EFFECTS OF GARLIC AND GINGER SUPPLEMENTS ON THE PERFORMANCE OF BROILERS

A Thesis

By

MD. MONJURUL ALAM

Registration No. 1405118

Semester: July-December, 2016

Session: 2014-15

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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DECEMBER, 2016

DEDICATED

TO MY

BELOVED PARENTS

AND

TEACHERS

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The Author
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ABSTRACT

This study was conducted to determine the efficacy of garlic, ginger and GG (garlic plus ginger) supplement on the performance of broilers. Forty Day Old Chicks were divided into four groups (A, B, C and D) and each group remains 10 broilers. Group A was kept for control which provided fresh feed and drinking water, Group B was treated with 1 g of garlic per kg feed, Group C was treated with 1 g of ginger per kg feed and Group D was treated both of 0.5 g garlic plus 0.5 g ginger per kg feed respectively. Weekly observations were recorded for live body weight, Feed Conversion Ratio (FCR) and blood parameters of birds for 35th days. All the treatment groups B (2.48±0.05**), C (2.51±58.02**) and D (2.52±0.03*) recorded significantly ($p<0.01$) higher means for live body weight than that of control A (2.21±0.08) group. All the treatment groups showed non-significant increase in weekly gain in weight, feed consumption and feed efficiency as compared to that of control group. In Bangladesh broilers production is mainly performed by non-technical farmers. The broiler production demand is very high because it supports short return of money but major problem is cost maintenance. The initial body weight of group A, B, C and D on 7th of this experiment were 174±7.30g, 175±7.30g, 173±7.30g and 178±7.30g respectively and after 35th day of experiment final body weight were 2217±0.08g, 2487±0.05**g, 2511±58.02g and 2524±0.03*g respectively. The net body weight gain were 2.04±7.22g, 2.31±7.25**g, 2.333±58.02g and 2.34±36.87*g respectively and economics of production were analyzed and found that net profit per broiler was 39.16Tk, 57.22Tk, 62.88Tk and 64.12Tk respectively. Hematological parameters were not significantly difference observed among RBC, Hb, PCV and ESR of the treated group compared to control group. The present study can be concluded that broiler production by using herbal supplement may be profitable and suitable for human consumption.

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LIST OF ABBREVIATIONS

B.wt.	:	Body weight
BAU	:	Bangladesh Agricultural University
Conc	:	Concentration
cu mm	:	Cubic millimeter
d.w	:	Drinking water
ESR	:	Erythrocytes Sedimentation Rate
et al.	:	Associates
Fig.	:	Figure
GG	:	Garlic and Ginger
mg	:	Milligram
Hb	:	Hemoglobin
i.e.	:	That is
J.	:	Journal
Kg	:	Kilogram
Lit	:	Litre
Ltd	:	Limited
Mg	:	Milligram.
g	:	Gram
mm3	:	Cubic millimeter
No	:	Number
PBS	:	Phosphate Buffer Solution
PCV	:	Packed Cell Volume
PM	:	Population Mean
SE	:	Standard Error
SM	:	Sample Mean
TEC	:	Total Erythrocyte Count
Vol.	:	Volume
Pg	:	Microgram
%	:	Percent
and	:	And
<	:	Less than
>	:	Greater than
±	:	Plus minus
0^oC	:	Degree centigrade
FCR	:	Feed Conversion Ratio
Tk	:	Taka
NS	:	Non Significant
*	:	0.05% level of significant
**	:	0.01% level of significant

CHAPTER I

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. The population growth rate gradually increasing in the world, but do not increasing landing capacity and proper sources of food. The protein is playing an important role for human health. To fill up the protein deficiency for big population in the world the contribution of poultry is mark able. 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 "growth promoters". 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 The main objective of herbal plants is to boost animal performance by increasing their growth rate, better-feed conversion efficiency, greater livability and lowered mortality in poultry birds. These herbal plants are termed as "growth promoters" and often called as non-nutrient feed additives. 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. Their mechanism of action varies. 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. Because of the fact that growth promoters have different mechanisms of action, it is necessary to present every group individually and present the effect, which can be expected with their utilization. With the development and wide use of synthetic and semi-synthetic antibiotics, pros and cons have been experienced throughout the last 50 years, which have been directed research back to natural antimicrobial products as indispensable resources. 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 spices, for the development of new additives in animal feeding.

The Garlic (*Allium sativum*) from the family Meliaceae (Von Maydell, 1986) contains azadirachtin- a biologically active compound found in its seeds, bark and leaves (Wikipedia, 2007; Makeri *et al.,* 2007) which is responsible for its varied medicinal uses (Schmutterer, (1990. But it is known to induce some toxic effects (Wikipedia, 2007). Garlic preparations fed to laying hens have been reported by Sadre *et al.,* (1984) and Gowda *et al*., (1998) to significantly reduce the content of hemoglobin, erythrocyte count and packed cell volume. Despite these findings, there is a dearth of information on the possible hematological effects of Garlic (*Allium sativum*) aqueous extract in chickens of Northeastern, Nigeria.

This investigation was therefore, designed to study the hematological effects of Garlic (*Allium sativum*) aqueous extract in chicken, with a view to establishing its safety. Plants are the oldest friends of mankind. They not only provide food and shelter but also serve humanity by preventing and curing different ailments. Herbs and spices have always been helpful to cure diseases. In modern animal feeding, they are forgotten because of use of Antimicrobial Growth Promoters (AGP). But due to the prohibition of most of AGP, plant extracts have gained interest in animal feed strategies (Charis, 2000). The risk of the presence of antibiotic residues in milk and meat and their harmful effects on human health has led to their prohibition for use in animal feed in the European Union. Many plants also produce secondary metabolites such as phenolic compounds, essential oils and sarasaponins (Chesson *et al*., 1982; Wallace *et al*., 1994; Kamel, 2001). Herbs normally used are picorhiza, garlic, cloves, slippery elm, garlic fruit and leaves, sophora flavescens, Nutmeg, cinnamon, ginger, peppermint, sage, thyme, mustard and fenugreek. These plants are used as digestive stimulants, antidiarrhoic, antiseptic, antiinflammatory, antiparasitic and appetite stimulants inhuman beings as well as animals. It is conceivable that herbal agents could serve as safer alternatives as growth promoters due to their suitability and preference, lower cost of production, reduced risks toxicity and minimum health hazards. Interestingly recent biological trials of certain herbal formulations in India as growth have shown encouraging results and some of the reports have demonstrated improvement with respect to weight gain, feed efficiency, lowered mortality, increased immunity and increased livability in poultry birds (Kumar, 1991).

Also these herbal growth promoters have shown to exert therapeutic effects against liver damage due to feed contaminants like aflatoxin (Ghosh, 1992). Garlic (*Allium sativum*) dry leaves extract as medical herbs could be beneficial in immunosuppressant diseases of poultry.

Garlic (*Allium sativum*) extract has immunostimulant effect that activates the cell mediated immune response and therefore, creates an enhanced response to any future challenges occurred by disease organisms. So, the feeding Garlic (*Allium sativum*) to immunosuppressed birds increase their humoral and cell mediate immune responses (Sadekar *et al.,* 1998). Garlic (*Allium sativum*) contain a vast array of hemically diverse and iologically active ingredients (Devakumar and Suktt, 1993). Low dose of Garlic (*Allium sativum*) extract have an inhibitory action on wide spectrum of microorganisms Talwar *et al.,* 1997) and immuomodulator actions that induce cellular immune reaction (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). 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, dem ethoxy curcumin, bisdem ethoxy curcumine, (Wuthi-Udomler *et al.* 2000) and tetra hydro curcuminoids (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, layer 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.

Objectives:

The research has been carried out with the following objectives:

i) To evaluate the efficacy of garlic, ginger and garlic plus ginger supplement on the growth performance of broilers.

ii) To determine the effects of garlic, ginger and garlic plus ginger on the hematological parameter.

iii) To determine the cost effectiveness among the different treatment groups.

CHAPTER II

REVIEW OF LITERATURE

CHAPTER II

REVIEW OF LITERATURE

Garlic:

Ansari *et al.* (2008) was conducted to determine the comparative efficacy of six medicinal plants including *Nigella sativa, Boerhavia diffusa, Withania somnifera, Ipomea digitata, Allium sativum and Corylus avellena* with 4 g/kg of feed as growth promoter and their subsequent influence on the performance of broilers. 210-day-old chicks were randomly divided into 21 experimental units of 10 chicks each. These experimental units were randomly allotted to 7 treatments comprising of 3 replicates each. Commercially formulated broiler starter and finisher rations were offered *ad libitum* from 0-4 and 4-6 weeks of age. Authenticated samples of the plant materials were dried in shade, pulverized and mixed each with 4g kg-1 of feed and offered to the chicks of the respective treatment groups. Maximum gain in weight was observed with the *Withania somnifera* (1.819 kg) followed by *Nigella sativa* (1.805 kg) and *Allium sativum* (1.800 kg). The best cumulative FCR at the end of 6th week of age was for that of *Withania somnifera* (2.038) followed by *Nigella sativa* (2.054) and *Allium sativum* (2.083). The lowest results as regards FCR were recorded for *Ipomea digitata* (2.394) and *Boerhavia diffusa* (2.396). The results of the *Corylus avellena* (2.209) and control (2.235) were statistically similar. The maximum profit per bird was obtained from *Allium sativum* treated birds followed by *Nigella sativa* and *Withania somnifera* treated chickens as compared to control. It was concluded from this study that medicinal plants especially *Withania somnifera, Nigella sativa* and *Allium sativum* can be used as growth promoters in the poultry diets with better production performance.

Biu *et al.* (2009) showed that The hematological effect of aqueous extract of *Allium sativum* administration intraperitoneally to chickens for 18 days with graded doses of 500, 1000 and 2000 mg/kg body weight was evaluated. Twenty (20) chickens weighing between 400 and 725 grams divided into four groups of five birds each were used. There was a significant decrease ($p<0.05$) in the mean packed cell volume (PCV%) and hemoglobin concentration (Hb) which were dose dependent, while the mean white blood cell count (WBC) did not alter significantly ($p>0.05$). The mean differential counts of the extract-exposed chickens indicated that the mean values for monocytes, basophils and

eosinophils increased significantly ($p<0.05$) with increasing dose, while mean values for lymphocytes and heterophils decreased significantly ($p<0.05$). The significance of these findings is discussed.

Dorababu *et al.* (2006) showed that standardized aqueous extract of Garlic *(Allium sativum)* leaves (AIE) has been reported to show both ulcer protective and ulcer healing effects in normal as well as in diabetic rats. To study the mechanism of its ulcer protective/healing actions, effects of AIE (500 mg/ kg) was studied on various parameters of offensive acid-pepsin secretion in 4 hr pylorus ligation, pentagastrin (PENTA, 5 micro g/kg/hr)-stimulated acid secretion and gastric mucosal proton pump activity and defensive mucin secretion including life span of gastric mucosal cells in rats. AIE was found to inhibit acid-pepsin secretion in 4 hr pylorus ligated rats. Continuous infusion of PENTA significantly increased the acid secretion after 30 to 180 min or in the total 3 hr acid secretion in rat stomach perfusate while, AIE pretreatment significantly decreased them. AIE inhibited the rat gastric mucosal proton pump activity and the effect was comparable with that of omeprazole (OMZ). Further, AIE did not show any effect on mucin secretion though it enhanced life span of mucosal cells as evidenced by a decrease in cell shedding in the gastric juice. Thus, our present data suggest that the ulcer protective activity of AIE may be due to its anti-secretary and proton pump inhibitory activity rather than on defensive mucin secretion. Further, acute as well as sub acute toxicity studies have indicated no mortality with 2.5 g/kg dose of AIE in mice and no significant alterations in body or tissues weight, food and water intake, haematological profile and various liver and kidney function tests in rats when treated for 28 days with 1 g/kg dose of AIE.

Hudha *et al.* (2010) studied that A total of 96 straight run day old (cobb 500) broilers were fed *ad libitum* on a starter (crumble) containing 13.23 MJ ME/kg, 245g CP/kg, 40g CF/kg (max), 12g Ca/kg, 7.5g available phosphorus/kg, 6.5g methionine (max)/kg, 14g cystine/kg, 50g fat/kg, 140g moisture (max)/kg from day old to 14 days of age and thereafter on a grower (pellet) containing 13.33 MJ ME/kg and 240g CP/kg, 40g CF (max)/kg, 12g Ca/kg and 7.5g available phosphorus/kg, 6g methionine (max)/kg, 14g cystine/kg, 50g fat/kg, 110g moisture (max)/kg up to 35 days of age. They were provided with 0, 0.05, 0.10, and 0.15% acetic acid (AA) in drinking water to observe the effect of AA on growth and meat yield. Body weight and feed intake were higher ($p<0.05$) on 0.15% AA level than that on control, 0.05 and 0.10% AA level. However, Feed

conversion was lower on 0.15% AA than those on 0, 0.05 and 0.10% AA. Feed cost /broiler significantly increased ($p<0.01$) with increasing AA levels. Increased cost for producing each kg broiler on 0.15% AA than that on other levels perhaps indicates that AA level should be below 0.15% to optimize economic performance. Dressing yield was increased with increasing AA levels ($p<0.05$). Drumstick meat was higher ($p<0.01$) on 0.05% AA than those on other levels. Proportion of thigh meat and feather did not vary among 0, 0.05 and 0.15% AA but significantly varied on 0.10% level. On the other hands no significance differences ($p>0.05$) observed in breast, dark, breast: dark, wing meat, abdominal fat, skin, liver, heart, gizzard, spleen, head, neck, wing bone, thigh bone, and blood weight by using different level of AA. It can be concluded that supplementation of AA in drinking water might improve growth; feed conversion and meat yield of broilers.

Halim *et al.* (2003) studied that combination (1:1) of water extract of dried extract of root and leaves (200 mg/kg body wt) of *A. augusta* and *A. indica* respectively was administered orally to alloxan diabetic rats once a day for 8 weeks. This treatment caused significant lowering of blood sugar in fasted as estimated by glucose tolerance test. The treatment resulted in a significant reduction in serum lipids. Aqueous extract also decreased the formation of lipid peroxides estimated as Thiobarbituric Acid Reactive substance, (TBARS), and increased antioxidants (superoxide dismutase, catalase, glutathione peroxidase and glutathione transferase) in erythrocytes. There was reduction in LPO as TBARS in heart, liver, kidney, and muscles. It also prevented decrease in body weight. Present study showed that Abroma augusta roots and A. indica leaves when given together as water extract had hypoglycaemic action and had better effect than given alone.

Habib *et al.* (2005) showed that a research work of herbal medicine viz. Garlic (*Allium sativum*) extract (*Azadirachta indica*), nayantara leaf extract (*Catharanthus roseus)* and bitter melon fruit (*Momordica charantia*) juice with the patent drug gliclazide (Comprid®, Square Pharmaceuticals Bangladesh Ltd.) were studied on blood glucose level, hematological parameters and on body weight in rats. Twenty-five apparently healthy adult rats were randomly divided into 5 equal groups namely A, B, C, D and E. One group (group A) was kept as control. The rest four groups (B, C, D and E) of rats were treated with gliclazide (Comprid®) with 4.5 mg/kg bd. wt./day, Garlic (*Allium sativum*) extract (NLE) with 500 mg/kg bd. wt/day, nayantara leave extract (NtLE) with

500mg/kg bd. wt./day and bitter melon fruit juice with 500 mg/kg b. wt./day respectively for 14 consecutive days. Blood glucose levels were significantly (P<0.01) reduced in all treated four groups of rats (39.78-44.31%) in comparison to their pre-treatment values. Total Erythrocyte Count (TEC), Total Leukocyte Count (TLC) and Differential Leukocyte Count (DLC) were not changed significantly in any treated group (B, C, D and E). Eosinophil and monocytes and hemoglobin contents were decreased significantly (P<0.01) in all groups. Among the herbal drugs used in the study bitter melon fruit juice was more effective (7.45%) in increasing the body weight in comparison with other herbal preparations i.e. NtLE (7.4%) and NLE (4.86%). From the present study, it may be further revealed that although the patent drug gliclazide was found to be highly effective, as blood glucose lowering agent, but the efficacy of three Different combined form of herbal preparations was also seemed to be encouraging.

Lavinia *et al.* (2009) studied that essential oils from aromatic plants have an antimicrobial activity against many bacterial pathogens. We have conducted an in vivo experiment to study the effect of some aromatic plants and in particular to investigate the effect of oils extracted from these plants at the immune level and duodenal morphology. During the experiment 90 chicken broilers were divided in three experimental groups: control group (C), group 1 (G1) and group 2 (G2). The chicken broilers from group G1 had received feed with 0.05% incorporated oils extracted from savory (Satureja hortenis), mint (Mentha piperita) and sea-buckthorn (Hippophae rhamnoides). Group G2 received a premix of plants (savory, mint and sea-buckthorn) during daily feeding. The control group (C) received normal feed with no supplements. The amount of lysozyme detected at group G1 was doubled (28.55 mcg/cm3) compared to G2 (13.2 mcg/cm3) and the control (11.42 mcg/cm3). The incorporation of extracted oils in food resulted in a powerful stimulation of intestinal mucous membrane, manifested by development of intestinal villi, the hypertrophy of villi, hyperplasic hypertrophy of capillary network and the stimulation of leukocytes infiltration. The muscular hypertrophic processes and leukocyte infiltration are visible in the endomesium and perimesium of the muscular tunic. Microscopical images of the G2 group taken from the duodenum sections suggest the stimulation of angiogenesis. The processes are however of smaller intensity in the G1 group. This work shows that essential oils extracted from plants improve the immune response and also are able to cause changes of the duodenal mucosa with beneficial effects for the animal.

Mahmood *et al.* (2009) studied that the present work was aimed at knowing the effect of various levels of garlic (*Allium sativum*) and kalongi (*Nigella sativa*) as herbal growth promoters on the (i) growth performance of broilers and on the (ii) dressing percentage, relative weight of heart, gizzard, liver, spleen and pancreas of the broilers. One hundred and fifty day old broiler (Hubbard) chicks were divided in five groups viz., A, B, C, D and E. Group A served as control and was fed ration without any supplementation. Whereas group B and C were fed ration supplemented with 0.5% and 1.0% kalongi, respectively. Similarly the birds in-group D and E were fed ration supplemented with 0.5% and 1.0% garlic, respectively. The experimental rations consisted of broiler starter mash and broiler finisher mash, which were fed from 2-4 and 5-6 weeks of age, respectively. The supplementation of kalongi and garlic in the broiler ration significantly ($P<0.05$) improved the weight gain of the birds of various groups as compared to those of control group. The birds' (in group D) using ration supplemented with 0.5% garlic gained the highest live weight (1588 g) among the treated groups and the best-feed conversion ratio (1.91). Different levels of the herbal growth promoters did not exhibit any significant influence upon the feed intake values of the experimental groups. There was no difference ($P>.05$) between the average dressing percentages, relative giblet weight (heart, gizzard, liver and spleen) and relative pancreas weight of the broilers fed rations with or without supplementation of garlic or kalongi. It is therefore concluded that dietary inclusion of garlic or kalongi in the rations may be used for economical and efficient production of broilers.

Mohan *et al.* (2008) studied that a cost-benefit analysis was made of the effect of three organic growth-promoters on yield and quality of two vegetable crops, brinjal (*Solanum melonogena)* and tomato *(Lycopersicon esculentum*), grown under field conditions. Traditional Ayurvedic growth-promoters, Panchagavya and Amrit Pani, were compared with Bokashi made using Effective Microorganisms (EM) technology. The results indicate higher yield and lower glycoalkaloid content in Bokashi-treated crops, followed by Panchagavya. Panchagavya was the most cost-effective growth-promoter followed by Amrit Pani and then Bokashi. We recommend the use of Panchagavya as an organic growth-promoter for small and marginally profitable vegetable-crop farmers.

Perić *et al.* (2009) studied that Subsequent to banning of use of antibiotics as growth promoter sin poultry nutrition, numerous studies turned to finding of alternative solutions, i.e. other, natural substances, which would have positive effect on chicken growth and

feed conversion. Today, several groups of these additives are in use, and most often probiotics, prebiotics, enzymes, acidifiers, antioxidants and phytogene additives. Considering that each of the stated groups has its own specificities, objective of this work was to present main mechanism of their action and to present their effect on production results in fattening of broiler chickens through review of research published in this field.

Saxena *et al.* (2004) conducted that type 2 diabetes has become a global epidemic. Modern medicines, despite offering a variety of effective treatment options, can have several adverse effects. Ayurveda, a science that uses herbal medicines extensively, originated in India. Of considerable interest is the adoption of Ayurveda by the mainstream medical system in some European countries (e.g., Hungary), emphasizing this modality is increasing worldwide recognition. From ancient times, some of these herbal preparations have been used in the treatment of diabetes. This paper reviews the accumulated literature for 10 Indian herbs that have antidiabetic activity and that have been scientifically tested. Few of these herbs, such as Momordica charantia, Pterocarpus marsupium, and Trigonella foenum greacum, have been reported to be beneficial for treating type 2 diabetes. Mechanisms such as the stimulating or regenerating effect on beta cells or extrapancreatic effects are proposed for the hypoglycemic action of these herbs.

Tipu *et al.* (2006) showed that the medicinal plants and herbs have been used for many years in the treatment of various diseases in animals and human beings. Now a day, utilization of these medicinal plants is increasing. These are used in animal feed as the growth promoters. Due to prohibition of most of the antimicrobial growth promoters in animal feed because of their residual effects, plant extracts are becoming more popular. They act as antibacterial, antioxidant, anticarcinogenic, antifungal, analgesic, insecticidal, anticoccidial and growth promoters. These plant extracts compete with the synthetic drugs. Majority of medicinal plants do not have the residual effects. *Azadiracht indica, Zizyphus vulgaris, Ocimum gratissimum* and *Atlanta monophylla* have the strong antibacterial activity, whereas ocimum plant has strong antioxidant, anticarcinogenic, antifungal, analgesic and antipyretic properties. Leaves of *Allium sativum* are used for feeding and reducing the parasitic load of animals. The fruit of *Allium sativum* also has the anticoccidial activity for poultry.

Tollba *et al.* (2009) showed that An experiment was performed to reduce the intestinal pathogenic bacteria populations of broiler chicks under normal or heat stress conditions by using medical herbs (Garlic leaves), probiotic (biogen) or sand as a litter. A total of 240, unsexed one week old Hubbard chicks, were assigned into four equal groups, 60 chicks in each with two replicate in floor pens: 3 of 4 groups were fed an experimental diet and used the wheat straw as a litter, thus, inoculation of 2g biogen (bacteria concentration as probiotic) / kg of feed, 200 mg Garlic *(Allium sativum)* extract (medical plant) / kg of feed or without inoculation (control), respectively. Chicks in the fourth group were fed control diet and used sand as a litter. At 35 days of age, each group was divided into two equal sub-groups, the first was kept under normal conditions (23C) while, the second sub-group was exposed to 38°C for 3 hrs daily for 6 days from 35 to 40 days of age with 70 % relative humidity. Inclusion of biogen and Garlic (*Allium sativum*) extract in broiler feed at either normal temperature (23ºC) or high temperature (38ºC) allowed the statistically significant ($P<0.05$) improvement of the following parameters: body weight gain, feed consumption, feed conversion, mortality rate, carcass characteristics in terms of relative weight of dressing, giblets, and also lymphoid organs in terms of bursa and thymus relative weights. Blood total protein as well as albumin and globulin fraction, Tri-iodothyronine (T3), hemoglobin and hematocrit were increased ($P<0.05$). Conversely, plasma cholesterol and total lipids values were ($P<0.05$) reduced. Besides, creatinine, AST and ALT enzymes were not affected. Moreover, the total erythrocytic, leukocytic and leukocytic differential counts except heterophil cells were ($P<0.05$) increased. However, using the sand as a litter in broiler pens resulted insignificant improvement in the previous parameters, except the mortality rate was ($P<0.05$) improved with either normal or high temperature conditions**.** Furthermore, there were significant ($P<0.05$) decreases total count of some intestinal (ilium and caecum) or faeces pathogenic bacteria (total viable count, E. coli, Salmonella, staphylococci and Coccidia ovum) with all experimental groups including the sand as a litter treatment. On the other hand, there were ($P<0.05$) decreases in body weight gain, feed consumption, (T3), plasma total proteins and increase in mortality rate of chicks subjected to heat stress, by the way, experimental treatments reduced the deleterious effects of heat stress. Probiotics or Garlic (*Allium sativum)* extract was efficient as antibacterial and immuno-stimulant activities in controlling the intestinal pathogenic bacteria, consequently, improving broiler performance, physiological and bacteriological status. Therefore, It could be advisable to give more attention for importance of inclusion bacteria

concentration (probiotics) and medical plant (Garlic leaves) on broiler diets or using the sand as a litter in broiler house in either normal or stressed environmental condition.

Wankar *et al.* (2009) studied that An experiment was conducted on 120 day old broiler chicks divided into four groups, T_0, T_1, T_2 and T_3 which were supplemented with Garlic *(Allium sativum)* extract with 0ml, 1ml, 2ml and 3ml/kg of broiler ration, respectively. Weekly observations were recorded for live body weight, weekly gain in weight, weekly feed consumption and feed efficiency of birds for six weeks. All the treatment groups T_1 (813.03), T_2 (855.07) and T_3 (834.21) recorded significantly ($P<0.01$) higher means for live body weight than that of control T_0 (768.69) group. All the treatment groups showed non-significant increase in weekly gain in weight, feed consumption and feed efficiency as compared to that of control group.

Nutritional value of garlic

Energy	149 Kcal	7.5%
Carbohydrates	33.06 g	25%
Protein	6.36 g	11%
Total Fat	0.5 g	2%
Cholesterol	0 mg	0%
Dietary Fiber	2.1 g	5.5%
Folates	3 µg	1%
Niacin	0.700 mg	4%
Pantothenic acid	0.596 mg	12%
Pyridoxine	1.235 mg	95%
Riboflavin	0.110 mg	8%
Thiamin	0.200 mg	17%
Vitamin A	9 IU	<1%
Vitamin C	31.2 mg	52%
Vitamin E	0.08 mg	0.5%
Vitamin K	1.7 µg	1.5%
Sodium	153 mg	10%
Potassium	401 mg	8.5%
Calcium	181 mg	18 %
Copper	0.299 mg	33%
Iron	1.70 mg	21%
Magnesium	25 mg	6%
Manganese	1.672 mg	73%
Phosphorus	153 mg	22%
Selenium	14.2 µg	26%
Zinc	1.160 mg	10.5%

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± 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 T_2 and T_3 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 T_2 (0.1% ginger) and T_3 (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 with 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 and 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. There was also distinct decrease in lipid peroxidation and enhancement of fibrinolytic activity in ginger treated animals. Authors suggested the protection was probably because of its free radical scavenging, prostaglandin inhibitory properties.

Akhani *et al.* (2004) reported that treatment with *Z. officinale* also caused a decrease in serum cholesterol, serum triglyceride and blood pressure in diabetic rats. The data suggest a potential antidiabetic activity of the juice of *Z. officinale* in type I diabetic rats, possibly involving 5-HT receptors stated by Akhani, S.P. *et al.* (2004).

Ginger has more than 50 antioxidants:

Jagetia *et al.* (2004) reported that ginger root extract was shown to have antioxidant activities in a cell study. It may contain more 50 antioxidants. In one study, ginger rhizome (*Zingiber officinale*) was found to protect mice against radiation-induced lethality. The irradiation of animals resulted in a dose-dependent elevation in the lipid peroxidation. However, treatment of mice with ginger rhizome before irradiation caused a significant depletion in lipid peroxidation.

Anti-bacterial properties of ginger:

Jagetia *et al.* (2003) reported that ginger root extract was demonstrated to have a dose-dependent antimicrobial activity against *Pseudomonas aeruginosa, Salmonella typhimurium, Escherichia coli* and *Candida albican*s.

Mahady *et al.* (2003) reported that a methanol ginger root extract containing gingerols inhibited the growth of all helicobacter pylori strains. In another in vitro study, ginger root extracts containing the gingerols inhibited the growth of H. *pylori* CagA+ strains.

Ginger may promote gastric intestinal motility:

Yamahara *et al.* (1990) reported that intake of ginger root *(Zingiberis Rhizome)* was found to enhance the transport of a charcoal meal in a study of mice.

CHAPTER III

MATERIALS AND METHODS

CHAPTER III

MATERIALS AND METHODS

The experiment was conducted under the Department of Physiology and Pharmacology, Faculty of Postgraduate Studies, Hajee Mohammad Danesh Science and Technology University, Dinajpur.

Study Area: The experimental poultry farm was under the department of dairy and poultry science, Hajee Mohammad Danesh Science and Technology University, Basherhat, Dinajpur.

Duration of Study: 31st October-2016 to 2nd Decmber-2016.

3.1 Collection and processing of plant materials

Garlic and ginger were selected for effectiveness as performance on broilers. Mature and disease free garlic and ginger were collected from Basherhat market, Dinajpur.

3.1.1 Preparation of Garlic supplement

For the preparation of dust, the garlic's were dried in sun for 10 days and followed by oven at 55-60°C for 2 days. The dried garlic's were pulverized with a blender to obtain the fine dust. Then dust was preserved in airtight plastic container until they were directly used for feed supplement.

3.1.2 Preparation of Ginger supplement

For the preparation of dust, the ginger were dried in sun for 10 days and followed by oven at 55-60°C for 2 days. The dried ginger was pulverized with a blender to obtain the fine dust. Then dust was preserved in airtight plastic container until they were directly used for feed supplement.

Experimental Layout

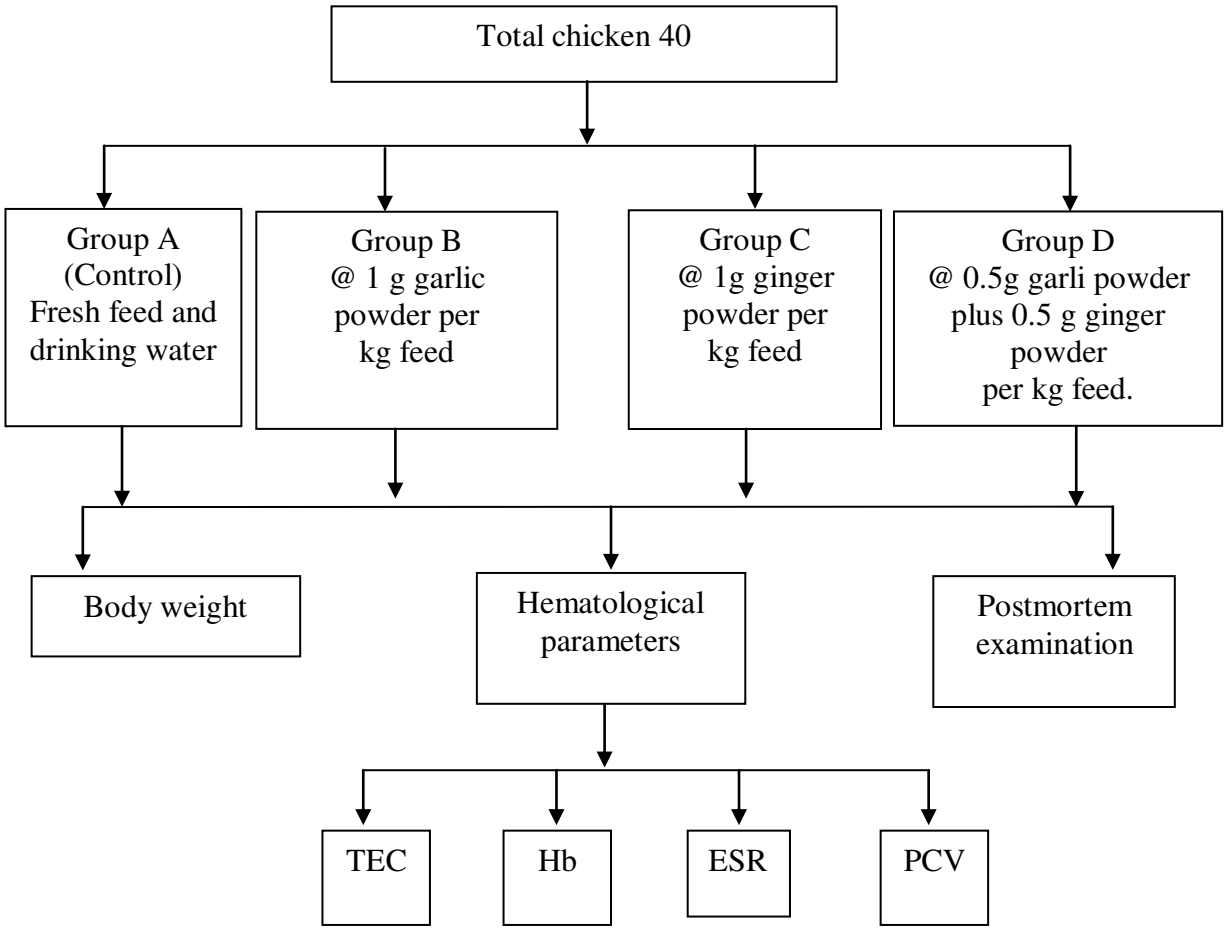

Figure 1: Layout of the experiment

3.1.3 Preparation of GG supplement

For the preparation of GG supplement previous procedure was followed and kept supplement for use in feed.

3.2 Preparation of the Experimental house and equipment:

An open sided house was partitioned into 4 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 cholorine solution (500ppm). The room was left vacant for 14 days. Later, it was again disinfected with Finis® solution (with 1 g/litre) 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.

3.2.1 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 poultry shed in HSTU. Day old broiler chicks were (40 in number) brought in the experimental shed. The body weight of all selected chicken ranged from 25 to 35g respectively. Then the broiler chicks were managed carefully. Immediately after shifting from the chicks boxes the chicks were provided Vitamin-C and glucose to prevent the stress occurring during transport. The chickens were allowed to take rest for the adaptation without any treatment. The broiler chicks were kept in the same compartment for 7 days and brooding temperature were correctly maintained. The litter management was also done very carefully. The starter and grower rations were supplied to the broiler chicken appropriately.

3.3 Experimental diets:

The commercial broiler starter and grower diets manufactured by power poultry feed Ltd. was purchased from the local agent of Dinajpur.

Composition of the diets/100 kg:

Ingredient	Amount
Maize	57 kg
Soybean Meal	20 kg
Rice Polish	17 kg
Soybean oil	1 kg
Di Calcium Phosphate (DCP)	800 g
Limestone	800 g
Lysine	100 g
Methionine	70 g
Toxin Binder	200 g
Autozyme	100 g
Vitamin Mineral Premix	1.53 kg
Meat and Bone Meal	1 kg
Salt	300 g

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 2 cm. The litter was disinfected with proper disinfectants. The litter was stirred three times a week from 14 days to prevent cake formation. Litter material when found damp was replaced by new litter, flowed by standard rules.

3.4.2 Floor space:

The space provided for each bird was 1.2 square ft. Therefore 10 birds required 10×1.2 square ft. This space were for ten birds. Each pen has equal space. The space for per birds were gradually increased related to the duration.

3.4.3 Brooding:

The bird was brooded with one 100 watt electric bulb in each pen from day old to 7 days. The bulb was just hanged just above the bird's level at the center of each pen. Brooding

temperature was kept 32^0C 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 12 hours of lighting and a dark period of 1 hour per day throughout the experimental period. After 7 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 waterer management:

For the first 2 days, feeds were given on tray feeders and water was supplied in a round. After two days of age, one feeder and one round waterer were provided for each replicate pen. Each waterer was placed on two flat bricks. Feeders were cleaned everyday 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 fresh feed and drinking water were supplied to the all birds. After seven days the dietary treatment were provided control group (A) provided with fresh feed and water, Group (B) 1g garlic per 1kg feed, Group (C) 1g ginger per 1kg feed and Group (D) 0.5 g garlic plus 0.5 g ginger per 1kg feed.

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 there after feeder was used to feed the birds. Leftover feeds were mixed with mictured 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 Immunization:

The birds were vaccinated against New castle disease at 5th day and infectious bursal disease (Gumbaro) at 10th day and infectious bursal disease (Gumbaro) again as 17th day finally New castle disease at 21st days of age.

3.4.8 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.

3.5 Experimental design

Fourty chicken's were randomly divided into 4 groups (A, B, C and D) for assessing the efficacy of garlic and ginger supplement as growth promoter on broilers.

Chickens of group 'A': 10 chickens were kept as control and were provided fresh feed and water.

Chickens of group 'B': 10 chickens were treated with garlic with 1g per 1 kg feed as supplement.

Chickens of group 'C': 10 chickens were treated with ginger with 1g per 1 kg feed as supplement.

Chickens of group 'D': 10 chickens were treated with 0.5 g garlic plus 0.5 g Ginger per 1 kg feed as supplement.

Figure 2: Picture of garlic

Figure 3: Grinding procedure

Figure 4: Picture of ginger

Figure 5: Grinding procedure

Figure 6: Day old chicks

Figure 7: Weighting broiler at grower stage

Figure 8: Experimental broiler shed

Figure 9: Final stage of broiler

Figure 10: Weight of broiler at 35th days of age.

Figure 11: Blood collection through wing vein.

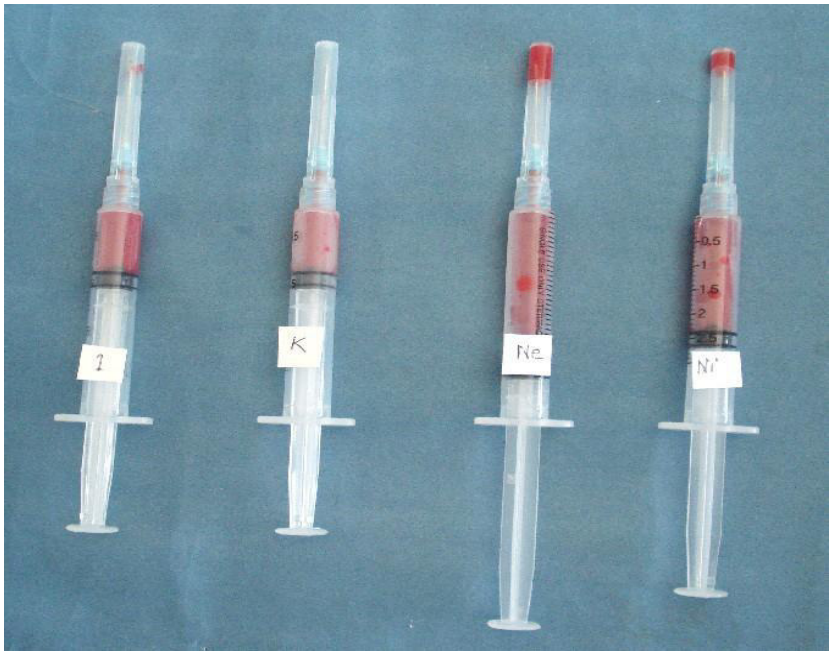

Figure 12: Blood samples for hematological tests

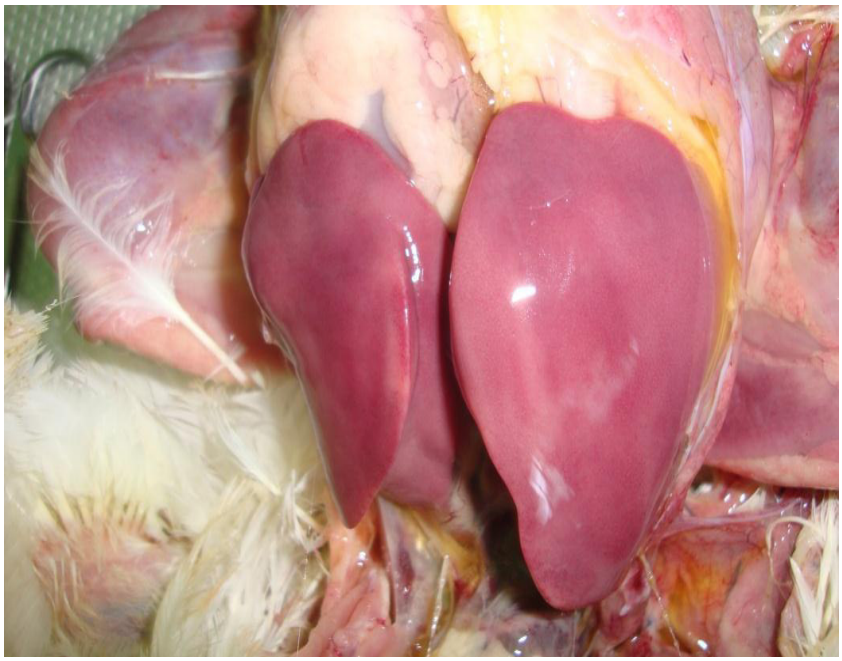

Figure 13: Visceral part after post mortem examination

3.5.1 Clinical examination

i) The effects of the garlic and ginger and GG as feed supplement on body weight, feed consumption and water consumption were recorded.

ii) Chickens under trial and control groups were weighed with Electric weighing machine. The weight of each chicken was taken before feeding in the morning, in noon and afternoon. The average of these three weights was calculated and recorded.

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

3.5.2 Hematological parameters

Blood samples were collected from wing vein of chicken of both control and treated groups at pre-feeding and during feeding period at 7 days interval to study the effect of the garlic and ginger 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 (10x) 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 (45x). 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 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 hydrochloric acid (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 haematocrit 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 haematocrit tube was placed in the centrifuge machine and was centrifuged for 30 minutes at 3000 rpm. Then, the haematocrit or PCV was recorded by reading the graduation mark; the percent volume occupied by the haematocrit was calculated by using the following formula as described by Lamberg and Rothstein (1977).

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

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.

3.6 Postmortem examination for side effects

Three chickens from each group were slaughtered to see if there were any pathological changes present on 21^{st} day and 28^{th} day of treatment. There was no significant pathological change in any internal organs of the chickens of treated groups.

3.7 Statistical analysis

The data were analyzed in completely randomized design (CRD) by using SPSS (Version 20).

CHAPTER IV

RESULTS AND DISCUSSION

CHAPTER IV

RESULTS AND DISCUSSSION

This experiment was conducted to evaluate the efficacy of garlic, ginger and GG supplement as a growth promoter in broilar. The experiment was held at the small scale poultry farm of HSTU Campus, under the Department of Physiology and Pharmacology, Faculty of Postgraduate Studies. A total number of 40 DOC (Day Old Chicks) were randomly divided into 4 equal groups (A, B, C and D).

The experimental units were kept on a floor litter system in separate pens. A weight amount of the ration was offered to the birds twice a day and the left over feed was collected to calculate feed consumption of the birds. Fresh and clean water was made available at all the completed randomized design and data about per replicate body wt. weekly feed consumptions were recorded during the experimental period.

The birds using ration supplemented with 1g of garlic, ginger and GG supplement (group B,C,D) gained the highest live wt. among the treated groups (Table- I).

In Group A (Control group, n=10) live weight were measured and found as initial live wt.27±1.80g, final live wt. 2217±0.08g, weight gain 2043±7.22g and FCR- 1.67

In Group B (n=10) initial live wt. 30±1.10g, final live wt 2487±0.05g, weight gain 2312±7.22g and FCR -1.57

In Group C (n=10) initial live wt. 28±1.80final live wt 2511±58.02g, weight gain 2338±50.72g and FCR-1.521.

In Group D (n=10) initial live wt.29±1.10g final live wt 2524±0.03g, weight gain 2344±36.87g and FCR-1.49

Statistical analysis of the data did not show any difference ($P<0.5$) between the dressing percentages of the birds of different feeding groups (Table II).

Statistical analysis of the data did not show any difference between the relative gizzard weights of the birds of different feeding groups (Table II).

Economics of Production:

The average rearing cost of broiler kept under different treatment groups A, B, C and D were 226.88Tk, 241Tk, 238.44TK, and 238.76Tk (Table III). Including the cost of labour because the experiment was conducted on the local poultry farm shed at Basherhat, Dinajpur. Miscellaneous cost summed up Tk. 15 per broiler, which included the estimated cost of electrically gas, litter disinfectant. The average live weight of broilers in group A, B, C and D were 2.217 kg, 2.487**kg, 2.511kg and 2.524*kg respectively. The broiler was sold in live weight basis at the rate of TK 120/kg. The net profit/Kg live weight in the respective group excluding the cost of labours was found taka 39.16, taka 57.22, taka 62.88, taka 64.12 respectively. The level of garlic, ginger and GG supplement used is the ration exhibited their effect on the profit margin of the broiler.

4.1 Effect of garlic, ginger and GG supplementation on the performance of broiler

The observations for live body weight (g) means of A,B,C and D groups after thirty two days of the experimental period were2217±0.08g, 2487±0.05g**, 2511±58.02g and 2524±0.03*g respectively. It is observed from the results in Table I, that supplementation of Garlic (*Allium sativum*), Ginger and Garlic + Ginger supplement in B,C,D group of broilers significantly ($P<0.01$) increased the mean live weight as compared to control (A) group. Similarly Manwar *et al.,* (2005) supplemented Garlic, Ginger and GG with 1 g per kg feed supplement and reported significant increase in the live body weight of broilers in the treated groups when compared with control group. It is observed from Table I. that the final live weight gains in weight (g) for A and D groups were 2217±0.08g and 2524±0.03*g respectively

The treatment groups of broilers (D) showed numerically highest body weight gain as compared to control (A) group.

Table 1: Initial and final live weight, weight gain, feed consumption and feed conversion ratio of broilers fed different levels garlic, ginger and garlic + ginger supplements from initial to 35th days of age

Variables	Control (A)	Treatment Groups		
		B	C	D
Initial live weight (g) of day old chicks	27±1.80	30±1.10	28±1.80	29±1.10
Live weight (g) on 7th day	174±7.30	175±7.30	173±7.30	178±7.30
Final live weight (g) on 35th day	2217±0.08	2487±0.05**	2511±58.02	2524±0.03*
Weight gain (g)	2043±7.22	2312±7.25**	2338±50.72	2344±36.87*
Feed consumption (g)	3710	3910	3820	3780
Feed conversion ratio (FCR) g feed consumed/g weight gain	1.67	1.57	1.521	1.49

Mean values within the same row, which have different superscripts, were significantly different ($P<0.05$). **=Significant at 1% level ($p<0.01$), *=Significant at 5% level ($p<0.05$).

Table 2: Dressing percentages and relative weights of heart, gizzard, liver, spleen and pancreas of broilers on 35th day of different treated group compare to control group.

Variables	Control	Treatment Groups		
	A	B	C	D
Carcass Weight	1.4±0.02	1.615±0.04	1.50±0.02	1.625±0.04
Relative heart weight	17.00±1.08	19.50±1.04	19.50±1.04	20.10±1.04*
Relative gizzard weight	45.00±1.87	46.50±1.47	46.25±0.8	47.25±0.8**
Relative liver weight	65.25±1.70	67.50±3.24	66.50±2.19	68.50±2.19*
Relative spleen weight	0.12±0.005	0.12±0.006	0.12±0.040	0.15±0.040
Relative pancreas weight	0.28±0.018	0.29±0.019	0.29±0.029	0.31±0.029*

Mean values within the same row, which have different superscripts, were significantly different ($P<0.05$). **=Significant at 1% level ($p<0.01$), *=Significant at 5% level ($p<0.05$).

Table 3: The Data showing economics of broiler production among control group (A) and treatment group (B, C, D) from initial day to 35th days of age.

Description	A	B	C	D
Cost/chick (Taka)	56	56	56	56
Average feed consumed (Kg)/chicks	3710	3910	3820	3780
Feed price/Kg (Taka)	42	42	42	42
Cost of herbal growth promoters/Chicks(Taka)	0.00	6	7	9
Total Feed cost /Chick(Taka.)	155.82	164.22	160.44	158.76
Miscellaneous/Chicks (Taka)	15	15	15	15
Total cost/broiler (Taka)	226.88	241.22	238.44	238.76
Average live weight (Kg)	2217±0.08	2487±0.05	2511±58.02	2524±0.03
Sale price/Kg live wt. (Taka.)	120	120	120	120
Sale price/broiler (Taka)	266.04	298.44	301.32	302.88
Net profit/broiler (Taka.)	39.16	57.22	62.88	64.12
Profit/Kg live weight (Taka)	17.66	23.007	25.04	25.40

Mean values within the same row, which have different superscripts, were significantly different ($P<0.05$). In this and other tables, B = 1 g garlic, C=1g ginger, D = 0.5 g garlic and 0.5 g ginger. Supplementation with garlic, ginger and GG was found to be more profitable than control group A 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 garlic, ginger and GG were more beneficial in broilers production.

4.2 Study of garlic, ginger and GG supplement on hematological parameter of broilers

Observation of hematological parameter (RBC, Hb, PCV, ESR) on 21st day and 35th days did not show any significant difference ($P<0.05$) among the control (group A) and garlic, ginger and GG treated groups.

Table 4: Hematological parameters of broiler.

Days of post treatment	Treatment		Mean ± SE
21st day	RBC million/mm3	Control	191.35±6.37
		Garlic	197.30±7.52
		Ginger	197.32±7.54
		Garlic and ginger	198.33±6.54
	Hb (g%)	Control	6.00±0.14
		Garlic	6.46±0.06
		Ginger	6.47±0.07
		Garlic and Ginger	6.48±0.08
	PCV (%)	Control	16.33±0.88
		Garlic	19.00±0.59
		Ginger	19.10±0.60
		Garlic and Ginger	19.40±0.08
	ESR (mm in 1st hour)	Control	10.67±0.86
		Garlic	8.66±0.88
		Ginger	8.65±0.87
		Garlic and Ginger	8.85±0.08
35th day	RBC million/mm3	Control	288.70±13.87
		Garlic	345.66±12.11
		Ginger	346.67±12.12
		Garlic and Ginger	346.99±0.08
	Hb (g%)	Control	7.50±0.27
		Garlic	7.82±0.19
		Ginger	7.85±0.2
		Garlic and Ginger	7.89±0.2
	PCV (%)	Control	17.50±0.61
		Garlic	21.30±0.33
		Ginger	21.38±0.34
		Garlic and Ginger	21.42±0.2
	ESR (mm in 1st hour)	Control	7.00±0.60
		Garlic	3.95±1.00
		Ginger	3.90±1.01
		Garlic and Ginger	3.85±0.2

Supplementation of garlic, ginger and GG supplement in the treatment caused improvement in the feed efficiency as compared to that of control group. Similarly, Nagalakshmi *et al.,* (1996) reported increase in feed efficiency in garlic, Ginger and GG-Group A, B, C, D which is in agreement with the findings of the present study. Birds supplemented with garlic, ginger and GG supplement had higher body weight, weekly gain in weight, feed consumption and feed efficiency. These results may be due to antimicrobial and Anti-Protozoal properties (Kumar *et al.,* 2005) of garlic, ginger and GG, which help to reduce the microbial load of birds and improved the feed consumption and feed efficiency of the birds. It was concluded that supplementation with 1 g of garlic, ginger and GG supplement in feed of the treatment groups caused significant increase in live body weight and improvement in weight gain and feed efficiency as compared to that of control group of broiler.

Garlic, ginger and GG supplement has effects as alternative growth promoter. The feed supplement showed no mortality, without any antibiotic and also taking proper bio-security. This result may be due to antibacterial, anti-inflammatory, anti-stress, antifungal, insecticidal and liver tonic properties of garlic, ginger and GG supplement which help to reduce 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 garlic, ginger and GG supplementation.

CHAPTER V

CONCLUSION AND RECOMMENDATION

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Keeping one group as normal control group (A) and others three groups (B, C and D) as group subjected to treatment with garlic, ginger and GG supplement. The group of B was supplemented with garlic powder with 1 g per kg feed as supplement, C was supplemented with ginger powder with 1 g per kg feed as supplement , GG powder with 1 g per kg feed as supplement and the group of A was provided with the fresh water. Weekly observations were recorded in live body weight for 35^{th} days and blood parameters of birds at 21^{st} and 35^{th} days. The treatment group B,C,D recorded statistically significant ($p<0.05$) increase for live body weight than that of control group A. Net live weight gain was increased in garlic, ginger and GG treated group (2312±7.25g**, 2338±58.02g 2344±36.37g*) than control group is 2043±7.22g and profit/ Kg live broiler was. Tk.23.00, Tk. 25.04, Tk. 25.40 in treatment group and in control group was Tk. 17.66.

This research work showed that continuous treatment with garlic, ginger and GG supplement produced a significant ($p<0.05$) increase in live body weight but there is no significant ($p<0.05$) change on blood parameters.

Further research work will be done related to determine blood pressure, cholesterol level, Triglyceride, HDL, LDL.

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