2005). Additionally it has been suggested that curcumin possess hepatoprotective, antitumor, antiviral and anticancer activity (Polasa *et al.* 1991). It is used in gastrointestinal and respiratory disorders (Anwarul *et al.* 2006). The significant biological properties of ginger powder make it a potential substitute for in feed antibiotics in livestock diets. A number of studies have been conducted to evaluate its effect on the performance of broiler chickens, laying hens and rabbits. There is growing interest in developing natural alternatives to antibiotic growth promoters in order to maintain both bird's performance and health. In the last decade, ginger has been extensively used in poultry diets. Wide range medicinal properties of this plant have been advocated. In poultry feed, ginger has been extensively used in different concentrations, dosages and durations.

Medicinal plants compete with the synthetic drugs. Majority of medicinal plants do not have the residual effects (Tipu *et al.* 2006). As the world is becoming more advanced, new diseases are emerging in animals and human beings by irrational use of antibiotics and antimicrobial growth promoters. Now it is the need of the time to work more extensively on the medicinal plants in the greater interest of mankind.

Considering the present situation of poultry production, the work has been carried out with following objectives:

1) To evaluate the growth performance of broiler supplemented with tulsi leaves and ginger solution.
2) To evaluate the effect of tulsi and ginger on blood parameters of the broiler.
3) To study a valid and cost effective herbal tonic to the farmers.



CHAPTER 2

REVIEW OF LITERATURE

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REVIEW OF LITERATURE

The purpose of this chapter is to provide a selective review of the research works accomplished in relation to the present study. Literature on growth performance of broilers supplemented tulsi and ginger related to this study has been reviewed under the following headings.

Tulsi:

Tulsi is an annual plant which is generally found in the Indian sub-continent. It is regarded as one of the most sacred plants in India and is found in many Indian households. Almost all parts of tulsi plant can be consumed which includes leaves, flowers, seeds and bark.

Taxonomy of Tulsi leaves:

Kingdom: *Plantae*

Division: *Tracheophyta*

Class: *Magnoliopsida*

Order: *Lamiales*

Family: *Lamiaceae*

Genus: *Ocimum L.*

Species: *Ocimum basilicum L.*

Chemical Constituents of Tulsi:

Main chemical constituents of tulsi are-

- Eugenol (4-9%)
- Oleanolic acid.
- Ursolic acid.
- Rosmarinic acid.
- Carvacrol.
- Linalool.
- β-caryophyllene (8%).
- β-elemene (11%).
- germacrene D (2%).

Medicinal uses and health benefits of tulsi:

- Tulsi has anti-bacterial properties fights against fevers, cough and cold.
- Have insecticidal properties.
- Used as an anticarrhal agent.
- Used as a spasmolytic agent.
- Used as a stomachic.
- Acts as a good immuno-modulatory agent.
- Used for respiratory and lung diseases such as asthma and bronchitis.
- Used as antioxidants which check the development of free radicals.

Therapeutic uses of *Ocimum sanctum*:

Whole tulsi plant has been found to possess several therapeutic properties and it is used by the medical practioners. Flower, fruit, leaf, stem, root and for that matter almost every part of the plant is used as an expectorant, analgesic, anticancer, anti-asthmatic and anti-emetic etc.

Tulsi as a prophylactic agent:

The juice of fresh leaves is also given to patients to treat dysentery. Oil is insecticidal and larvicidal. Paste prepared from tulsi leaves is used against the ringworm infection. Use of tulsi in the treatment of all kinds of cuts, wounds and ulcers is highly beneficial. Tulsi also reduces the chances of ulcers. It removes excess cough from lungs and nasal passages. It also lowers the uric acid levels and

hence is considered as a potential anti-inflammatory agent. Tulsi is an important constituent of many cough syrups and expectorants. It helps to mobilize mucus in bronchitis and asthma. The leaves are nerve tonic. It is a good source of antioxidants. Antioxidants thus play important role in protecting the human body against damage by reacting oxygen species (Eshrat Halim *et al.* 2001).

Antibacterial, antiviral and antifungal activities:

Essential oil present in most of the Ocimum species is responsible for its antifungal, antibacterial and antiviral properties. Microorganisms develop resistance against various antibiotics and due to this an immense clinical problem develops in treatment of infectious diseases. Tulsi leaves have been reported to show strong antifungal activities against the *Aspergillus* species (Joglekar GV *et al.*1959). *Ocimum* shows strong antibacterial activity against *Klebisella* (causes pneumonia and urinary tract infections), *E. coli*, *Proteus* & *Staphylococcus aureus* and *Vibrio cholerae*. Essential oil from *Ocimum sp* which contain eugenol, carvacrol, methyl eugenol, caryophyllene are considered mainly to be responsible for various antimicrobial properties.

Stress relieving agents:

Stress can be either physical or psychological. When stress becomes extreme, it is harmful for the body and, hence, needs to be treated. Stress is involved in the pathogenesis of a variety of diseases that includes psychiatric disorders such as depression and anxiety, immunosuppression, endocrine disorders including diabetes mellitus, male impotence, cognitive dysfunction, peptic ulcer, hypertension and ulcerative colitis. Tulsi has antihypoxic effect and it increases the survival time during anoxic stress (Rai V. *et al.* 1997). A study conducted with rabbits has suggested that tulsi decreased oxidative stress (Rastogi, S. 2009). Tulsi leaves are regarded as an 'adaptogen' or anti-stress agent. Recent studies have shown that the leaves afford significant protection against stress (S. Rajeshwari, 1995).

As an immunomodulatory agent:

Tulsi strengthens the immune response by enhancing both cellular and humoral immunity. It reduces the pain and dangerous inflammation that leads to arthritis. Fixed oil of tulsi was found to possess significant anti-inflammatory activity against carrageenan and different other mediator-induced paw edema in rats. Tulsi may be a useful anti-inflammatory agent which blocks both the pathways, i.e. cyclooxygenase and lipoxygenase of arachidonic acid metabolism.

Ajit Singh (2014) conducted in broiler chickens to evaluate the effect of dietary supplementation of Tulsi (*Ocimum sanctum*) leaf powder. A total of 72 (Arbor-Acres) day old chicks were used in this study. Four levels of a Tulsi (*Ocimum sanctum*) leaf powder at the rate of 0.00%, 0.25%, 0.50%, and 1% were incorporated into the basal diet for six weeks. Feeding period for all groups was lasted for 42 days. Results revealed a significant effect of Tulsi (*Ocimum sanctum*) leaf powder in feeds on weight of breast, thigh, and leg ($P<0.05$) were significantly on feed supplemented with 1.0% Tulsi (*Ocimum sanctum*) leaf powder. It was concluded from this study that 1.0% Tulsi *(Ocimum sanctum*) leaf powder feed supplemented has a beneficial impact on the growth of these muscle tissues.

Reddy, L.S.S *et al.* (2014) carried out to study the effect of dietary supplementation of Tulsi (*Ocimum sanctum*) and selenium on performance in broiler chicken. A total of forty-two broiler day-old chicks divided into six groups of seven each were used for this study. *O. sanctum* leaf powder (0.25 and 0.5%), organic selenium (0.3 ppm) and their combinations were added to the basal diet. Body weight and feed consumption were recorded at weekly intervals. The mean body weight, feed conversion ratio (FCR) and cumulative feed consumption did not vary significantly ($P > 0.05$) among the groups during the trial period. It is concluded that dietary supplementation of O. sanctum at 0.25 and 0.5% levels and its combination with selenium (0.3 ppm) cannot significantly change the growth performance in broilers.

Nath, D. D. *et al.* (2013) conducted a study to determine the efficacy of tulsi (*Vitex negundo*) leaves, black pepper (*Piper nigrum*) and cloves (Curcuma longa) extract (TBC extract) as a growth promoter in broilers. A total of 20 day-old broiler chicks were purchased from Nourish Hatchery and after seven days of acclimatization the chicks were randomly divided into two equal groups A and B. No vaccination schedule was practiced and no antibiotics were added in ration of either group A or group B. Group A served as control without any supplement while group B was supplemented with TBC extract @ 1ml/liter in drinking water. Weekly observations were recorded for live body weight gain up to 6th weeks and blood tests were performed at 21st and 42nd day to find out hematological changes between control A and treatment B group. The food conversion ratio (FCR) in group A was 1.94 while that in group B was 1.87. The result suggests that TBC extract played a vital role in gaining body weight in the treatment group B which gained significantly (p < 0.01) higher body weight (1660±32.80 gm) in comparison to control group A (1550±21.20 gm). For the hematological parameters (TEC, PCV, Hb and ESR) no significant change was observed between treatment A and control B group suggesting no side effects of herbal extracts in broiler. From the findings of the present study it can be concluded that the TBC extract is economic and safe in broiler production.

Tirupathi Reddy Eevuri and Ramya Putturu (2013) conducted a study to determine the effects of turmeric, tulsi, amla and aloe vera etc. on broilers growth. Turmeric (curcumin) acts as an antioxidant, antimutagenic, antiinflamatory and antimicrobial agent and protects liver against a variety of toxicants. Tulsi (eugenol) have anticancer properties, reduced blood glucose levels, total cholesterol levels and promotes immune system function. Amla, richest source of vitamin-c and its active tannoid principles have antimicrobial, antidiabetics, anticarcinogenic properties and enhance immune property. Aloe vera contains phytochemicals (Saponins, flavonoids, alkaloids and phenols), which is an indication of cosmetic and medicinal value. Turmeric, tulsi, amla and aloe vera preparations increased the body weight gain, feed efficiency and decreased the

feed intake. These preparations decreased the mortality rates and the cost of feed has been decreased from 6.2% to 13.5%. They have reduced the fat accumulation, increased dressing percentage, liver weight, spleen weight and whole giblet weights. Significant reduction of serum cholesterol, serum triglycerides and increased the humoral response against RD vaccine.

S. Sanjyal and S. Sapkota (2011) conducted an experiment to compare the effects of antibiotic (chlortetracycline) and probiotic (*Lactobacillus acidophilus*) with three herbal growth promoters, Amala (*Emblica officinalis*), (EO), Tulsi (*Ocimum sanctum*), (OC) and Aswogandha (*Withania somnifera*), (WS) on growth performance, feed consumption, feed conversion efficiency, carcass characteristics, and economics of broiler production. The experiment was laid out in a completely randomized design with day-old broiler chick (192) randomly assigned to eight groups containing 8 chick in each and replicated three times. The control group received the maize-soybean based basal diet. In the treatment groups, the basal diet was supplemented with one of the following antibiotic, probiotics, Tulsi, Amala, and Aswogandha and also in combination of herbs, forming eight treatments respectively. Results showed significantly better production in herbs. Significantly higher digestibility of all the nutrients ($P<0.05$) was observed in Amala+Tulsi+Aswogandha (T_8) supplemented group. Highest body weight (1.440kg) was recorded in birds fed diet supplemented with Amala and Tulsi, and the lowest body weight (1.317kg) was seen in antibiotics (T_2) fed birds. The highest income over expenditure (Rs.26.36) was recorded in birds fed diet supplemented with Tulsi (T_6), although the difference was not significant among the treatments. Looking at the benefit cost ratio, highest B/C ratio was found in birds supplied with Tulsi (1.19) supplemented diet and minimum (1.12) was recorded in Amala supplied diet. Hence, this experiment showed that herbs as growth promoters can replace antibiotics in the diet of broiler chicken. However, it needs multilocational trials before recommendation for adoption by poultry growers.

Vera Prasad Ready (2009) conducted in broiler chickens to evaluate the effect of dietary supplementation of tulsi (*Ocimum sanctum*) and selenium on antioxidative enzyme levels. Total forty-two broiler chicks of day-old divided into six groups of seven each were used for this study. *Ocimum sanctum* leaf powder (0.25% and 0.5%), organic selenium (0.3 ppm) and their combinations were added to the basal diet. Superoxide dismutase (SOD), Glutathione peroxidase (GSH-Px) and Catalase levels in plasma were measured at the end of 3rd and 6th week of age. Dietary selenium (0.3 ppm) supplementation in itself significantly ($P<0.01$) increased GSH-Px activity and supplentation of only *Ocimum sanctum* leaf powder (o.5%) significantly ($p<0.01$) increased SOD and Catalase levels. However, *Ocimum sanctum* leaf powder (o.5%) and its combination with selenium (0.3ppm) more effectively enhanced the levels of SOD, GSH-Px and Catalase. It is concluded that dietary supplementation of *Ocimum sanctum* at 0.5% level and its combination with selenium (0.3ppm) can combat oxidative stress in broilers there by increasing the antioxidative enzyme levels.

Despande *et al.* (2009) Experiments were conducted on layers from 24 weeks old to the age of 32 weeks to investigate the effect of tulsi *(Ocimum sanctum)* on the performance of layers. 45 experimental pullets were randomly divided into three experimental groups 15 pullets in each. Control (To) receive standard layer diet, group T1 received standard layer diet with tulsi (0.5%), group T2 received standard layer diet with tulsi (1%). Supplementation of tulsi leaf powder at 0.5% or 1% in layer diet did not affect body weight, egg production, egg weight, feed consumption and feed efficiency. The average egg yolk cholesterol and serum HDL cholesterol was reduced significantly on 60th day in group T2. The average serum triglycerides were numerically reduced on 60th day in group T2 followed by group T1. The average serum LDL cholesterol was reduced significantly on the 60th in group T2 followed by group T1. As the effect of tulsi leaves was gradual, long term feeding of it in laying hens diet at the rate of 1% of the diet, may be helpful in lowering egg and blood cholesterol.

Baskaran (2008) was conducted *Ocimum sanctum* commonly known as 'Sacred basil' or 'Holy basil' is grown as a household plant in India. This preliminary phytochemical study was carried out in acetone, benzene and chloroform extracts and the results showed the presence numerous phytochemical compounds. The antibacterial activity was analyzed using four different bacterial strains (*E.coli*, *Bacillus subtilis*, *Staphylococcus aureus* and *Klebsiella pneumonia*) by using agar disc diffusion method. Our bacterial assay revealed that the extracts showed good antibacterial activity, but the acetone extract didn't show any specific activity. The presence of the phytochemicals signifies the potential of *Ocimum sanctum* as a source of therapeutic agents and may provide leads in the ongoing search for antimicrobial agent from plants.

Prakash and Gupta (2005) studied that the medicinal plants are used by the traditional medical practitioners for curing various diseases in their day to day practice. In traditional systems of medicines, different parts (leaves, stem, flower, root, seeds and even whole plant) of *Ocimum sanctum* Linn (known as tulsi in Hindi), a small herb seen throughout India, have been recommended for the treatment of bronchitis, bronchial asthma, malaria, diarrhea, dysentery, skin diseases, arthritis, painful eye diseases, chronic fever, insect bite etc. The *Ocimum sanctum* L. has also been suggested to possess antifertility, anticancer, antidiabetic, antifungal, antimicrobial, hepatoprotective, cardioprotective, antiemetic, antispasmodic, analgesic, adaptogenic and diaphoretic actions. Eugenol (1-hydroxy-2-methoxy-4-allylbenzene), the active constituent present in *Ocimum sanctum* L. has been found to be largely responsible for the therapeutic potentials of tulsi. Although because of its great therapeutic potentials and wide occurrence in India the practitioners of traditional systems of medicine have been using *Ocimum sanctum* L. for curing various diseases. A rational approach to this traditional medical practice with modern system of medicine is, however, not much available. In order to establish the therapeutic uses of *Ocimum sanctum* L. in modern medicine, in last few decades several Indian scientists and researchers have studied the pharmacological effects of steam distilled, petroleum ether &

benzene extracts of various parts of tulsi plant and eugenol on immune system, reproductive system, central nervous system cardiovascular system, gastric system, urinary system and blood biochemistry and have described the therapeutic significance of tulsi in management of various ailments. These pharmacological studies have established a scientific basis for therapeutic uses of this plant.

Ginger:

Ginger is a herb but is often known as a spice, with a strong distinct flavor that can increase the production of saliva. It is used in many countries as a medicinal ingredient. Some say it can help cure diabetes, headaches, colds, fatigue and nausea. The health benefits of honey and ginger in treating respiratory problems. The ginger plant is approximately 30 - 60 cm tall and is extremely rare to find in the wild.

Taxonomic classification of ginger:

Kingdom: *Plantae*

Phylum: *Magnoliophyta*

Class: *Liliopsida*

Order: *Zingiberaceae*

Genus: *Zinger Mill*

Species: *Zingiber officinale*

Chemical constituents of ginger:

There are some chemical constituents of ginger are given below-

- Gingerols: Responsible for taste.
- Zingiberene: Responsible for scent.
- Zingibain: Has an antibacterial and anti-inflammatory activity.
- Vitamin E: Acts as an antioxidant which helps to neutralize free radicals.
- Ascorbic acid.
- Caffeic acid.
- Capsaicin.
- Beta-sitosterol.

- Beta-carotene.
- Curcumin.
- Lecithin.
- Limonene.

Chemical and bioactive properties of fresh and dried ginger:

Chemical and bioactive properties	Materials	
	Fresh ginger	Dried ginger
Mosture content (%)	94.17 ± 0.16^{a}	$11.54\pm o.29^{b}$
[6]- gingerol content (mg/g dry weight basis)	21.15 ± 0.13^{a}	18.81 ± 0.15^{b}
Total phenolic content (mg gallic acid/g extract	24.63 ± 0.43^{b}	59.40 ± 0.14^{a}
EC_{50} (µg/ml)	64.60 ± 18^{a}	32.95 ± 1.32^{b}
ABTS assay (µ mol Trolox/g extract)	169.06 ± 3.96^{b}	403.71 ± 7.24^{a}

a,b means ± standard deviation in the same row with different letters is significantly different ($P \leq 0.05$) Efficient Concentration; The amount sample (µg) needed for 50% decreasing in the initial DPPH concentration per 1.0 ml of initial solution.

Medicinal properties of ginger:

- antiemetic/antinausea
- anticlotting agent
- antispasmodic
- antifungal
- anti-inflammatory
- antiseptic
- antibacterial
- antiviral
- antitussive
- circulatory stimulant
- carminative
- expectorant
- increases blood flow

Ginger helps in growth performance of broilers:

W.B. Zomraw *et al.* (2012) conducted a study using one hundred and twenty eight unsexed day old broiler chicks (Ross 308) 32 birds/treatment with four replicates was conducted to evaluate the effect of ginger root powder as natural feed additives on growth performance, blood and serum constituents of broiler chickens. Four dietary treatments were formulated to meet the nutrient requirements of broiler chick containing ginger root powder at levels 0%, 0.5%, 1% and 1.5%. Result showed that significant decreased ($P<0.05$) were observed in feed intake and weight gain for birds fed 0.5% ginger root powder. There were no significant differences ($P>0.05$) in feed conversion ratio among all dietary treatments. Treatments had significant decreased ($P<0.05$) in pre-slaughter weight for birds fed 0.5% ginger root powder. No significant differences ($P>0.05$) were observed in dressing percentage. There were no significant effect ($P>0.05$) on serum glucose, total protein and creatinine. Significant differences were observed in serum triglyceride and cholesterol levels. There were no significant differences ($P>0.05$) among all dietary treatments in Hb percentage, PCV percentage, TRBcs, MCV, MCH and MCHC percentage. The results showed that the inclusion of ginger root powder at levels 0.5% and1% in the diet, had lowering effect on cholesterol levels, and the chick may tolerate up to 1.5% without adverse effect on growth performance and blood parameters.

Arkan, B. Mohamed *et al.* (2012) carried out a study to explore the usage of different levels of ginger at concentration of 0.1 and 0.2% respectively supplemented to diets on the performance and blood serum traits of the broiler chickens. 180 (ROSS) 3 weeks old broiler chicks raised to 6 weeks of age. The birds were distributed into 3 treatment groups with three replicates per treatment (20 birds per replicate + 10 females). Ginger was supplemented at the rate 0.1 and 0.2% in the diets to treatments T2 and T3 respectively while treatment one served as control. The result of performance parameter showed significant difference between treatments. However body weight, weight gain, FCR and feed intake showed a significant differences ($p<0.05$) between T2 (0.1% ginger) and T3 (0.2% ginger) and control. The total protein didn't differ significantly between the

treatment groups. Serum cholesterol, triglyceride and glucose level was a significantly lower in the 0.1 and 0.2% of ginger ($p<0.05$) than control. Findings of the research study indicated that groups receiving ginger at the rate of 0.1 and 0.2% of the diets showed better performance and serum profiles in broiler.

M. Arshad *et al.* (2012) conducted a study to explore the economic and immunological impact of ginger (*Z. officinale*) in commercial broiler chicks. One hundred and sixty (160) day old broiler chicks were divided into four groups A, B, C and D; having 40 chicks in each group. Each group was further replicated four times with 10 chicks per replicate. Ginger extract @ 30, 40 and 50 ml/liter of drinking water was given to groups A, B and C respectively. Group D was kept as control. Data on body weight gain, feed intake and economics were recorded for each replicate of the respective groups. It was observed out that treatment groups gained significantly ($P<0.05$) higher body weight than control group. Significant ($P<0.05$) difference was noticed in mean feed intake in group B and C. Mean antibody titer against IBD was higher for group B and C. Whereas Mean anti body titer against ND was higher for group C. Mean feed cost per chick was not affected by any group. Gross return was significantly ($P<0.05$) better in all the treatment groups as compared to control group D. It was concluded that use of ginger extract had significantly improved the immunity and over all improves body weight.

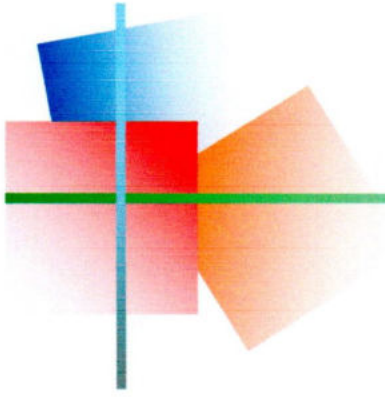
F. E. Dieumou *et al.* (2009) conducted an experiment to evaluate the effect of ginger and garlic essential oils on some blood parameters, growth performance and gut microbial population of broiler chickens. Forty two male and female day old chicks of A*rbour acres* line were arranged in a fractional factorial experiment of an unbalanced completely randomised design and allotted to three treatments given by stomach tube except for the control in three doses 0 (Control), 10mg/kg/day, 20mg/kg/day, and 40mg/kg/day. The trial lasted for seven weeks and there were no differences in feed intake, body weight gain and the feed conversion ratio among the birds. All organ weights and carcass characteristics were not affected by the treatments, except for a decrease ($P< 0.05$) in relative

liver weight of birds on garlic oil treatment compared with those given ginger oil and control. Similarly, a lower ($P< 0.001$) proportion of the head weight of birds given essential oils was observed compared to the control. Dosages effects showed a decrease in relative weight of organs only for the head ($P<0.001$) and the gizzard ($P<0.05$) compared to the control. Male broilers deposited less ($P<0.001$) than the females. There were no significant differences observed in the activities of the serum transaminases (AST & ALT) and blood creatinine level, indicating that none of the three dosages of essential oils given to birds was toxic. However, *Escherichia coli*, and other Enterobacteria counts in the ileo-cæcal digesta numerically decreased ($P<0.05$) compared to the control as the doses of essential oils given increased. The same observation was made for the *Salmonella* and *Shigella* species ($P< 0.001$).The colony forming units (CFU) of *Staphylococci spp* were statistically similar between the two oil-treated groups, but were significantly ($P< 0.01$) reduced compared with the control group.

Beneficial effects of ginger on nausea and vomiting of pregnant women:
Ozgoli *et al.* (2009) reported that ginger has antiemetic and anxiolytic activities. Shogoal and gingerol from ginger may stimulate the flow of saliva, bile, and gastric secretions. Ginger was also found to suppress gastric contractions and improve intestinal muscle tone and peristalsis. Constituents in ginger may interact with 5HT-3 receptors and may be partially responsible for its antiemetic (antinausea) benefits. A recent single blind clinical trial study of 67 pregnant women showed that twice administration of 250 mg of ginger daily for four days could subside the incidents of vomiting.

Willetts *et al.* (2003) reported that its effects on nausea and vomiting during pregnancy are as good as vitamin B6. However, a study in Thailand of 138 women shows that there is no significant difference between ginger and vitamin B6 for the treatment of nausea and vomiting during pregnancy.

Ginger may benefit people at risk of cardiovascular diseases:
Verma *et al.* *(2004)* reported that ginger was found to inhibit 50% of a distinct development of atheroma in the aorta and coronary arteries of rabbits in a study.



CHAPTER 3

MATERIALS AND METHODS

CHAPTER 3

MATERIALS AND METHODS

The experiments were conducted for a period from 02 March/2014 to 14 April/ 2014 at small scale poultry farm at Basherhat, Dinajpur. To complete the research work following steps were followed-

3.1 Collection and processing of plant material:

Tulsi and ginger were selected for effectiveness as growth promoter of broilers. Mature and disease free tulsi leaves were collected from HSTU campus. Ginger was purchased from Basherhat, Dinajpur. It was identified with the help of Botanists.

3.1.1 Preparation of tulsi leaves solution:

At first 20gm of tulsi leaves were weighted from electric balance and then thoroughly washed in tap water. The leaves were cut into small pieces with the help of knife; thereafter the fleshy parts were grinded with the help of pestle and mortar. Then grinded portion was filtered it through the filter paper with the help of beaker and funnel. From filtrate portion 5ml were measured and mixed with 495ml distilled water to prepare 500ml solution where 1% tulsi ingredients contain. Finally 5gm iodide salt was added and stored in a refrigerator at 4°C to preserve the active ingredients of solution.

3.1.2 Preparation of ginger solution:

At first 50gm of ginger were weighted from electric balance and then thoroughly washed in tap water. The ginger were cut into small pieces with the help of knife, thereafter the fleshy parts were grinded with the help of pestle and mortar. Then grinded portion was filtered it through the filter paper with the help of beaker and funnel. From filtrate portion 5ml were mixed with 495ml distilled water to prepare 500ml solution where 1% ginger ingredients contain. Finally 5gm iodide salt was added and stored in a refrigerator at 4°C to preserve the active ingredients of solution.

3.2 Experimental design:

After seven days of acclimatization all the thirty chicks were randomly divided into three equal groups (A, B and C) for assessing the efficacy of tulsi and ginger as growth promoter on broilers.

Chicks of group 'A': were kept as control and were not treated.

Chicks of group 'B': were treated with tulsi solution @ 1 ml/liter added in drinking water for consecutive five weeks.

Chicks of group 'C': were treated with ginger solution @ 1 ml/liter added in drinking water for consecutive five weeks.

All the chicks of treated and control groups were closely observed for forty two days after treatment and following parameters were studied.

EXPERIMENTAL LAYOUT

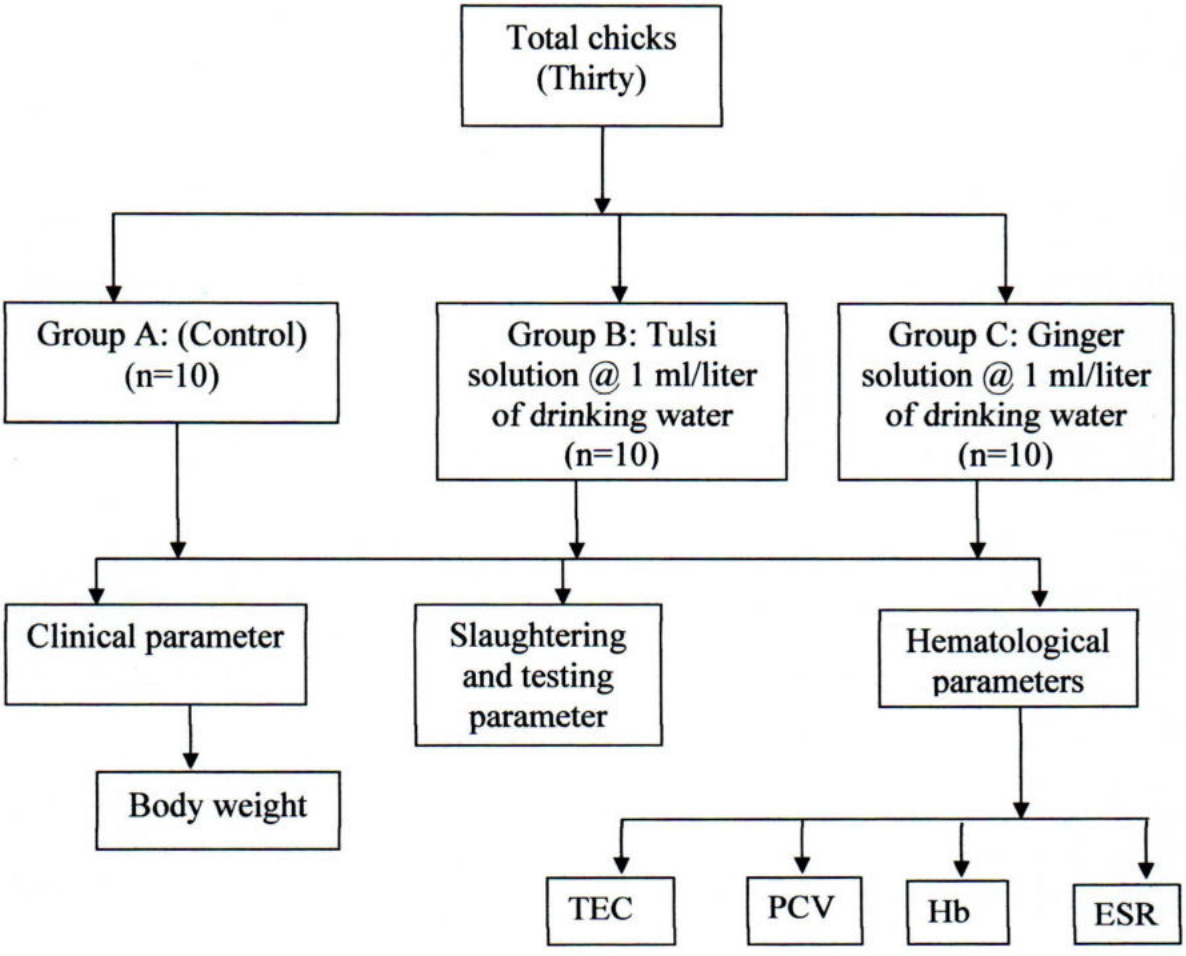


Fig. 01: Layout of the experiment.

Plate 01. Picture of tulsi leaves.

Plate 02. Tulsi leaves after grinding.

Plate 03. Filtration of grinded tulsi.

Plate 04. Mixture of grinded tulsi with water.

Plate 05. Picture of ginger.

Plate 06. Grinding of ginger.

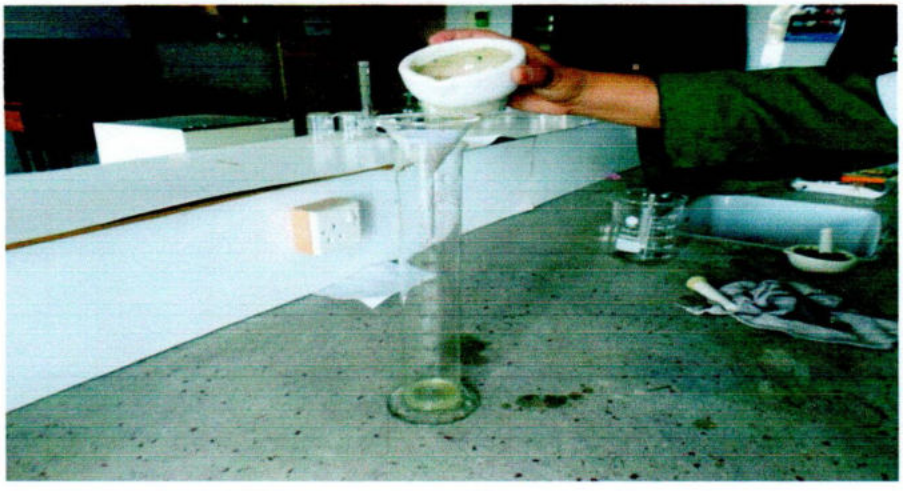


Plate 07. Filtration of grinded ginger.

Plate 08. Mixture of grinded ginger with water.

Plate 09. Broilers at growing stage.

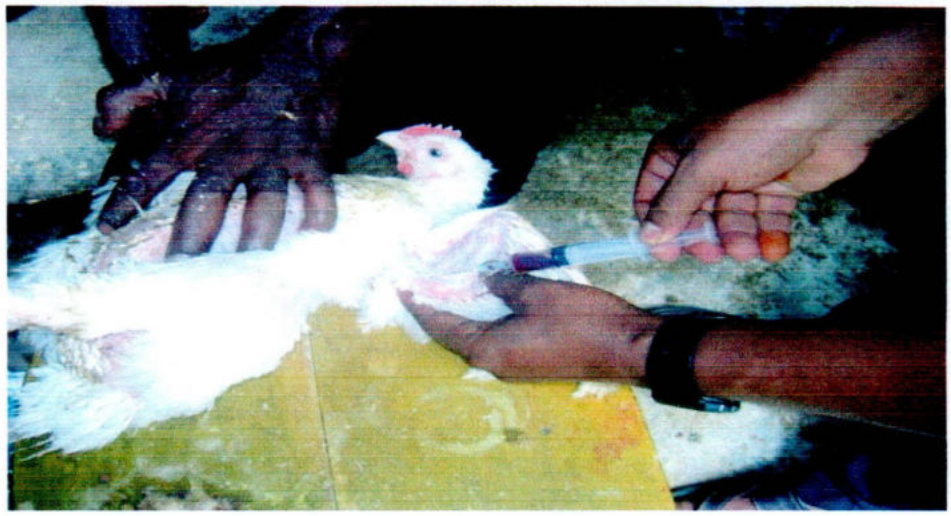


Plate 10. Blood collection from wing vein.

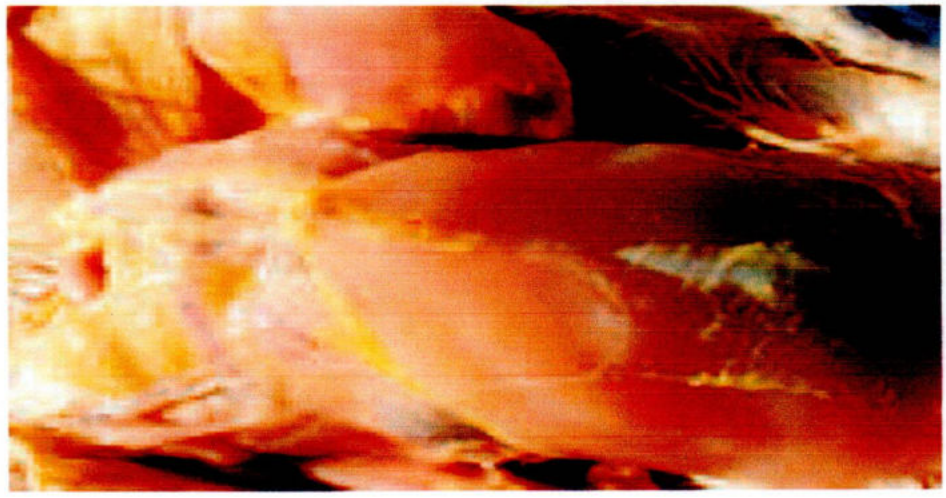


Plate 11. Some chickens found sub-cutaneous fat

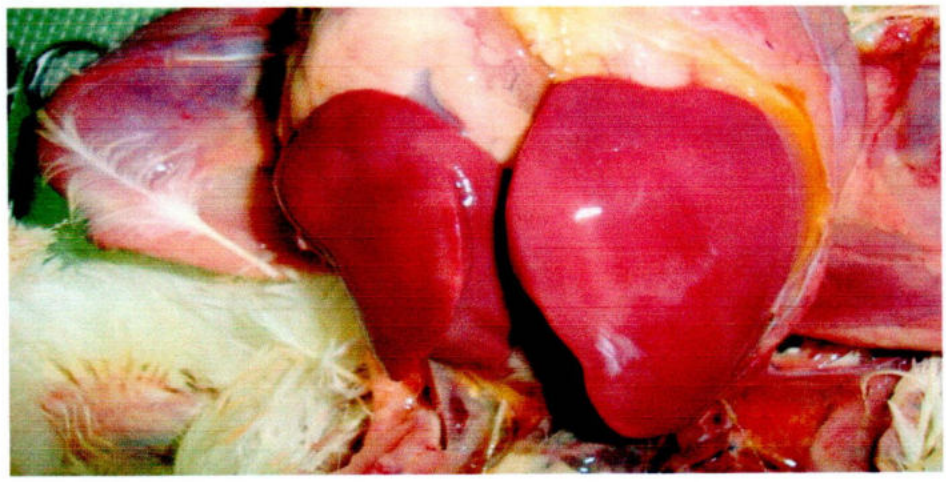


Plate 12. Post mortem examination of chicken.

3.3 Experimental birds:

A total of thirty day old chicks were used in the study. They were kept on the floor in isolated pens and fed commercial ration and water adlibitum.

The experimental chicks were randomly divided into three equal groups consisting of designated as group A, B and C. Chicks in group A were fed basal diet and Group B and C supplemented with tulsi and ginger solution respectively during five weeks experimental period. Weekly feed consumption for each group was determined. Mean initial and weekly body weight of birds for each group were determined and then body weight gain was calculated. By the end of experimental period, five birds from each group were weighed, numbered and then slaughtered. The weight of breast and thigh were recorded along with the vital organs (heart, liver and gizzard).

3.3.1 Preparation of the experimental house and equipment:

An open sided house was partitioned into twelve pens of equal size by using expanded wire net, wood, rod and bamboo materials. A service area was running along the middle of the pens. It was brushed, swiped properly and cleaned with tap water. After washing with clean water, the pens were disinfected by using chlorine solution (500ppm). The room was left vacant for 14 days. Later, it was again disinfected with finis solution (1gm/liter) left to dry up properly. During this time all the feeders, waters and other necessary equipment were properly cleaned, washed and disinfected with finis solution and dried before use.

3.3.2 Collection and management of chickens:

Day old chicks marketed by CP Bangladesh Ltd. were purchased from local market for this experiment. The experiment was carried in small scale poultry farm at Basherhat, Dinajpur. Day old broiler chicks were (Thirty in number) brought in the experimental shed. The body weight of all selected chicken ranged from 100 to 120gm respectively. Then the broiler chicks were managed carefully. Immediately after unloading from the chicks boxes the chicks were given Vitamin-C and glucose to prevent the stress occurring during transport. The chickens were allowed to take rest for ten days for the adaptation. The broiler

chicks were kept in the same compartment for seven days and brooding temperature were correctly maintained. The litter management was also done very carefully. The starter and finisher rations were supplied to the broiler chicken appropriately.

3.3.3 Experimental diets:

The commercial broiler starter and prestarter diets manufactured by Nourish poultry feed Ltd. was purchased from the local agent in Dinajpur.

3.4 Routine management:

The commercial management procedures were followed during the whole experimental period.

3.4.1 Litter management:

Fresh and dried husk was used as a litter at a depth of two cm. The litter was disinfected with finis solution. The litter was stirred three times a week from fourteen days to prevent cake formation. Litter material when found damp was replaced by new litter.

3.4.2 Floor space:

Each pen was 2.5 ft. x 2 ft. which was for seven birds. Therefore, the space given for each bird was one square ft.

3.4.3 Brooding:

The bird was brooded with 100 watt electric bulb in each pen from day old to twenty one days. The bulb was just hanged just above the bird's level at the center of each pen. Brooding temperature was kept 32°c at the beginning of the first week of age and decreased gradually in subsequent week until adjusted to the normal environmental temperature. Increasing or decreasing of temperatures were done by lowering or raising the bulbs according to the temperature prevailed and the birds behavior.

3.4.4 Lighting:

The birds were exposed to twelve hours of lighting and a dark period of one hour per day throughout the experimental period. After twenty one days only one 60

watt electric bulb was set at a height of 240 cm which provide sufficient lighting up to the end of experiment. The dark provision was practiced to make broilers familiar with possible darkness due to electricity failure.

3.4.5 Feeder and water management:

For the first two days, feeds were given on tray feeders and water was supplied in a round. After two days of age, one trough feeder and one round waterer were provided for each replicate pen. Each waterer was placed on two flat bricks. Feeders were cleaned every day at morning and afternoon and fresh clean drinking water was supplied for all times.

3.4.6 Feeding and drinking:

Immediately after distribution of chicks in the pens electrolyte and vitamin solutions were provided to drinking water for four hours. Then dietary treatment was applied to the chicks.

Feed was supplied four times daily for the first seven days and gradually reduced to three times. Initially feed was given on tray feeder and thereafter through feeder was used to feed the birds. Leftover feeds were mixed with fresh feed into the feeder in the morning and spoiled feed was excluded by taking weight of the waste feed. Feed was supplied adlibitum and water was made available all the items.

3.4.7 Biosecurity and sanitation:

Proper hygienic and sanitation programs were followed during the experimental period. To prevent the outbreak of disease strict biosecurity was maintained during the experimental period. The following measures were taken to maintain the biosecurity.

- Visitors were not allowed to enter in the house.
- All equipment's in the experimental house were kept clean.
- Dead birds were removed promptly.

All the chicken of treated and control groups were closely observed for forty two days after treatment and following parameter were studied.

3.5 Clinical examination:

i) The effect of the tulsi leaves extract on body weight gain, feed consumption was recorded before and during administration of treatment.

ii) Chickens under treatment and control groups were weighed with electric weighing machine. The weight of each chicken was taken weekly. The average of these weights was calculated and recorded.

Mean live weight gain of each group of chickens on 7^{th}, 14^{th}, 21^{th}, 28^{th}, 35^{th} and 42^{th} days were recorded.

3.6 Hematological parameters:

Blood samples were collected from wing vein of chicken of both control and treated groups at 21^{th} and 42^{th} days to study the effect of the tulsi and ginger extract and the following parameters were observed:

(a) Total erythrocyte count (TEC)

(b) Hemoglobin estimation (Hb)

(c) Packed Cell Volume (PCV)

(d) Erythrocyte Sedimentation Rate (ESR)

Determination of total erythrocyte count (TEC):

Total erythrocyte count was done following the method described by Lamberg and Rothstein (1977). Well-mixed blood sample was drawn with red blood cell diluting pipette exactly up to 0.5 marks of the pipette. Outside of the tip of the pipette was wiped with cotton. Then the pipette was immediately filled with the red cell diluting fluid (Hayem's solution) up to 101 marks. The free end of the pipette was wrapped around with the rubber tube stretching to both the ends and held with thumb and middle finger. The content of the pipette was mixed thoroughly by shaking with 8-knot motion for 3-5 minutes. Then the counting chamber was placed with special cover glass under microscope using low power (10 x) objectives. After discarding 2 or 3 drops of fluid from the pipette, a small

drop was placed to the edge of the cover glass on the counting chamber as the entire area under the cover glass was filled by the fluid. One-minute time was spared to allow the cells to settle on the chamber under the cover glass. Taking 5 larger squares (4 in the 4 corners and the central one) of the central large square, the cells were counted from all the 80 small squares (16 x 5) under high power objectives (45 x). After completion of counting, the total number of RBC was calculated as number of cells counted x 10, 000 and the result was expressed in million/µl of blood.

Determination of hemoglobin concentrations (Hb):

The N/10 hydrochloric acid (HCl) was taken in a graduated tube up to 2 marks with the help of a dropper. Well-homogenized blood sample was then drawn into the Sahli pipette up to 20 cm. mark. The tip of the pipette was wiped with sterile cotton and the blood of the pipette was immediately transferred into the graduated tube containing hydrochloric acid. This blood and acid were thoroughly mixed by stirring with a glass stirrer. There was a formation of acid hematin mixture in the tube by hemolysing red blood cells by the action of HCl. The tube containing acid hematin mixture was kept standing in the comparator for 5 minutes. After that distilled water was added drop by drop. The solution was mixed well with a glass stirrer until the color of the mixture resembled to the standard color of the comparator. The result was read in daylight by observing the height of the liquid in the tube considering the lower meniscus of the liquid column. The result was then expressed in g %. The above procedure was matched by the Hellige hemometer method as described by Lamberg and Rothstein (1977).

Determination of packed cell volume (PCV):

The citrated well mixed blood sample was drawn into special loading pipette (Wintrobe pipette). The tip of the pipette was inserted up to the bottom of a clean, dry Wintrobe hematocrit tube. Then the Wintrobe tube was filled from the bottom by pressing the rubber bulb of the pipette. As blood came out, the pipette was slowly withdrawn but pressure was continued on the rubber bulb of the pipette so as to exclude air bubbles. The tip of the pipette was tried to keep under the rising

column of blood to avoid foaming and the tube was filled exactly to the 10 cm mark. Then the Wintrobe hematocrit tube was placed in the centrifuge machine and was centrifuged for 30 minutes at 3000 rpm. Then the hematocrit or PCV was recorded by reading the graduation mark; the percent volume occupied by the hematocrit was calculated by using the following formula as described by Lamberg and Rothstein (1977).

$$PCV\% = \frac{\text{Height of the red cell volume in cm}}{\text{Height of total blood in cm}} \text{ X } 100$$

Determination of erythrocyte sedimentation rate (ESR):

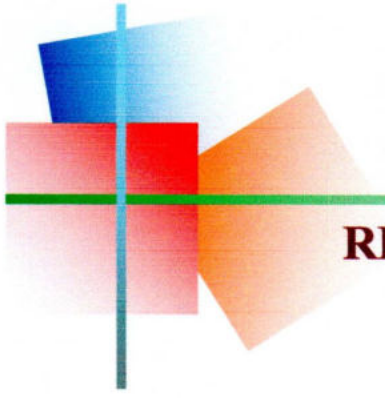
The fresh anticoagulant blood was taken into the Wintrobe hematocrit tube by using special loading pipette exactly up to 0 marks. Excess blood above the mark was wiped away by sterile cotton. The filled tube was placed vertically undisturbed on the wooden rack for one hour. After one hour the ESR was recorded from the top of the pipette. The result was expressed in mm/in 1st hour.

3.7 Postmortem examinations:

There was no mortality in experimental birds during the experimental period. However, at the end of the experiment (i.e. after 42nd day) postmortem examinations were carried out but there was no significant change in any organ.

3.8 Statistical analysis:

The data were analyzed statistically between control and treated groups of chicken by the well-known Student's *t* test ('t' test).



CHAPTER 4

RESULTS AND DISCUSSION

CHAPTER 4

RESULTS AND DISCUSSSION

This experiment was conducted to study the efficacy of tulsi and ginger as a growth promoter in broiler chicken. This experiment was held in small scale poultry farm at Basherhat, Dinajpur. The results are described based on the following headings:

4.1 Economics of production:

The average rearing cost of broiler kept under different treatment groups viz. (A), (B) and (C) were 191.88 Tk., 193.10 Tk and 195.47 Tk respectively (Table 3). Miscellaneous cost summed up Tk. 20 per broiler, which included the estimated cost of electricity and litter disinfectant. The average live weight of broilers in group (A), (B) and (C) were 1.561 kg, 1.698 kg and 1.763 kg respectively. The broiler was sold in live weight basis at the rate of Tk 135/kg. The net profit/Kg live weight in the respective group was found taka 18.82, taka 36.13 and taka 42.53 respectively.

4.2 Effect of tulsi and ginger supplementation on growth in broiler:

The observations for live body weight (g) means of (A), (B) and (C) groups after six weeks of the experimental period were 1561±12.10g, 1698±12.87g and 1763±13.28g respectively (Table 1). So, broilers of Group C supplemented with ginger got the maximum weight ($p<0.01$) followed by Group B (supplemented with tulsi) among all of the experimental groups and the control group (Group A) got the lowest body weight. These findings regarding on body weight has very close agreements with the study of Manwar *et al.* (2005) who performed a research on supplementation of tulsi and ginger solution @ 1 ml drinking water and reported significant increase in the live body weight of broilers in the treated groups when compared to control group.

Similarly, broilers of group B and C also gave marked positive impacts on FCR in which in group C the results were more significant.

Table 01. Initial and final live weight, weight gain, feed consumption and feed conversion ratio of broilers feed @ 1ml/L tulsi leaves and ginger solution from 1 to 6 weeks of age.

Variables	Control	Treatment Groups	
	A (n=10) Mean±SE	B (n=10) Mean±SE	C (n=10) Mean±SE
Initial live weight (g) on 7th day	168±8.54	166±7.95^{NS}	166±7.90^{NS}
Final live weight (g) on 42nd day	1561±12.10	1698±12.87*	1763±13.28**
Weight gain (g)	1393±11.07	1533±11.98*	1588±12.10**
Feed consumption (g)	3140	3050	3035
Feed conversion ratio (FCR) g feed consumed/g weight gain	2.25	1.99	1.90

The above values represent the mean ± standard error (SE) of the initial and final live weight, weight gain, feed consumption and feed conversion ratio of feed of broiler chickens of different groups (n = 10).

**=Significant at 1% level ($p<0.01$)

*=Significant at 5% level ($p<0.05$)

^{NS}= Non significant

Feed conversion ratio (FCR) = Total feed consumed by birds / total weight gain

FCR 1.90 means it takes 190 gm of feed to produce 100 gm of body weight.

FCR 1.99 means it takes 199 gm of feed to produce 100 gm of body weight.

FCR 2.25 means it takes 225 gm of feed to produce 100 gm of body weight.

Table 02. Dressing percentages, relative weights of heart, gizzard, liver, spleen and pancreas of broilers on 42nd day in control and treatment groups.

Variables	Control	Treatment Groups	
	A (n=5) Mean±SE	B (n=5) Mean±SE	C (n=5) Mean±SE
Dressing percentage	63.59±1.02	63.09±1.14 ^{NS}	63.01±1.02 ^{NS}
Relative heart weight	0.45±0.09	0.46±0.095 *	0.46±0.20 ^{NS}
Relative gizzard weight	1.48±0.076	1.52±0.070 **	1.52±0.28 ^{NS}
Relative liver weight	2.60±0.047	2.61±0.09 *	2.61±0.20 ^{NS}
Relative spleen weight	0.12±0.005	0.12±0.006 ^{NS}	0.12±0.040 ^{NS}
Relative pancreas weight	0.28±0.018	0.29±0.019 *	0.29±0.029 ^{NS}

The above values represent the mean ± standard error (SE) of dressing percentages, relative weights of heart, gizzard, liver spleen and pancreas of broiler chickens of different groups (n = 5).

**=Significant at 1% level ($p<0.01$)

*=Significant at 5% level ($p<0.05$)

^{NS}= Non significant

$$\textbf{Relative weight (\%)} = \frac{\text{Weight of organ}}{\text{Live body weight of bird}} \times 100$$

Table 03. Data showing economics of broiler production among control group (A), treatment groups (B) and (C) from 1 day-old to 6 weeks of age.

Description	A (Control)	B (Tulsi)	C (Ginger)
Cost/DOC (Taka)	40	40	40
Average feed consumed (Kg)/broiler	3.140	3.050	3.035
Feed price/Kg (Taka)	42	42	42
Cost of herbal growth promoters (Taka)	0.00	5	8
Feed cost (Taka.)	131.88	128.10	127.47
Miscellaneous (Taka)	20	20	20
Total cost/broiler (Taka)	191.88	193.10	195.47
Average live weight (Kg)	1.561	1.698	1.763
Sale price/Kg live wt. (Taka.)	135	135	135
Sale price/broiler (Taka)	210.70	229.23	238.00
Net profit/broiler (Taka.)	18.82	36.13	42.53
Profit/Kg live weight (Taka)	12.05	21.27	24.12

Supplementation with ginger was found to be more profitable than the control (A) and treatment group (B) of broiler rearing. The results of the present study are in live with the findings of Hernandez *et al.* (2004), who reported that dietary inclusion of tulsi and ginger @ 0.5% in the rations were more beneficial in broilers production.

4.3 Study of tulsi and ginger on hematological parameters of broilers:

Observation of hematological parameters (RBC, Hb, PCV and ESR) on 21st day and 42nd day did not show any significant difference ($P<0.05$) among the control (A), tulsi treated group (B) and ginger treated group (C) (Table 04).

Table 04. Hematological parameters of broiler.

Days of post treatment	Treatment		Mean ± SE	Significance value
21st day	RBC million/mm^3	Control	191.35±6.37	NS
		Tulsi	197.30±7.52	
		Ginger	197.32±7.54	
	Hb (g%)	Control	6.00±0.14	
		Tulsi	6.46±0.06	
		Ginger	6.47±0.07	
	PCV (%)	Control	16.33±0.88	NS
		Tulsi	19.00±0.59	
		Ginger	19.10±0.60	
	ESR (mm in 1st hour)	Control	10.67±0.86	
		Tulsi	8.66±0.88	
		Ginger	8.65±0.87	
42nd day	RBC million/mm^3	Control	248.70±13.87	NS
		Tulsi	297.66±12.11	
		Ginger	297.67±12.12	
	Hb (gm%)	Control	6.92±0.27	NS
		Tulsi	7.62±0.19	
		Ginger	7.64±0.2	
	PCV (%)	Control	17±0.61	NS
		Tulsi	20.70±0.33	
		Ginger	20.71±0.34	
	ESR (mm in 1st hour)	Control	7.00±0.60	NS
		Tulsi	4.00±1.00	
		Ginger	4.00±1.01	

The above values represent the mean ± standard error (SE) of hematological parameters of broiler chickens of different groups (n = 5).

NS= Non significant

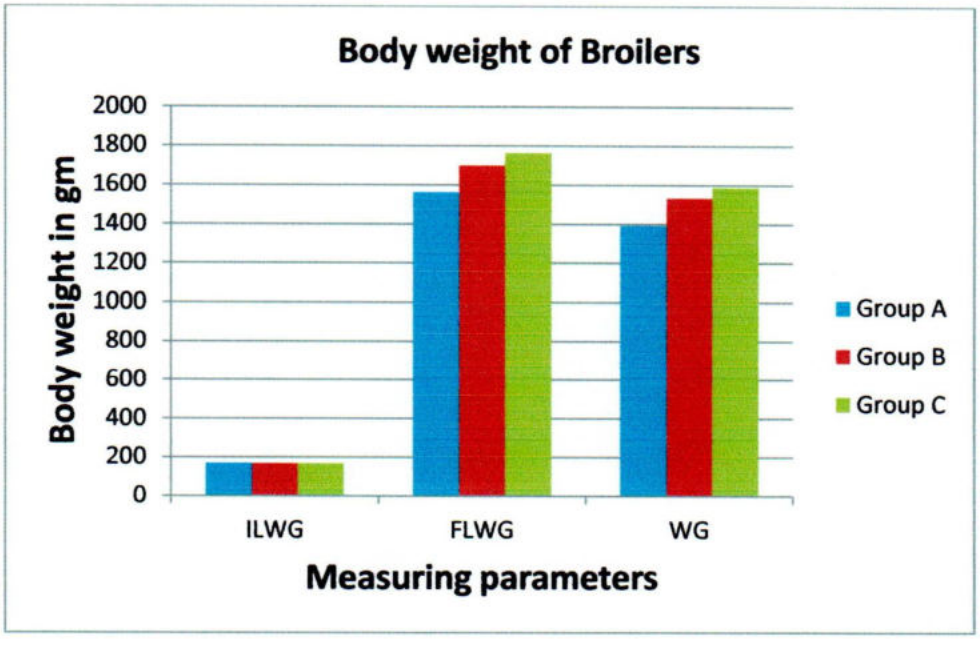


Fig. 02: Body weight gain in broilers.

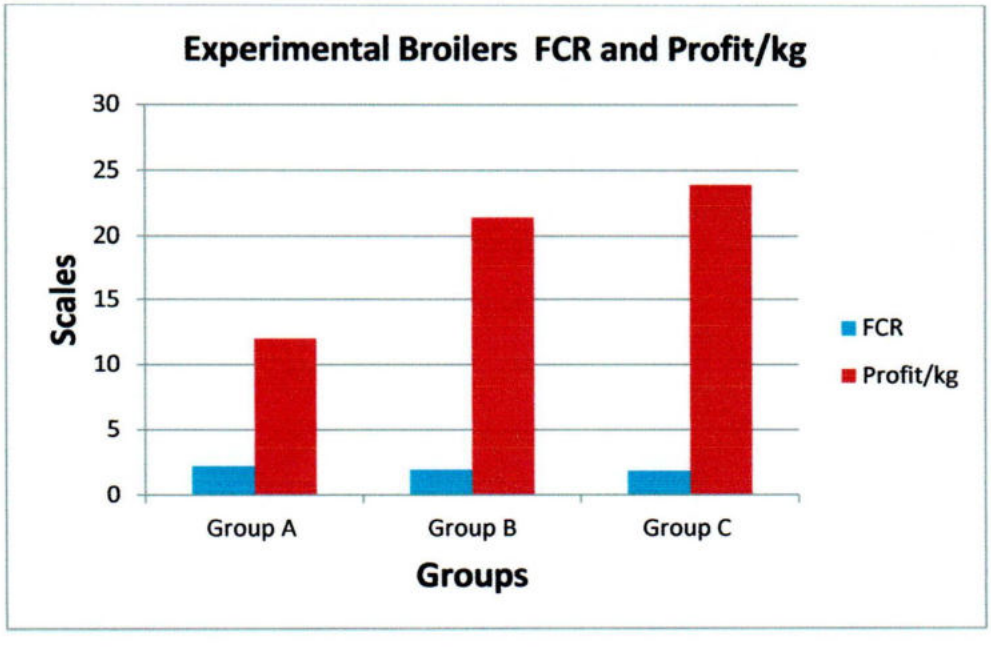


Fig. 03: FCR/profit per kg live broilers.

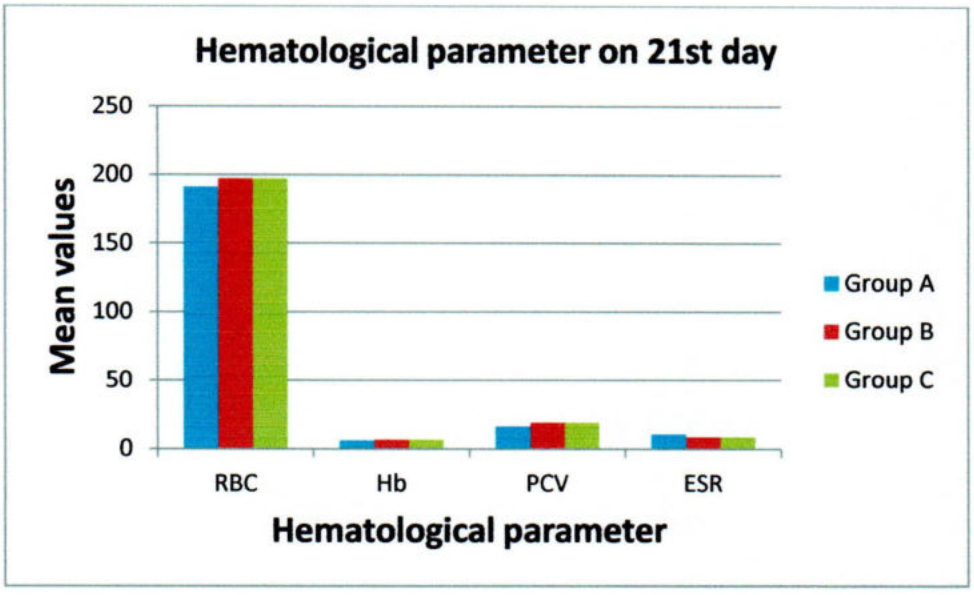


Fig. 04: Hematological parameters of broiler on 21st day.

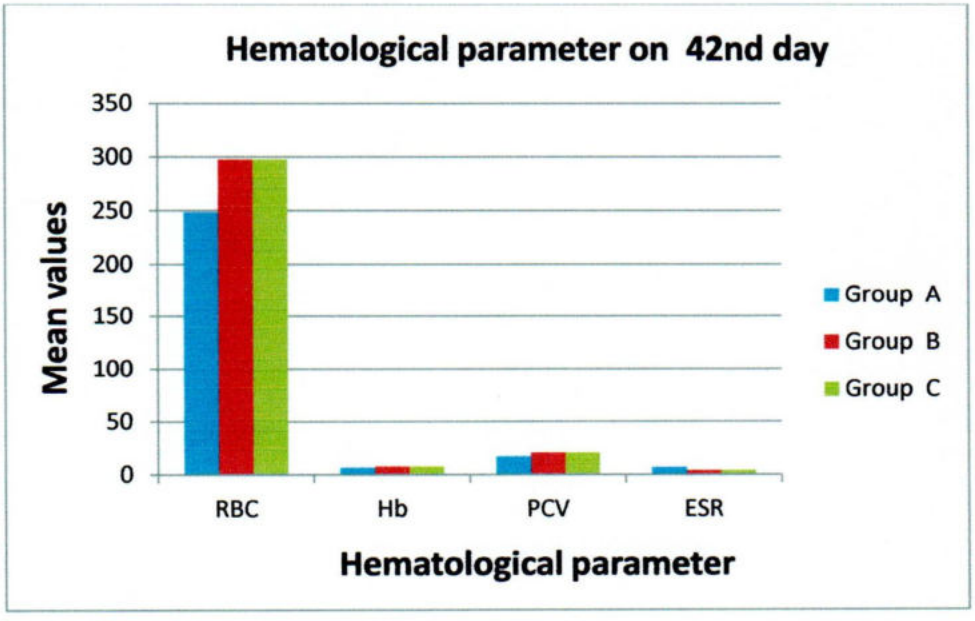
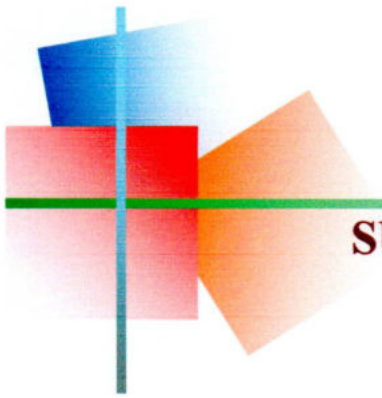


Fig. 05: Hematological parameters of broiler on 42nd day.

Supplementation of ginger in the treatment caused improvement in the feed efficiency as compared to that of tulsi treated group (B). Similarly, Nagalakshmi *et al.* (1996) reported increase in feed efficiency in ginger fed groups, which is in agreement with the findings of the present study. Birds supplemented with ginger had higher body weight, weekly gain in weight, feed consumption and feed efficiency. These results may be due to antimicrobial and anti-zymotic properties which help to reduce the microbial load of birds and improved the feed consumption and feed efficiency of the birds. It is concluded that supplementation with 1 ml of ginger in drinking water of the treatment groups caused significant increase in live body weight and improvement in weight gain and feed efficiency as compared to that of tulsi treated group of poultry.

Ginger has effects as alternative growth promoter. The extract showed no mortality, without any antibiotic and vaccination and also taking proper bio-security. This result may be due to antibacterial, anti-inflammatory, anti-stress, antifungal, insecticidal and liver tonic properties of ginger extract which help to ensure the microbial load of birds and improve the feed consumption and feed efficiency. Care should be taken to ensure its safe use for medicinal references. Similar results have been reported by Sharma and Reddy (2002), where the broilers fed rations with added kalongi, fetched more profit than those using rations without supplementation of this herbal growth promoter. Increase in the profit margin of the birds fed rations containing herbal growth promoters may be attributed to the better efficiency of feed utilization, which resulted in more growth and better feed to gain ratio, ultimately leading to higher profit margin in the broilers reared on ginger supplementation.



CHAPTER 5

SUMMARY AND CONCLUSION

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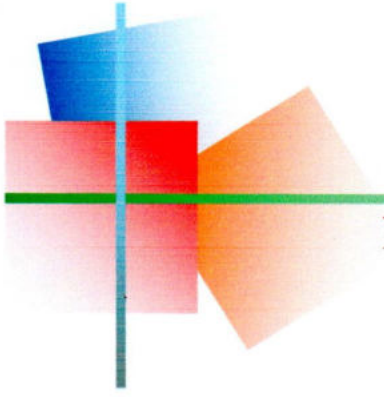
In this experiment, tulsi and ginger was studied in terms of growth promoter on broilers. The experiment was conducted in the small scale poultry farm at Basherhat, Dinajpur. Thirty day old chicks were equally divided into three groups (n=10) to carry out this research work.

Keeping one group as normal control group (A) and other two group (B) and (C) was subjected to treatment with tulsi and ginger respectively. The group of (B) and (C) was supplemented with tulsi and ginger @ 1ml/liter in drinking water respectively and the group of (A) was provided with the fresh water. Weekly observations were recorded in live body weight for 6^{th} weeks and blood parameters of birds at 21^{st} and 42^{nd} days. The treatment group (C) recorded statistically significant ($p<0.01$) increase for live body weight than that of treatment group (B) and control group (A). Net live weight gain was increased in ginger treated group (1763±13.28g) than tulsi treated group (1698±12.04g) and control group (1561±12.10g) and profit/ Kg live broiler was Tk. 24.12 in ginger treated group, in tulsi treated group was Tk. 21.27 and control group was Tk. 12.05.

This research work shows that continuous treatment with ginger produced a significant ($p<0.01$) increase in live body weight but there is no significant ($p<0.05$) change on blood parameters. It can be concluded that ginger and tulsi may be used as growth promoter but ginger is more effective and economic in broiler production. Further study is necessary to evaluate the biochemical and molecular test to investigate any adverse effect in future.



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