USE OF TULSI LEAVES JUICE AS GROWTH PROMOTER ON PRODUCTION PERFORMANCE IN SONALI CHICKEN

A THESIS

BY

MD. ABU BAKKAR SIDDIK
Registration No. 1605473
Semester: Jan – June, 2018

MASTER OF SCIENCE (M.S.)

IN

POULTRY SCIENCE

DEPARTMENT OF DAIRY AND POULTRY SCIENCE
HAJEE MOHAMMAD DANESH SCIENCE AND TECHNOLOGY UNIVERSITY, DINAJPUR - 5200

MAY 2018

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A Thesis

Submitted to the Department of Dairy and Poultry Science
Hajee Mohammad Danesh Science and Technology University, Dinajpur in partial fulfillment of the requirements for the degree of

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DEPARTMENT OF DAIRY AND POULTRY SCIENCE
HAJEE MOHAMMAD DANESH SCIENCE AND TECHNOLOGY UNIVERSITY, DINAJPUR - 5200

MAY 2018

Dedicated to
My
Beloved Parents

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The Author

ABSTRACT

This study was conducted under the Department of Dairy and Poultry Science Hajee Mohammad Danesh Science and Technology University. Objective of the research was to evaluate the effect of tulsi leaves (*Ocimum sanctum*) juice supplementation in drinking water as a growth promoter in sonali chickens. For this purpose, 120 day old chicks were purchased from Rafid Hatchery Ltd. After 7 days of brooding the chick were randomly divided into four treatment groups namely, T_0, T_1, T_2, and T_3 having three replications in each treatment group. Brooded chick was randomly separated into replication wise in separate pen for rearing 8 weeks. Each treatment group contain 30 birds where as each replication contain 10 birds. Experimental birds in T_1, T_2 and T_3 were provided tulsi leaves juice @ 1.5, 3 and 4.5 ml per liter drinking water while T_0 was provided without tulsi leaves juice. The results of this study was indicated that final live weight gain and feed efficiency of birds was significantly ($p<0.05$) higher that received @ 3 ml/L tulsi leaves juice compared to control T_0 group. This result also indicated that body weight gain, feed intake and feed efficiency were increased at dose rate 3 ml/L tulsi leaves juice. Meat yield parameters there were no significant difference among the treatment group except breast meat weight and dressing percentage. In bacterial test *E. coli* and *Salmonella* load was decrease significantly in treatment group as compared to the control group. Data obtained feed cost, lowest was seen in tulsi leaves juice treated group T_2 and highest in untreated T_0 group. Net profit was found maximum in T_2 (26.52±1.20Tk.) then T_1 (20.36±1.33Tk.), T_3 (17.76±1.11Tk.) and T_0 (12.96±1.12Tk.) respectively. Based on the result it could be concluded that the supplementation of tulsi leaves juice 3 ml/L in drinking water has potential used as growth promoter for production of sonali chicken.

Keywords: Tulsi, sonali chicken, production performance *E. coli* and *Salmonella*.

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LIST OF ABBREVIATION AND SYMBOLS

AGP	: Antibiotic Growth Promoter
ANOVA	: Analysis of variance
CRD	: Completely Randomized design
Dr.	: Doctor
et al.	: Associates
Fig.	: Figure
G	: Gram
HSTU	: Hajee Mohammad Danesh Science and Technology University
kcal	: kilo-calorie
Ltd.	: Limited
ME	: Metaboilizable energy
ML	: Mille Litter
^{o}C	: Degree Celsius
Prof.	: Professor
SEM	: Standard Error of Means
Sl.	: Serial Number
Tk.	: Taka
%	: Percentage
&	: and
/	: Per/or
@	: At the rate of
+	: Plus/and
<	: Less than
>	: Greater than
±	: Plus-minus
µl	: Micro Liter

CHAPTER-I

INTRODUCTION

Poultry plays a vital role in the rural socio-economic system as maximum households are directly involved in poultry farming. Around 22 core poultry are remaining in Bangladesh (DLS, 2016). About 44 percent of daily human intake of animal protein comes from livestock products. The poultry industry has been supplying quality protein to the people of Bangladesh at the lowest price in the world. Poultry Industry is one of the fastest growing segments of the agricultural sector today in Bangladesh and has become a means of improving the economy of the farming community due to its enhanced production performance. Apart from improving the livelihood, it also provides proteinaceous food. However less mortality in layer type chicken plays a major role in determining the economic profitability.

Poultry egg and meat in recent years become important and popular food for the 68% of non-vegetarian population (Mohpatra, 2005). Consequently, meat plays an important role in Bangladesh meal not only as it due to its increasing capability in coping up with the ever increasing population but also as a fame of healthy, nutritious and protein rich food for the society and hence the quality of each food has to be tested as per as health point of view. Meat quality is assessed through physical (viz. pH, colour, tenderness, water holding capacity), chemical (viz. moisture, protein, ether extract, cholesterol, fatty acid, oxidative status, residuals etc.), organoleptic (viz. taste, flavor, juiciness etc.) and microbiological characteristics (Thakur *et al.,* 2008). Hence many researchers started to improve the meat quality by altering the meat composition by using herbal medicinal plant such as tulsi, aleo vera, black piper, ashwagandha (*Withania somnifera*), neem etc. The use of medicinal plants as feed additives is gaining popularity worldwide.

Feeding of herbal additives to poultry are that they cause the intestinal tract health and suppress harmful bacterial growth in the digestive system, counteract adverse effect of antibiotics, nutrient synthesis, stimulate immune system, decreased diarrhea and mortality. Further, they improve the feed intake, feed conversion ratio, body weight and lower cholesterol in blood, serum and meat, and increase the tenderness and meat quality along with carcass yield. So that feeding of herbal additives is highly beneficial for economic production of poultry.

Since ancient times herbs and their essentials have been known for their varying degree of antimicrobial activity (Juven *et al.,* 1994). More recently, medicinal plants extracts were developed and proposed for use in food as natural antimicrobials (Hsieh *et al.,* 2001). Tulsi has attracted worldwide prominence due to its vast range of medicinal properties without showing any adverse effects. Tulsi also promotes growth and feed efficiency of birds because of their antibacterial properties (WHO, 1997). In modern animal feeding, plant 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 poultry industry creates numerous employment opportunities in Bangladesh (Shamsuddoha and Sohel, 2003). Peoples in our country reared deshi chicken for egg and meat purpose and consumer have high demand on its, but the production performance of deshi chicken could not fulfill consumer demand. As like desi, sonali chicken are reared recent year. The Sonali is a cross-breed of Rhode Island Red (RIR) cocks and Fayoumi hens and has a similar phenotypic appearance to that of local chickens, it was introduced in 1996–2000 in northern parts of Bangladesh, through SLDP and PLDP. Sonali birds are well adapted to the country's environmental conditions so require less care and attention than other breeds, making them easier for women and children to rear (Saleque and Saha, 2013). Traders can sell Sonali at higher prices than broiler chickens. The Sonali population has been increasing and in 2010 about 150.9 million Sonali DOCs were produced, representing about 35 percent of the country's total commercial broiler and layer production (Huque, 2011).

Poultry farmers are interested in sonali chicken production due to its high market price, smaller marketing age, less space requirement, less feed requirement, high quality meat production and lower mortality. Many synthetic drugs and growth promoters are supplemented to the sonali 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. More recently, medicinal plants extracts were developed and proposed for use in food as natural antimicrobials (Hsieh and Mau 2001). Tulsi has attracted worldwide prominence due to its vast range of medicinal properties like antibacterial, antiviral, antifungal, antiprotozoal, hepatoprotective and various other properties without showing any adverse effects (Kale *et al.*, 2003). Also tulsi promotes growth and feed efficiency of birds because of their antibacterial properties (Prasannabalaji *et al.*, 2012).

This research work was provided useful information on efficacy of tulsi leaves juice as a growth promoter and its safety in sonali chickens. The main objective was adding feed additives is to boost animal performance by increasing their growth, better feed conversion efficiency, greater livability and lowered mortality in poultry birds. Considering the fact, the work has been undertaken with the objectives.

I. To know the production performance of sonali chicken supplemented with tulsi leaves juice.
II. To observe the effects of tulsi leaves juice on *E. coli* and *Salmonella* colony count in faeces of sonali chicken.

CHAPTER-II

REVIEW OF LITERATURE

At present days, herbal plants feed additives was used as an alternative feeding strategy to replace antibiotic growth promoters. Effect of phytobiotic feed additives on production performance in poultry was reported by Hashemi and Davoodi (2010). Use of plant extracts as feed additive is a new attention drawing field that has attracted animal nutritionist throughout the world. Tulsi have anticancer properties, causes reduce blood glucose levels, and total cholesterol levels and promotes immune system function. It increases the dressing percentage, liver weight spleen weight. A selected review of the past research works related to the present study is discussed below:

2.1 History of tulsi

In Bangladesh tulsi is one of the chief sources of large number of drugs and medicine. It has very effective and remedial uses which is safe and effective, inexpensive in relation to its availability (Kumar *et al.,* 2011). Due to its medicinal values tulsi is important plant among other herbs known for the medicinal properties. It is belongs to the Ocimum genus and family Lamiaceae identified for their medicinal significance. There were two main varieties of tulsi have been identified i.e. black (Krishna tulsi) and green (Rama tulsi), both have similar chemical constituents (Mondol *et al.,* 2009). In a Sanskrit language tulsi is described as "matchless one". The medicinal values of the tulsi properties have attributed not only in Ayurveda and Siddha but also in Greek, Roman and Unani systems of medicine (Vishwabhan *et al.,* 2011). In China tulsi was used first the natural herbal preparations as medicines have therapeutic uses. In the old literatures tulsi has described 4000-5000 B.C and (Monga *et al.,* 2011). Rigveda was the first referred and said to be written between 3500-1600 B.C (Sirkar NN, 1989). Tulsi (*Ocimum sanctum*), is believed the "Queen of Herbs", the Legendary, "Incomparable One" is one of the holiest and highly respectable for most therapeutic and restorative herbs distributed mainly in the all regions of Bangladesh (Jeba *et al.,* 2011). Tulsi a widely grown, sacred plant, is found growing in environment having moist soil nearly all over the world (Naquvi 2012), which is original from its wild form (Vana tulsi). Ocimum genus have about 50 to 150 species of herbs and shrubs from the tropical regions of Asia (Bailey 1924). Tulsi has square stems, fragrant opposite leaves and whorled flower on spiked inflorescence (Darrah 1980). The essential

oil of tulsi is extracted by steam distillation from the leaves and flavouring tops are used into foods, dental and oral products, in fragrances and in traditional rituals and medicines (Guenthar 1949, Simon *et al.,* 1990). Extracted essential oils have also been shown to contain biologically active constituents that are insecticidal (Chogo *et al.,* 1981), nematicidal (Chatterjee *et al.,* 1982) and fungicidal (Reuvwni *et al.,* 1984). The chemical constituent in tulsi is essential oil which has methyl chavicol, eugenol linalool, camphor and methyl cinnamate.

2.1.1 Botany of tulsi

Tulsi is a member of the family Lamiaceae (Labiatae) and is closely related to the common basil (*Ocimum basilicum*). It is an upright, 30-60 cm tall plant covered with soft hairs. The stems are square in transaction, and the leaves are opposite, elliptical-oblong with relatively long petioles and serrated leaf margins. The flowers appear in racemes arising in whorls on the terminal part of the stems and are labiate, bilaterally symmetrical and purplish in colour.

2.1.2 Chemical composition of tulsi

Ocimum sanctum (tulsi) has specific aromatic odour because of the presence of essential or volatile oil, mainly concentrated in the leaf. This aromatic volatile oil mainly contains phenols, terpenes and aldehydes. The oil extracted from seeds is called fixed oil and mainly composed of fatty acids. Besides oil, the plant also contains alkaloids, glycosides, saponins and tannins. The leaves contain ascorbic acid and carotene as well. The present information about the chemical properties is based on the various studies that have been done in different parts of the world (Kothari *et al.,* 2004) and it is likely that chemical constituents may be varying due to edaphic and geographic factors (Bakkali *et al.,* 2008).

2.2 Use of tulsi in pharmacology

Pharmacological studies have revealed that animals treated with tulsi extract were useful for both physical and chemical stress relievers. A leaf extract has been acts as stimulant to release of ACTH from pituitary cells in vitro (Wagner *et al.,* 1994). The evidence shows that the non-toxic nature of the tulsi plant and its extract, makes an excellent example of an adaptogenic medicinal plant.

2.3 Tulsi use as a medicine

Subhash *et al.*, (2016) undertaken an experiment to evaluate the effect of herbal medicine. Herbs used within Ayurveda, tulsi (*Ocimum sanctum Linn*) is most excellent, has been proved for its beneficial effects. There is lot of literature showing that tulsi can address physical, chemical, metabolic and psychological stress through a unique combination of pharmacological actions. It has been found that tulsi can protect organs and tissues against chemical stress from industrial pollutants and heavy metals, and physical stress from prolonged physical exertion, ischemia, physical restraint and exposure to cold and excessive noise. Tulsi have broad-spectrum antimicrobial activities which includes activity against a range of human and animal pathogens. It has been also recommended for use as a hand sanitizer, mouthwash, water purifier, wound healing, preservation of food. Farming of tulsi has both religious and practical importance that connects the cultivator to the innovative powers of nature. Organic farming of tulsi can offers solutions for food security, rural poverty and hunger alleviation, prevention of environmental degradation and climate change. The use of tulsi in daily rituals is a witness to Ayurvedic intelligence and provides an example of ancient knowledge offering solutions to modern problems. Keeping above tulsi is requires to commercialize and increase area under organic cultivation, increase income and livelihood cultivators, prevention of soil & environment degradation. Use of tulsi in various ayurvedic medicines which makes Indian cultivators empowered by selling herbs and disease free society by using tulsi as medicines.

2.3.1 Use of tulsi in coughs

Tulsi has important component of many Ayurvedic cough syrups and expectorants. It helps in bronchitis and asthma. It relieves from cold and flu after chewing of leaves.

2.3.2 Use in throat infection

Tulsi leaves taken in water boiled for few minutes and filter this extract is very beneficial in sore/painful throat and it is also use as gargle.

2.3.3 Use in respiratory disorder

Tulsi has been use for the treatment of respiratory disorder. Green leaves juice mixed with honey and ginger are very effective in bronchial asthma, cough, cold and influenza. If it is added with cloves and common salt also gives instant relief in influenza.

2.3.4 Tulsi use in fever and cold

Tulsi leaves are specific for many fevers in the rainy season; when malaria and dengue fever are widely prevalent. Tender leaves, boiled with tea, act as preventive against these diseases. In case of acute fevers, a decoction of the leaves boiled with powdered cardamom in half a litre of water and mixed with sugar and milk brings down the temperature. The juice of tulsi leaves can be used to bring down fever. Tulsi leaves extract in fresh water should be given to children, it is every effective in bringing down the temperature.

2.4 Tulsi uses in stress

Tulsi leaves juice are considered as an 'adaptogen' or anti-stress agent. In the recent studies conducted which reveals that the leaves juice gives significant defense against stress. If a healthy persons chew 10-12 leaves of tulsi, twice or thrice of a day, to prevent stress. It purifies blood and helps to prevent several common ailments.

Vasanthakumar *et al.,* (2013) studied an experiment on the performance of broiler chicken, fed tulsi leaf powder and leaf extract supplemented diets during summer to alleviate heat stress. They concluded that supplementation of tulsi powder (0.5%) and commercial grade tulsi extract (0.1%) in the diet enhances the overall performance, antioxidant status and immunity in commercial broiler chickens during summer.

2.5 Tulsi use as a growth promoter

Nath *et al.,* (2012) was conducted an experiment to identify the efficacy of tulsi (Vitexnegundo) leaves, black pepper (*Piper nigrum*) and cloves (*Curcuma longa*) extract (TBC extract) as a growth promoter in broilers. The result suggests that TBC extract played a vital role in gaining body weight in the treatment group in comparison to control group. For the hematological parameters (TEC, PCV, Hb and ESR) no significant change was observed between treatment and control 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.

Khatun *et al.,* (2013) was evaluated the effect of tulsi (*Ocimum sanctum*) and neem (*Azadirachta indica*) leaves extract as a growth promoter in broiler. A total of 40 day-old broiler chicks were randomly divided into four groups (n=10). No vaccination schedule

was practiced and no antibiotic was added in ration of group A, B, C, and D respectively. Group A served control without any supplements while group B, C and D were supplemented with combination of tulsi and neem extract @ 1 ml, 2ml and 3 ml/liter of drinking water. Live body weight gain was recorded weekly. The birds of group D utilized their feed more efficiently among the treatment groups ($p<0.05$). The net body weight gain in treated groups as compared to control group was significantly changed respectively. Hematological parameterss (TEC, PCV, Hb and ESR) were not significantly changed among the treated and control group suggesting no side effects of herbal extracts in broiler. It can be concluded that tulsi and neem extract is economic and safe in broiler production.

Singh *et al.*, (2014) was studied an experiment to evaluated the effect of Tulsi (*Ocimum sanctum*) leaf powder on muscle growth in broiler chicken. Results revealed a significant effect of Tulsi (*Ocimum sanctum*) leaf powder supplementation on weight of breast, thigh and leg ($P<0.05$) muscles which were significantly increased in feed supplemented with 1.0%Tulsi (*Ocimum sanctum*) leaf powder. It was thus 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 for meat yield.

Alom *et al.*, (2015) research work was conducted that tulsi leaves extract as a growth promoter in broilers. They concluded that supplementation of Tulsi (*Ocimum sanctum*) leaf extract @ 2ml/liter in drinking water in broiler cause significant increase in live body weight and significant change in hematological parameters. Thus, tulsi leaves extract supplementation in the broiler ration may be useful for the safe, economical and efficient production of broiler and this formulation can be used as an alternative to antibiotic growth promoter.

Hasan *et al.*, (2016) was evaluated the effect of tulsi leaf (*Ocimum sanctum*) extract supplementation in drinking water as a growth promoter in broiler chickens. They show that supplementation with tulsi leaf extract @ 2ml/L in drinking water causes significant increase in live body weight and improvement in weekly weight gain and feed efficiency as compared to that of control group of broiler. Thus, tulsi leaf extract supplementation in the broiler rations may be useful safe, economical and efficient production of broiler.

Gupta and Charan (2007) was elucidated that feed supplementation with different doses of *Ocimum sanctum*, only particular dose rate of 200 mg/bird daily of dried leaves of

Ocimum sanctum for 15 days revealed the highest and consistent weight gain at all specified intervals. Also, at same dose rate the chickens had not shown any hematological, biochemical, histopathological, gross as well as clinical harmful effect.

Lanjewar *et al.,* (2008) was demonstrated the efficacy of dietary supplementation of Tulsi (O. sanctum) leaf powder (TLP) on the growth performance and serum lipid profile in broilers. One hundred twenty day old broiler chicks were randomly distributed into three experimental groups. T1 (control) received the standard broiler diet, T2 and T3 groups were fed on standard broiler diet supplemented with TLP at the rate 0.5% and 1.0% of the diet. They observed that live body weight and weekly weight gain increased significantly ($P<0.01$) with the supplementation of TLP. The FCR improved significantly in 1.0% TLP supplemented group with no significant difference in feed intake of the birds. The total serum cholesterol, serum LDL-cholesterol and serum triglycerides decreased significantly ($P<0.01$) in TLP supplemented group @ 1% of the diet. There was significant increase in serum HDL-cholesterol in the TLP supplemented groups.

Bhosale *et al.,* (2015) experiment was evaluated the effect of addition of Tulsi (*Ocimum sanctum*) leaf powder and Vitamin E in diet of Broiler. One hundred eighty, day-old broiler chicks divided into three groups with three replicates of 20 chicks were used to evaluate the comparative efficacy of dietary addition of tulsi (*Ocimum sanctum*) leaf powder and vitamin E (α-tocopherol acetate). The birds were fed basal diet, basal diet + tulsi leaf powder @ 5 g/kg of feed and basal diet+ vitamin E (α-tocopherol acetate) @ 100 mg/kg of feed in treatments T1, T2 and T3, respectively. Dietary addition of tulsi leaf powder and vitamin E in the diet of broilers showed higher ($P<0.05$) weight gain and net profit per bird compared to the basal diet during early growth phase.

Mamtakumari *et al.,* (2017) was conducted an experiment to evaluate the effect of *Ocimum sanctum* leaves powder/extract on body weight when supplemented to broiler chicken in feed/water. O. sanctum belongs to family lamiaceace and contains compounds such as carnosol, ursolic acid, rosmarinic acid, apigenin, eugenol, cirsilineol and cirsimaritin which are known to possess antioxidant properties. The reduced oxidative stress due to supplementation of this plant to broilers is found to enhance the growth rate and thus result in higher body weight.

Sakthi *et al.,* (2017) carried out an experiment to elucidate effect of herbal supplements in poultry to replace the antibiotic growth promoter. Hence this study was carried out to find

the effect of a blend herbal preparation *(Ocimum sanctum, Zingiber officinale, Allium sativum, Trigonella foenum graceum* and *Curcuma longa*) on the vital parameters in layers. An experimental trial for three weeks was carried out on 80 layers aged 11 weeks. The significant increase in the vital parameters, decrease in hepatic enzymes inside the clinically healthy condition denote that the birds were in good health. Birds increased nutrient utilization, improved oxygen carrying capacity and caused active immune system. The better absorption of minerals like calcium and phosphorus signifies the role of herbs in enhancing digestion performance. Oral feeding caused a normal activity of hepatic enzymes which can prove safety and hepatoprotective nature of these herbs. Therefore, it can be concluded that supplementation of these herbs in the layer feed could be important in prevention of diseases in birds. However further studies are recommended to indicate the toxic levels of these herbs and optimize the beneficial dosage in diet of layer birds.

Biswas *et al.,* (2017) That study was conducted to determine the efficacy of tulsi (*Ocimum sanctum*) leaves extract as a growth promoter in broilers. Fourty number of day old broiler chicks were taken and after seven days divided into two groups A and B. The B group was supplemented with tulsi leaves extract @ 1ml/litre in drinking water. No significant difference in hematological changes was observed in both treatment and control group in 1st week of age but significant change in body weight gain was observed on 35th day. Bacterial sensitivity test was positive in case of Escherichia coli and produced zone of inhibition 0.5 cm and other was negative.

Tirupati Reddy *et al.,* (2012) an experiment was conducted with three types of herbal preparations *viz* Amla, Turmeric and Tulsi either alone or in combination with nine dietary treatments to study the performance of broilers(n=216). The better body weight gain ($P<0.05$) and higher feed intake ($P<0.01$) were significant in 0.25% herbals combination groups compared to control group throughout the experimental period. However, the best feed efficiency ($P<0.01$) was noticed in 0.25% Tulasi leaves powder and 0.25% herbals combination groups compared to control group. The feed cost per kg live weight gain was lowest in the 0.25% herbals combination groups compared to other groups. The different types of herbals either alone or in combinations at 0.25% and 0.5 % levels did not influence the carcass traits, SGOT, SGPT, Serum Cholesterol and Immune response (HI titre to ND Vaccination) .It is inferred that supplementation of Tulasi leaves powder or herbals combination at 0.25% level in broiler diets can reduce the cost of production without affecting their performance.

2.6 Tulsi use as a bacterial inhibitor

Kishwar *et al.,* (2004) study was elucidated the effect of Bio-Mix (herbal extract) on the growth performance during bacterial enteritis in broiler chickens. Bacterial enteritis induced by oral administration of 2 ml Escherichia coli and Salmonella typhi suspension (109 organisms/ml) showed negative effects on the growth rate of broiler chicks. 140ml bacterial suspension was also mixed in drinking water. Bio-Mix was used against bacterial enteritis, after 24 h at 100 g/50 kg feed for 7 days. Supplementation resulted in the control of disease. Loose dropping, less feed intake and reduced growth rate were observed in diseased birds compared to treatment (Bio-Mix) group.

Mamta *et al.,* (2010) carried out an experiment to evaluate the effects of dried Tulsi (*Ocimum sanctum*) leaf powder on pathology of Salmonella gallinarum in chickens. Based upon the investigation, they concluded that Tulsi dry leaf powder had protective effects on pathology of experimental S. gallinarum infection in broiler chickens as evident from reduced severity of gross and histopathological lesions in chicks fed Tulsi leaves and inoculated with S. gallinarum.

Sakthi *et al.,* (2017) study was undertaken to optimize the level of feeding of the herbal preparation (*Ocimum sanctum*, Zingiber officinale, Allium sativum, Trigonella foenum graceum and Curcuma longa) in different doses @ 0.1percent, 0.25 percent and 0.5 percent in layer feed to reduce the faecal total bacterial count, faecal coliform count and screening for the presence of E. coli. The study was conducted in eleven weeks old Lohman breed growers at 11 weeks of age with 20 birds per group. Control group was fed only with the regular feed without any herbal preparation and the treatment groups I, II and III were fed with the herbal preparation in different levels as mentioned above in the regular feed. The experimental trial was conducted for twenty one days and the data were collected from a sample of six birds from each group. There was a significant reduction ($p<0.01$) in faecal total bacterial count and faecal coliform count in all the groups with the highest reduction nearing to one log in the group III when compared to the control. There was presence of E. coli in the contol and absence in the treatment groups. Thus, 0.5 percent level of the herbal preparation in the feed can be claimed as the optimum level of feeding in the layer chickens to combat enteric infections. However, further study is required to make concrete recommendation for commercial layer chicken productivity.

Singh *et al.,* (2013) Experiment was conducted to evaluate the antimicrobial activity of tulsi. *Ocimum sanctum* L. is an aromatic plant in the family Lamiaceae. The main chemical constituents of Tulsi are: Oleanolic acid, Ursolic acid, Rosmarinic acid, Eugenol, Carvacrol, Linalool, and β-caryophyllene, have been used extensively for many years in food products, perfumery, and dental and oral products. Recent studies suggest that Tulsi may be a COX-2 inhibitor, like many modern painkillers, due to its high concentration of eugenol. The present study was to evaluate the qualitative estimation of phytochemicals and antimicrobial activity of aqueous and methanol extracts of root and leaves of *Ocimum sanctum* against pathogenic bacteria i.e. Escherichia coli, Proteus mirabilis, Staphylococcus aures. Study has been shown the presence of steroids, alkaloids and tannins. Significant antimicrobial activity of plant extract has been observed.

2.7 Tulsi use as an antioxidant

A number of studies have demonstrated, either directly or indirectly, that tulsi good antioxidant activity. Tulsi demonstrated protective effects against copper sulphate toxicity in rats (Shyamala *et al.,* 1996). Copper sulphate caused the development of free hydroxyl radicals and subsequent increased lipid peroxidation and led to rises in levels of antioxidant enzymes such as superoxide dismutase and catalase. Administration of tulsi restored the various parameters to near normal values.

Gupta *et al.,* (2006) was conducted an experiment that demonstrated the antihyperlipidaemic and antioxidant effect of *Ocimum sanctum* Linn Seed Oil (OSSO) in rabbits. Administration of OSSO (0.8 g/kg body weight/day) for four weeks, in cholesterol (100 mg/kg body weight/day) fed rabbits significantly decreased serum cholesterol, triacylglycerol and LDL+VLDL-cholesterol as compared to untreated cholesterol fed group. There was significant fall in atherogenic index in OSSO treated group. In addition, treatment with OSSO decreased lipid peroxidation and increased reduced glutathione content in blood. Antidiabetic effect of *Ocimum sanctum* seed oil was evaluated in alloxan diabetic rabbits. Two weeks treatment of diabetic rabbits with OSSO (0.8 gm/kg/day) showed no significant hypoglycaemic effect. Results of the study showed that OSSO has hypocholesterolaemic and antioxidant effects but it does not have antidiabetic effect.

Lanjewar *et al.*, (2009) carried out an experiment to demonstrated the efficacy of dietary supplementation of tulsi (*Ocimum sanctum*) leaf powder on meat cholesterol and serum lipid profile of broiler from day old to 42nd day of age. The study concluded that

supplementation of tulsi leaf powder at the rate of 1% in broiler diet for 42 days reduced meat and blood cholesterol levels of broiler.

Reddy *et al.,* (2009) carried out an experiment to evaluate the effect of dietary supplementation of Tulasi (*Ocimum sanctum*) and selenium on antioxidative enzyme levels in broiler chickens. It is concluted that dietary supplementation of *Ocimum sanctum* at 0.5% level and its combination with selenium (0.3 ppm) can combat oxidative stress in broilers there by increasing the antioxidative enzyme levels.

2.8 Use in antidiabetic activity

Oral administration of tulsi extract led to marked decreaseing of blood sugar in normal, glucose fed hyperglycemic and streptozotocin-induced diabetic rats. A randomized, placebo controlled, cross over single blind human trial indicated a significant decrease in fasting and postprandial blood glucose levels by 17.6% and 7.3%, respectively. Urine glucose levels showed a similar trend. Further, tulsi has aldose reductase activity, which may help in reducing the complications of diabetes such as cataract, retinopathy, etc (Halder *et al.,* 2003).

Leaves of tulsi have been shown to possess hypoglycaemic effects in experimental animals (Kochhar *et al.,* 2009). Decoction prepared with various parts of plant lowers the blood sugar level. A study conducted on rats has suggested that constituent of *O. sanctum* leaf extracts have stimulatory effects on physiological pathways of insulin secretion (Mondal *et al.,*1993).

Various studies have been performed on the antiglycemic properties of Ocimum but its mechanism of action has not been elucidated as yet. Study conducted with tulsi plus neem has suggested that this combination is better for the diabetic patients in lowering the sugar level (Singh *et al.,* 2007).

Sethi *et al.,* (2004) study was elucidated *Ocimum sanctum* leaves have been traditionally used in treatment of diabetes mellitus. Dietary supplementation of fresh tulsi leaves in a dose of 2 g/kg BW for 30 days led to significant lowering of blood glucose levels in test group. Intake of *Ocimum sanctum* also led to significant increase in levels of superoxide dismutase, reduced glutathione and total thiols, but marked reduction in per-oxiodised lipid levels as compared to untreated control group. The observations establish the efficacy

of *Ocimum sanctum* leaves in lowering blood glucose levels and antioxidant property appears to be predominantly responsible for hypoglycemic effect.

Rai *et al.,* (1997) experiment was evaluated the effect of Tulsi (*Ocimum sanctum*) leaf powder supplementation on blood sugar levels, serum lipids and tissue lipids in diabetic rats. This study used at 1% level of tulsi leaf powder in normal and diabetic rats to explore the effect on fasting blood sugar, uronic acid, total amino acids, and the lipid profile in serum and tissue lipids. The results indicated a significant reduction in fasting blood sugar, uronic acid, total amino acids, total cholesterol, triglyceride, phospholipids and total lipids. In liver, total cholesterol, triglyceride and total lipids were significantly lowered. Total lipids were significantly reduced in kidney. In heart, a significant fall in total cholesterol and phospholipids was observed. All these observations indicate the hypoglycemic and hypolipidemic effect of Tulasi in diabetic rats.

2.9 Tulsi use as an immunomodulator

Mode *et al.,* (2009) was conducted an experiment to determine the herbal immunomodulator in immunosuppressed broiler birds in terms of body weight gain. The study was conducted with *Ocimum sanctum* and *Emblica officinalis* @ 3 gm /kg feed for 2 weeks were found to be effective immunomodulator in increasing body weight gain in broiler birds.

Singh and Doley (2012) was conducted and study to elucidate the immunomodulator of broilers fed diets supplemented with a 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. Birds were vaccinated with ND virus and serum was assessed for humoral immune response (HI). Cell mediated immune response (CMI) was assessed an increase in IDF thickness after and before PHA-P injection. Supplementation of Tulsi at either dose showed improved HI and CMI responses. Increasing the supplementation level of herbal Tulsi (from 0.25 to 1%) improvement HI and MI. The humoral immune response (HI) and cell mediated immune response (CMI) significantly higher in 1% Tulsi leaf powder group (T4) as compared control (T1) in a column (4th week & 6th week). The study concluted that Tulsi at 1% could be used as natural supplement to improve immune response in broiler chicken.

Arivuchelvan (2013) carried out an experiment to determine the immunomodulatory effect of *Ocimum sanctum* in broilers exposed to high dose of gentamicin which is common in poultry practice of Tamilnadu. Two hundred and seventy day old broiler chicks of either sex were randomly divided into nine groups of 10 each with three replicates. Different doses of gentamicin (30 mg/kg & 50 mg/kg) single intramuscular injection, different inclusion level of *Ocimum sanctum* crude extract (1 and 2 %) in feed and their combinations were tested. The results of the study revealed that gentamicin treatment produced significant reduction in serum total protein, albumin and globulin and numerical decrease in HI (Haemagglutination Inhibition) titre against Newcastle vaccine. The groups treated with *Ocimum sanctum* alone showed significant increase in all the above parameters. Dose dependent increase in all the parameters were noticed in the combination groups which clearly supports the immunoprotective effect of *Ocimum sanctum*.

2.10 Tulsi use as a feed additive

Pandian *et al.,* (2013) carried out an experiment to determine the effect of phytobiotic viz. Tulsi, Turmeric and Garlic as feed additive on part of production performance in Rhode Island Red (RIR) layers. They concluded that inclusion of 0.1% Tulsi and 0.2% Turmeric to the laying hens diet is economical and showed production performance than control diet.

Eevuri and Putturu (2013) was carried out an experiment to evaluate the effect of herbal remedies (Turmeric, Tulsi, Amla and Aloe vera) in broiler feed. They concluded that herbal preparations increased the feed intake. These preparations decreased the mortality rates and the cost of feed decreased from 6.2% to 13.5%. They reported reduced fat accumulation, increased dressing percentage, liver weight, spleen weight and whole giblet weights in broilers.

Pakrawan *et al.,* (2017) The present investigation entitled “effect of different herbals feed additives on body weight gain and dressing percentage of Giriraja poultry birds” was carried out to assess the effect of feeding coriander and Tulsi seed powder on body weight gain and dressing percentage. The effect of coriander and Tulsi seed powder feeding on dressing percentage was found to be beneficial and positively effect on dressing percentage of poultry birds. Supplementation of 2 per cent Tulsi seed powder was found more beneficial to live body weight gain and dressing percentage of Giriraja poultry birds.

Safaei *et al.*, (2013) experiment was carried out to evaluate the effects of Trigonella foenum-graecum (Fenugreek) extract in drinking water on growth performance, immune response and some blood parameters in broilers. The results showed that this plant supplementation had improved significantly Body Weight Gain (BWG) and Feed Conversion Ratio (FCR) of broilers among treatments in total period ($p<0.05$). However, it had no significant effect on Feed Intake (FI) of broilers ($p>0.05$). In addition, results showed that using this extract in drinking water had significant effect on immune response as compared to the control group. The highest value of antibody titer against SRBC and weight of bursa of fabricius and the lowest ratio of heterophil- lymphocytes were observed in treatment 3 ($p<0.05$).

Hasan *et al.*, (2014) an experiment was conducted to elucidated the effect of herbal mixture (Fenugreek & Curcumine) and/or bioflavonoid supplementation to the broiler diet and drinking water on growth performance and morphometeric study of intestine. Herbal mixture diet and bioflavonoid watering significantly ($P<0.05$) affect live body weight when compared with other groups. Watering of Bio-Guard and aqueous herbal extract was the highest relative body weight gain (0.28) and differed significantly ($P<0.05$) from control (0.18), but it has no significant ($P<0.05$) difference with other groups. However, group 1 (0.98) recorded the higher significant value ($P<0.05$) when compared with control and those received herbal mixture in diet and watering of BioGuard and aqueous herbal extract. Birds received basic diet and watering of Bio-Guard and aqueous herbal extract (1.65) differed significantly ($P<0.05$) in feed conversion from other groups. The supplementation of herbal mixture and /or bioflavonoids to broiler feed increased the villus height and width, crypt depth and surface area in treated groups in comparison with control group. Overall, the current study recommends use combination of bioflavonoid (BioGuard-in drinking water) and herbal mixture (Fenugreek & Curcumine mixed in ration) as in group 1. This synergistic effect of Bio-Guard and herbal mixture were reflected on the highest significant records of the live body weight, body weight gain, feed conversion ratio and reduction of the marketing age (35 days) and rearing cost of broiler chicks.

CHAPTER-III

MATERIALS AND METHODS

3.1 Experimental site

The experiment was conducted at the Poultry farm under the Department of Dairy and Poultry Science of HSTU, Dinajpur 5200 during the period from 31 October 2017 to 1 January 2018. Commercial sonali chick was used in this study for a period of 9 weeks to find out the effects of tulsi leaves juice on the performance of sonali chicken.

3.2 Experimental birds

One hundred twenty vigorous day- old sonali chicks were procured from Rafid Hatchery limited, Joypurhat.

3.3 Layout of the experiment

The experiment was conducted in complete randomized design (CRD)**.** The chicks were randomly distributed to four dietary treatment groups T_0, T_1, T_2, and T_3, having three replications in each treatment. The chicks were reared in separated pens according to treatments and replications, each dietary treatment group contain of 30 birds. The layout of the experiment is shown in the following table:

Dietary treatment	No. of chicks in each replication			Total number of chicks in each treatment
	R_1	R_2	R_3	
T_0	10	10	10	30
T_1	10	10	10	30
T_2	10	10	10	30
T_3	10	10	10	30
Total				120

Where,

T_0: control (No tulsi leaves juice)

T_1: Tulsi leaves juice 1.5ml/L drinking water

T_2: Tulsi leaves juice 3ml/L drinking water

T_3: Tulsi leaves juice 4.5ml/L drinking water

3.4 Preparation of the experimental house

HSTU Poultry Farm was used for rearing experimental birds to evaluate the efficacy of tulsi leaves juice on growth performance and antibacterial effect. Experimental shed was constructed with compartment for housing for ten birds. Each compartment was dimensions 4.5×3.5 feet for length and breadth, respectively. The shed was constructed by iron net and wooden materials. At first the experimental house was properly washed and cleaned by using tap water. Ceiling, walls, and floor are thoroughly cleaned and subsequently disinfected with bleaching powder, then the room was left vacant for two weeks. Later the house was again disinfected with virocid solution 1ml per 3 liter water, at the same time, all federals, waterers and other necessary equipment were also properly cleaned, washed and disinfectant with bleaching powder. After drying the house was used for this study.

3.5 Collection and preparation of tulsi leaves juice

The experiment was conducted under the Department of Dairy and Poultry science Hajee Mohammad Danesh Science and Technology University, Dinajpur.

Tulsi (*Ocimum sanctum*) leaves were selected to determine its efficacy as growth promoter on sonali chicken. Mature and disease free Tulsi (*Ocimum sanctum*) leaves were collected from HSTU campus.

After collection and washing, the fresh leaves were grinding and water was added at 1:10 ratio. Then juice were prepared by blending the leaves with pestle and motor and stored in a refrigerator at 4°C to maintain the active ingredients of juice.

3.6 Experimental diet

The experimental diet was provided into two phages (Sonali-starter and Sonali-grower), starter was provided 0 to 30 days and grower was days 31 to end day of experiment days. The experimental diets were purchased from local market in Dinajpur, namely company (Nourish Poultry and Hatchery Limited). Tulsi leaves were collected from HSTU campus. All treatment was provided through drinking water during experimental period.

3.7 Chemical composition of basal diet

Chemical composition	Starter	Grower
Moisture %	12.00	12.00
Crude protein %	19.00	17.00
Crude fiber %	5.00	5.00
Lysin	1.00	0.95
Methionine	0.00	0.40
Calcium %	1.00	1.00
Available phosphorus %	0.42	0.42
ME (Kcal/Kg)	2850.00	2900.00

Source: Nourish Poultry and Hatchery Limited

3.8. Routine management

The birds were reared to similar care and management in all treatment groups throughout the experimental period. The following management practices were followed whole experimental period.

3.8.1 Litter management

Fresh and dried rice husk was used as litter at a depth 2-3 inch. After 5 weeks old litter was totally removed and new litter was provided as same depth. The litter was stirred one time per day from four weeks to upto the last day of experimental period.

3.8.2 Floor space

Each pen 4.5×3.5 sq. ft. was allocated for feeding, watering, and housing for 10 experimental birds.

3.8.3 Brooding management

Brooding is the first management of day old chick. In brooding period electric brooder was used to provide suitable heat in chick for maintaining their body temperature. The brooder was hanged just above the bird level at the center of chick guard. Before entry day old chick fresh dried litter provide at depth 3 inch then covered by newspaper. Pre-heating the brooding space and temperature adjust at 33 ± 2^0C. After entry day old chick provided vitamin C and glucose, one-hour latter feed was provided. At first day temperature maintain 33 ± 2^0C then gradually decrease 1^0C per day. Temperature and humidity recoded by using clinical thermometer and hygrometer.

3.8.4 Lighting management

The birds were exposed to 23 hours of lighting and 1-hour dark period throughout the experimental period.

3.8.5 Feeding and drinking

Provide ad libitum feed and water during the entire experimental period.

3.8.6 Vaccination

Name of Vaccine	Name of diseases	Age (days)	Route of administration
IB + ND	Infectious Bronchitis & Newcastle	5^{th}	One drop in one eye
IBD	Gumboro	10^{th}	One drop in one eye
IBD	Gumboro	17^{th}	Through drinking water
ND	Newcastle	22th	Through drinking water
ND	Newcastle	42th	Through drinking water

3.8.7 Sanitation

Drinkers were washed daily in the morning and feeders were cleaned weekly before being used. Strict sanitary measures were followed during the experimental period.

3.9 Temperature and relative humidity measure

Temperature (^{0}C) was recorded by clinical thermometer and relative humidity (%) was recorded by digital hygrometer three time daily.

3.10 Slaughtering of the birds

Prior to slaughtering the birds were fasted for 8 hours, but water was provided ad libitum. Two birds, representing average body weight of the particular replicate group, were randomly selected in each replication for slaughtering. The live weight of birds was taken individually before slaughtering. At the time of slaughtering the birds were secured by holding both shanks with one hand and both wings with other hand by the help of an assistant to prevent struggling. Slaughtering was done by Halal Method with sharp knife. Complete bleeding was accomplished by raising the bird approximately 45º so that the caudal part will be higher than the head. After complete bleeding was done then removal of shank, head and skin. Finally evisceration was done manually to separate liver, spleen, heart, gizzard, and meat yield.

3.11 Collection of feces

For bacteriological analysis two birds were randomly selected from each replication. Feces was collected from cloaca.

3.12 Storage and transport of fecal sample

After collection of feces it was kept air tight polythine bag then store at 4^0C.Then the feces sample was send in microbiology Laboratory of Microbiology Department in VAS faculty for analysis. Eosin Methylene Blue (EMB) agar medium was prepared by suspending 36.0 g in 1 litre of distilled water and Salmonella Shigela agar media was prepared by suspending 50g in 1 liter distilled water. This was brought to boil to dissolve completely and then sterilized by autoclaving at 121ºC for 15 minutes. After cooling to about 55 ºC, it was poured into the petri dish and checked for sterility by overnight incubation. The next day, the freshly collected faecal sample i.e 1 gram of faeces from the experimental birds at random from each group in three replicates was suspended in 9 mL of sterile normal saline and serially diluted from test tub. Form the last dilution a loopful of inoculum was streaked on the media and then incubated at 37 ºC for 24 hours to screen for the presence of E. coli as per the standard method.

3.13 Calculation

1. Total weight gain in (kg). This was computed as a group by subtracting the initial weight from the final weight.

   Total gain in weight = final weight – initial weight

2. Dressing percentage: The dressing percentage of sonali chicken was calculated as follows:

   Dressing (%) = (dressed weight ÷ body weight) x 100

3. Total feed consumption (kg). The amount of feeds consumed by the birds from the start until the end of the experiment (63 days). This was computed by adding the total feeds offered after the total left- over have been subtracted.

   Total feed consumption = total feed offered – total left-over

4. Feed efficiency. This was obtained per treatment by dividing the total feed consumed by the total gain in weight. Feed efficiency is computed for the whole duration of the experiment (63 days).

   Feed efficiency = total feed consumed / total gain in weight

5. Total cost of the total feed consumed (PhP). This was obtained by multiplying the cost of feed per kilogram to the total feed consumed.

   Cost of the total feed consumed = cost of feed per kilogram × total feed consumed

6. Feed cost per kg gain of sonali chicken (PhP). The feed cost per kilogram of gain in weight and this was computed as the price of feeds per kilogram multiplied by the total gain in weight.

   Feed cost per kilogram gain (PhP) = price of feeds per kg × total gain in weight

7. Mortality rate (%) = no. of dead chickens / total no. of birds as a group × 100

8. Cost of production (PhP). This includes the cost of stocks, feeds, commercial antibiotics and vitamins, electricity, and materials used.

9. Gross income (PhP). This was obtained as a group by multiplying the sum of the final weight of the birds by the price per kilogram of live weight.

Gross Income = total weight of the birds (as a group) × price per kilogram

10. Net income (PhP). This was obtained by subtracting the cost of production from the gross income.

    Net income = gross income – cost of production

3.14 Data collection and record keeping

The following records were kept during the experimental period: Initial DOCs weight and after brooding weight of chicks. Weekly Body weight gain and feed intake was recorded replication wise in each treatment group at last day of week. Mortality was recorded daily if death occurred. The different meat yield parameters like, carcass, thigh, breast meat, head, heart, liver, spleen, gizzard and shank weight for individual birds were recorded after slaughtering. Temperature and relative humidity was recorded three times daily.

3.15 Statistical analysis

The data of feed consumption, growth performance, carcass characteristics and bacterial count were recorded and analyzed by SPSS version-20 software by using one way ANOVA accordance with the principles of Complete Randomized Design (CRD). All values were expressed as Mean±SEM and significance was determined when ($P<0.05$). Mean was compared among the treatment groups by using Duncan test.

CHAPTER-IV

RESULTS AND DISCUSSION

This experiment was conducted to evaluate the efficacy of tulsi leaves juice on production performance in terms of weekly body weight gain, final live weight gain, feed intake, feed efficiency, dressing percentage and bacterial inhibitor of sonali chicken. Tulsi has been safely used in Asia for hundreds of years. There are no established contraindication of tulsi in use says drugs.com. This experiment was held under the Department of Dairy and Poultry Science, Faculty of Veterinary and Animal Science HSTU Dinajpur.

One day old chicks are randomly divided into 4 groups namely, T_0, T_1, T_2 and T_3 after 7 days for assessing the efficacy of tulsi leaves juice as growth promoter on sonali birds.

4.1 Weekly body weight gain

At the start of experiment, the average body weight of the birds in different treatment groups was not significantly differs. In Table 1 showed that after 7 days of brooding, initial body weight of chicks in different dietary treatment was similar. The live weight of birds in 1^{st}, 2^{nd}, 3^{rd}, 4^{th}, 5^{th} and 6^{th} weeks did not significantly ($P<0.05$) vary among the treatment groups. The efficacy of supplementation of tulsi @ 1.5 ml/L, 3 ml/L and 4.5 ml/L in drinking water upto 6 weeks increase live weight gain day by day compared to the control T_0 group. In 6^{th} weeks the highest values was found (508.33±17.11g) in tulsi group that was received @ 3 ml/L water and the lowest values was found (476.00±12.88g) that receive plain water T_0. Within the tulsi group respective treatment @ 1.5 ml/L, 3 ml/L and 4.5 ml/L in drinking water live weight was found (500.00±19.18g), (508.33±17.11 g) and (507.00±16.84 g). The result of this study clearly showed that tulsi leaves juice 3 ml/L of drinking water increase live weight upto 7 weeks of age. Live weight of 7^{th}, 8^{th} and 9^{th} weeks there were a significant ($p<0.05$) differences among the treatment group. Supplementation of tulsi leaves juice @ 3 ml/L was showed the maximum live weight gain and statistically significant ($p<0.05$) compare to control group and tulsi group T_1, but similar result was found with T_3 treatment group. However the inclusion level of tulsi 3 ml/L drinking water was showed maximum live weight (865.73±19.52 g) and minimum live weight was showed (786.00±21.42g) in T_0 treatment group at the terminal stage of experiment. Within tulsi treatment group 1.5 ml/L drinking water group was represented lowest live weight gain whereas, 3 ml/L drinking water treatment group represent highest

live weight gain. It is clearly stated that 3 ml/L increase live weight sonali chicken. The significant effect of tulsi leaves juice on body weight gains were found higher in treated group compared to non treated control group. Similarly, Mazhar-IIahi *et al.,* (2007) reported increase in feed efficiency in tulsi fed groups, which is in agreement with the findings of the present study. Mollah *et al.,* (2012) reported significant increase in the live weight of broiler chicken compared with control group.

4.2 Body weight gain

In Table 1 initial body weight of sonali chicks fed different levels of tulsi leaves juice was statistically insignificant ($p>0.05$). Final live weight gain was statistically significant ($p<0.05$) among the different treatment group. The highest body weight gain was attained in birds that received tulsi leaves juice 3 ml/L drinking water. However, treatment group T_2 was significantly ($p<0.05$) higher body weight gain compared to control group T_0. Within tulsi group treatment, T_2 was significant ($p<0.05$) compare to treatment group T_1. The result of this study was indicated that tulsi leaves juice 3 ml/L drinking water induces highest body weight gain compared to control group. The study has revealed that supplemented with tulsi leaves juice had higher body weight gain, weekly gain in weight, feed consumption and feed efficiency (Islam *et al.,* (2013). This study agree with Alom *et al.,* (2015) found that the growth parameters, such as survival, weight gain, feed conversion efficiency were significantly ($P<0.05$) higher in broiler given 2ml/L tulsi leaves extract in broiler. Hasan *et al.,* (2016) who was observed that supplementation with tulsi leaf extract @ 2ml/L in drinking water causes significant increase in live body weight and improvement in weekly weight gain and feed efficiency as compared to that of control group of broiler.

Table 1. Effect of supplementation of tulsi leaves juice on weekly body weight, and body weight gain of sonali chicken

Parameters	**T_0 0 ml/L**	**T_1 1.5 ml/L**	**T_2 3 ml/L**	**T_3 4.5 ml/L**	**Level of Sign.**
Initial live wt. (g)	29.00±0.00	29.00±0.00	29.00±0.00	29.00±0.00	(NS)
1st week	84.5±3.4	85.33±4	87.5±3.6	84.50±3	(NS)
2nd week	146.00±6.0	147.66±4.54	151.66±5.35	146.66±2.49	.827 (NS)
3rd week	213.86±6.56	220.33±5.1	228.66±7.33	222.00±5.96	.432(NS)
4th week	302.33±4.6	310.00±6.63	315.33±6.84	313.00±6.89	.498(NS)
5th week	400.73±8.70	413.80±10.95	428.00±12.17	425.00±10	.258(NS)
6th week	476.00±12.88	500.00±19.28	508.33±17.11	507.00±16.84	.495(NS)
7th week	574.46^{a}±16.3	598.06^{ab}±18.31	645.00^{b}±18.5	617.66^{ab}±16.93	.043*
8th week	695.73^{a}±12.77	708.33^{a}±23.52	763.53^{b}±20.39	740.33^{ab}±14.16	.046*
Final wt.	786.00^{a}±21.42	822.66^{ab}±14.42	865.73^{b}±19.52	832.33^{ab}±18.5	.034*
Total wt. gain	757.00^{a}±21.42	793.66^{ab}±14.42	836.73^{b}±19.52	803.40^{ab}±18.49	.034*

The mean values with different superscript (a to c) within the same row differs significantly, at least ($p<0.05$). All values indicate mean ± Standard error of mean

NS=Non significant, * statistically significant ($P<0.05$).

4.3 Feed intake

In the cumulative feed intake of sonali chicken in different dietary treatment during experimental periods was almost statistically similar and the differences were insignificant ($p>0.05$) in table 2. However, the lowest feed intake (1922.00±11.84g) was found in T_2 group. The birds of T_0 group did not took tulsi leaves juice showed higher feed intake (2020.33±17.83g). T_2 group that treated with 3 ml/L of drinking water showed lowest feed intake than compare to the non treated group T_0 similar to the other treated group T_1 and T_3 .Similarly, Mazhar-IIahi *et al.,* (2007) reported increase in feed efficiency in tulsi fed groups, which is in agreement with the findings of the present study. The study has revealed that supplemented with tulsi leaf juice had higher body weight gain, weekly gain in weight, feed consumption and feed efficiency (Islam *et al.,* 2013).

4.4 Feed efficiency

Feed efficiency of different treatment groups during the experimental period statistically significant (P<0.05). The birds of T_2 groups containing 3ml/L tulsi leaves juice converted feed to meat most efficiently. The feed efficiency of T_2 treatment groups was statistically significant (P<0.05) with T_0 treatment group. Also T_1 and T_3 treatment group was significantly (P<0.05) higher than the T_0 treatment group. From Table 2 feed efficiency was higher at the level of 3 ml/L tulsi leaves juice in drinking water. Highest feed efficiency 2.56±0.02 was found in T_2 groups and lowest feed efficiency 2.71±0.02 was found in T_0 groups. It was found that 3 ml/L of tulsi leaves juice induce higher feed efficiency. This study agree with Khatun *et al.*, 2013 studied efficacy of Tulsi and neem leaves extract in broiler production and found significant (p<0.05) increase FCR as compared to control group.

Table 2. Effect of tulsi leaves juice on feed intake, feed efficiency, and mortality of sonali chicken

Parameters	T_0 0 ML/l	T_1 1.5 ml/L	T_2 3 ml/L	T_3 4,5 ml/L	Level of Sign.
Feed intake(g)	2020.33±17.83	1929.66±30.56	1922.00±11.84	1984.00±31.56	0.06(NS)
Feed efficiency	2.71^{b}±0.02	2.64^{ab}±0.03	2.56^{a}±0.02	2.65^{ab}±0.02	0.04*
Mortality	0	0	0	0	0

The mean values with different superscript (a to c) within the same row differs significantly, at least (p<0.05). All values indicate mean ± Standard error of mean

NS=Non significant, * statistically significant (P<0.05).

4.5 Meat yield parameter

After slaughtering and eviscerating, remove all edible and non edible by-product, dressing percentage of different treatment group showed in Table 3. The data indicated significant differences among the treatment groups. Relatively the heavier dressing percentage was observed in T_2 (51.32±0.21%) groups than other treatments T_1 (51.21±0.28%), T_3 (50.38±0.34%) and T_0 (49.40±0.60%) respectively. The highest dressing percentage was found (51.32±0.21%) in T_2 treatment group and lowest was found (49.40±0.60%) in T_0 treatment group.

4.6 Breast meat

Breast meat obtained Table 3 was statistically significant (P<0.05) among the different treatment groups. Supplementation of tulsi leaves juice at the level of 3 ml/L drinking water was significant (P<0.05) compare to control group. However, highest weight was found (126.33±1.20g) that receive tulsi leaves juice 3 ml/L drinking water and lowest was found (103.33±4.05g) in untreated group. In group T_1 similar to T_3 treatment and close to T_2 treatment groups.

4.7 Thigh meat

Data obtained from Table 3 thigh meat of sonali chicken was statistically non significant (p>0.05) among the different treatment groups. Best result was observed in supplementation of tulsi leaves juice treated group T_2 (146.66g) whereas other group T_1 (140g) then T_3 (136g) and T_0 (127g) respectively.

4.8 Heart and Liver weight

Head, heart, gizzard and liver weight of sonali chicken in different dietary treatment groups was statistically insignificant (p>0.05). From Table 3 it was seen that heart weight maximum in T_3 treatment group and minimum in T_0 treatment group. Liver weight was maximum in T_1 group while gizzard weight was maximum (32.66±1.76g) found in T_1 treatment group.

Table 3. Effects of tulsi leaves juice on meat yield parameters of sonali chicken

Parameters	T_0 0 ml/L	T_1 1.5 ml/L	T_2 3 ml/L	T_3 4.5 ml/L	Level of Sign.
Final Live wt. (g)	786.00^{a}±21.42	822.66^{ab}±14.42	865.73^{b}±19.52	832.33^{ab}±18.5	.034*
Dressing (%)	49.40^{a}±0.60	51.21^{b}±0.28	51.32^{b}±0.21	50.38^{ab}±0.34	.027*
Breast meat wt. (g)	103.33^{a}±4.05	118.66^{ab}±6.96	126.33^{b}±1.20	118.33^{ab}±4.80	.046*
Thigh meat wt.(g)	127.66±12.19	140.00±13.61	146.66±2.40	136.33±6.64	.603(NS)
Heart (g)	3.33±0.33	3.66±0.33	3.66±0.33	4.00±0.00	.487(NS)
Liver (gm)	23.33±1.33	26.33±2.90	24.33±1.20	25.00±0.57	.647(NS)

The mean values with different superscript (a to b) within the same row differs significantly, at least (p<0.05). All values indicate mean ± Standard error of mean

NS=Non significant, *Statistically significant (P<0.05)

4.9 Faecal total bacterial count

The effect of tulsi leaves juice preparations on the faecal total bacterial count is presented in the Table 4. The *E. coli* and *Salmonella* bacterial count was significantly ($p<0.01$) reduced in the treatment groups when compared to the control groups. The *E. coli* and *Salmonella* bacterial load was increased in the control which was provided only the normal drinking water as against the treatment groups. Highest *E. coli* count was found (205.00±2.89) in T_0 groups and lowest *E. coli* count was found (161.66±4.41) in T_2 groups. Highest *salmonella* count was found (201.66±7.26) in T_0 groups and lowest was count (148.33±1.66) in T_2 groups. However one log reduction was noticed in the group T_2. It was concluded that tulsi leaves juice also reduce the bacterial load of *E coli* and *Salmonella.* These results may be due to antimicrobial and anti-protozoal properties (Kale *et al.,* 2003) of tulsi leaves, which might be attributed in reduction of microbial load of birds and improved the feed consumption and feed efficiency (Pushpagadan and Sobti, 1977).

Table 4: Effect of tulsi leaves juice on *E. coli* and *Salmonella* count on sonali chicken

Parameters	T_0 0 ml/L	T_1 1.5ml/L	T_2 3ml/L	T_3 4.5ml/L	Level of sign.
Salmonella	201.66^{b}±7.26	148.33^{a}±8.81	148.33^{a}±1.66	156.66^{a}±7.26	0.001*
E. coli	205.00^{c}±2.89	185.00^{b}±2.89	161.66^{a}±4.41	178.58^{b}±5.93	0.001*

The mean values with different superscript (a to b) within the same row differs significantly, at least ($p<0.05$). All values indicate mean ± Standard error of mean

NS=Non significant, *Statistically significant ($P<0.01$)

4.10 Cost benefit analysis of production

Production cost of sonali chicks in this study are presented in Table 5. Spending on feed, chick, vaccine, medicine, litter, tulsi leaves, miscellaneous (labour, electricity, transport cost) were constituted cost/chick live weight. Total production cost per chick weight gain lowest was (111.16±1.39Tk.) found in T_1 group and highest was found (115.36±1.15Tk.) in T_3 group. Total feed cost per chick in different dietary treatment was statistically similar ($p>0.05$). However, the total feed cost decrease that was received tulsi leaves juice 3 ml/L of drinking water whereas increased total feed cost in T_0 group. The net profit from per sonali chick was statistically similar ($p>0.05$). The highest profit (26.52±1.20Tk.) was

found T_2 group and lowest (12.96±1.12Tk.) was found in T_0 group. Tulsi leaves juice group net profit higher was found in T_2 (26.52±1.20Tk.) thenT_3 (17.76±1.11Tk.) and T_1 (20.36±1.33Tk.) respectively.

Table 5: Cost benefit analysis of different dietary treatment on sonali chicken production

Parameters (Tk.)	T_0 0 ml/L	T_1 1.5 ml/L	T_2 3 ml/L	T_3 4.5 ml/L	Level of sign
Chick cost/chick	15	15	15	15	NS
Litter cost/chick	4	4	4	4	NS
Vaccine + medicine cost/chick	10	10	10	10	NS
Dietary treatment cost/ chick	0	2	3	4	NS
Feed cost/ chick	80.80±1.18	77.16±1.39	76.88±1.09	79.36±1.15	NS
Miscellaneous cost/ chick	3	3	3	3	NS
Total cost Tk./chick	112.8±1.18	111.16±1.39	111.88±1.09	115.36±1.15	NS
Selling price Tk./kg	160	160	160	160	NS
Selling price Tk./chick	125.76± 1.34	131.52± 2.12	138.40 ±1.45	133.12± 1.66	NS
Net profit Tk./kg	12.96±1.12	20.36±1.33	26.52±1.20	17.76±1.11	NS

The mean values with different superscript (a to b) within the same row differs significantly, at least ($p<0.05$). All values indicate mean ± Standard error of mean

NS=Non significant, *statistically significant ($P<0.05$)

This study result showed that supplementation with tulsi leaves juice was more profitable than control group. The study has revealed that supplemented with tulsi leaf juice had higher body weight gain, weekly gain in weight, feed consumption and feed efficiency (Islam *et al.,* 2013). These results may be due to antimicrobial and anti-protozoal properties (Kale *et al.,* 2003) of tulsi leaves, which help to reduce the microbial load of birds and improved the feed consumption and feed efficiency of the birds (Pushpagadan and Sobti, 1977). It is concluded that supplementation 3 ml of tulsi leaves juice per liter of drinking water caused significant increase in live body weight and improvement in weekly

gain in weight and feed-efficiency as compared to that of control group of poultry. This results are in line with those reported by (Siddig and Abdelati, 2001) who carried out a research work in broiler fed rations containing tulsi leave extract showing higher weight gain. In this study, the use of tulsi leave juice showed more increase in live weight of the birds as compared to control, which is also in agreement with the findings of (Samanta and Dey, 1991) who concluded that tulsi may be incorporated as a growth promoter in the ration of Japanese quails. This study has revealed that tulsi juice had significant effect on the bacterial test, decrease the load of *Salmonella* and *E. coli* bacteria.

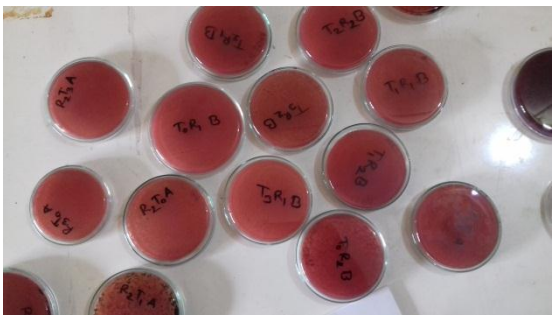
Brooding

Feed Weighting

Carcass Weight

Tulsi Juice

Feeding



Bacterial Colony

Figure 1: Different experimental picture

CHAPTER-V

SUMMARY AND CONCLUSION

The experiment was conducted to evaluate the efficacy of tulsi leaves juice on production performance, dressing yield and *E. coli* and *Salmonella* bacterial count of sonali chicken. For this purpose, 120 day old chicks were purchased from Rafid Hatchery Ltd. After 7 days of brooding the chick were randomly divided into four treatment groups namely T_0, T_1, T_2, and T_3 having three replications in each treatment group. Experimental birds in T_1, T_2 and T_3 were provided tulsi leaves juice @ 1.5, 3, and 4.5 ml per liter drinking water while T_0 was provided normal water. At the terminal stage of experiment, the cumulative body weight gain of different treatment groups was T_0 (786.00±21.42g), T_1 (822.66±14.42g), T_2 (865.73±19.52) and T_3 (832.33±18.50g), respectively. Birds that received tulsi leaves juice 3 ml/L drinking water was gained highest (865.73±19.52 g) body weight and lowest was found (786.00±21.42 g) in control group. The feed intake among different treatments were statistically similar ($p>0.05$). The cumulative maximum feed intake was observed in non treated T_0 group (2020.33±17.83g) and minimum in tulsi treatment group (1922.00±11.84g). Feed efficiency of different treatment was statistically significant ($P<0.05$) compared to T_0 control group. Respective feed efficiency was found T_0 (2.71±0.02), T_1 (2.64±0.03), T_2 (2.56±0.02) and T_3 (2.65±0.02). Tulsi treated group T_2 converted feed to meat most efficiently then T_1, T_3, and T_0 treatment respectively.

There was no significant ($P>0.05$) difference on the data obtained from treatments groups except breast meat weight and dressing percentage. The breast meat weight and dressing percentage was significantly ($p<0.05$) higher in treatment T_2 group compare to control group. Among the treatments highest dressing percentage (51.32±0.28%) was observed in the birds fed 3 ml/L tulsi in drinking water group and lowest (49.4±0.60%) in control group.

Data obtained on *E. coli* and *Salmonella* bacteria count were statistically significant ($P<0.05$) among treatments groups. The lowest *E. coli* count (161.66±4.41) was observed in supplementation of tulsi group T_2 and highest (205.00±2.89) was found in control group T_0. In *Salmonella* bacteria the highest value (201.66±7.26) was found in control group T_0 and lowest value was found (148.33±1.66) in T_2 group that treated 3 ml/L of drinking water.

Data obtained feed cost, lowest was seen in tulsi treated group T_2 and highest in untreated group. Net profit obtained maximum was found in T_2 (26.52±1.20Tk.) then T_0 (12.96±1.12Tk.), T_1 (20.36±1.33Tk.) and T_3 (17.76±1.11Tk.) respectively. Based on the result of present study it may be concluded that tulsi leaves juice is a good source of natural growth promoter and it has significant effect on body weight gain and feed efficiency of sonali chicken. The result of this study suggests that supplementation of tulsi leaves juice 3 ml/L drinking water can be used as growth promoter for the production of sonali chicken. The results suggest that better growth performance could be achieved in sonali chicken supplemented with tulsi leaf juice. Therefore, more studies are required to determine cost effective doses and form of use.

REFERENCES

Alom, F., Mostofa, M., Alam, M.N., Sorwar, M.G., Uddin, J. and Rahman, MM. (2015). Effects of indigenous medicinal plant tulsi (*Ocimum sanctum*) leaves extract as a growth promoter in broiler. Research in Agriculture, Livestock and Fisheries, 2 (1): 97-102.

Arivuchelvan, A., Murugesan, S. and Mekala, P. (2012). Antioxidant properties of *Ocimum sanctum* in broilers treated with high doses of gentamicin. Indian Journal of Drugs and Diseases, 1 (6): 143-146.

Ashish, R., Singh, A., Kumar, V., Bajaj, Singh, P., Sekhawatb and Singhb, K. (2013). Phytochemical estimation and Antimicrobial activity of Aqueous and Methanolic extract of *Ocimum sanctum* L. Journal of Natural Product Plant Resource, 3 (1):51-58.

Bailey, L.H. (1924). Manual of Cultivated plants. Macmillan Co. New York. 101-3.

Bakkali, F., Averbeck, S., Averbeck, D. and Idaomar, M. (2008). Biological effects of essential oils-A review. Food Chemical Toxicology, 46:446-75.

Bhosale, D.S., Bhagwat, S.R., Pawar, M.M. and Kulkarni, R.C. (2015). Comparative efficacy of dietary addition of tulsi (*Ocimum sanctum*) leaf powder and vitamin E on broiler performance. Indian Journal of Animal Nutrition, 32 (3): 348-350.

Charis, K. (2000). A novel look at a classical approach of plant extracts. Feed mix Special issue on nutraceuticals., 12: 19-21.

Chatterjee, A., Sukul, N.C., Laskal, S. and Ghosmajumdar, S. (1982). Nematicidal principles from two species of Lamiaceae. Journal of Nematology; 14(1):118-120.

Chogo, J.B.A. and Crank, G. (1981). Chemical composition and biological activity of the Tanzania plant *Ocimum suave*. Journal of Natural Products; 44:308-309.

Darrah, H.H. (1980). The cultivated basils. Buckeye Printing company, Karachi, India. 112-120.

DLS. (2016). Annual report on livestock 2016. Division of Livestock Statistics, Ministry of Fisheries and Livestock, Farmgate, Dhaka, Bangladesh.

Eevuri, T.R. and Putturu, R. (2013). Use of certain herbal preparation in broiler feeds. Veterinary World, 6 (3): 172-179.

Guenther, E. (1949). The essential oils VIII Roberts E. Krieger Publ. Co. Malabar, Florida: 399-433.

Gupta, G. and Charan, S. (2007). Exploring the potentials of *Ocimum sanctum* (Shyama Tulsi) as a feed supplement for its growth promoter activity in broiler chickens. Indian Journal of Poultry Science, 42 (2): 140-143.

Gupta, S., Mediratta, P. K., Singh, S., Sharma, K. K. and Shukla, R. (2006). Antidiabetic, antihyperlipidaemic and antioxidant effect of *Ocimum sanctum* Linn Seed Oil. Indian Journal of Experimental Biology, 44: 300-304.

Halder, N., Joshi, N. and Gupta, S.K. (2003). Lens aldose reductase inhibiting potential of some indigenous plants. Journal of Ethnopharmacology, 86(1):113-116.

Hasan, A., Abdul-Rahman, Abdel-Rahman, H.A., Fathallah, S.I., Helal, M.A., Nafeaa, A.A. and Zahran, I.S. (2014). Effect of Turmeric (Curcuma longa), Fenugreek (Trigonella foenum-graecum L.) and/or Bioflavonoid supplementation to the broiler chicks' diet and drinking water on the growth performance and intestinal morphometeric parameters. Global Veterinaria, 12 (5): 627-635.

Hasan, M.N., Mostofa, M., Sorwar, M.G., Hasan, M.T., Das, K. and Hossain, D.M.N. (2016). Effects of tulsi leaf extract on body weight gain in broiler production. Bangladesh Journal of Veterinary Medicine, 14 (1): 21-25.

Hashemi, S.R. and Davoodi, H. (2010). Phytogenics as new class of feed additive in Poultry industry. Journal of Animal and Veterinary Advances, 9: 2295-2304.

Hsieh, P.C., Mau, J.L. and Huang, S.H. (2001). Antimicrobial effect of various combinations of plant extracts. Food Microbiology 18: 35-43.

Huque, Q.M.E. (2011). Commercial poultry production in Bangladesh. Souvenir of 7th International Poultry Show and Seminar, 25–27, Dhaka, Bangladesh.

Islam, M.R., Mostofa, M., Roy, R.R., Sorwar, M.G. and Mondal, K.S. (2013). Role of max yeast culture probiotic in potentiating the growth performance of commercial broiler. Progressive Agriculture 24: 131-136.

Jeba, C.R., Vaidyanathan, R. and Kumar, R.G. (2011). Immunomodulatory activity of aqueous extract of *Ocimum sanctum* in rat. International Journal on Pharmaceutical and Biomed Research, 2:33-38.

Juven, B.J., Kanner, J., Schved, F. and Weissloweicz, H. (1994). Factors that interact with the antibacterial action of thyme essential oil and its active constituents. Journal of Applied Bacteriology, 76: 626-631.

Kale, B.P., Kothekar, M.A., TAyade, H.P., Jaju, J.B. and Mateenuddin, M. (2003). Effect of aqueous extract of Azadirachtaindica leaves on hepatotoxicity induced by antitubercular drugs in rats. Indian Journal of Pharmacology 35: 177-180.

Khatun, S., Mostofa, M., Alom, F., Uddin, J., Alam, M. N. and Moitry, N.F. (2013). Efficacy of tulsi and neem leaves extract in broiler production. Bangladesh Journal of Veterinary Medicine, 11 (1): 1- 5.

Kishwar, S., Chaudhry, T. M., Shahid, M. and Asma, A. (2004). Role of BioMix in the growth performance during bacterial enteritis in broiler chickens. Pakistan Journal of Biological Science, 7 (2): 201-202.

Kochhar, A., Sharma, N. and Sachdeva, R. (2009). Effect of Supplementation of Tulsi (*Ocimum sanctum*) and Neem (Azadirachta indica) Leaf Powder on Diabetic Symptoms, Anthropometric Parameters and Blood Pressure of NonInsulin Dependent Male Diabetics. Ethno Medicine, 3(1):5-9.

Kothari, S.K., Bhattacharya, A.K. and Ramesh, S. (2004). Essential oil yield and quality of methyl eugenol rich *Ocimum tenuiflorum* L. f. (syn *Ocimum sanctum* L.) grown in south India as influenced by method of harvest. Journal Chromatogr A, 1054:67-72.

Kumar, V., Andola, H.C., Lohani, H. and Chauhan, N. (2011). Pharmacological Review on *Ocimum sanctum* Linnaeus: A Queen of herbs. Journal of Pharmacological Research, 4:366-368.

Lanjewar, R.D., Zanzad, A.A., Ramteke, B.N. and Deshmukh, G.B. (2008). Effect of dietary supplementation of tulsi (O. sanctum) leaf powder on the growth performance and serum lipid profile in broilers. Indian Journal of Animal Nutrition, 25 (4): 395-397.

Lanjewar, R.D., Zanzad, A.A., Ramteke, B.N., Lalmuanpuii, Taksande, P.E. and Patankar, R.B. (2009). Incorporation of Tulsi (*Ocimum sanctum*) leaf powder in diet of broilers for quality meat production. Veterinary World, 2 (9): 340-342.

Mamta, Mishra, S.K. and Lather, D. (2010). Ameliorating effect of Tulsi (*Ocimum sanctum*) leaf powder on pathology of Salmonella gallinarum infection in broiler chickens. Haryana Vet, 49: 6-10.

Mandal, S., Das, D.N., Kamala, D., Ray, K., Roy, G. and Chaudhari, S.B. (1993). *Ocimum sanctum* Linn. A study on gastric ulceration and gastric secretion inrats. Indian Journal of Physiology Pharmacology, 1993; 37:91-92.

Mazhar-IIahi, Jangde, C.R., Arun-Handa, Waghmare, S.P. and Ajit-Handa. (2007). Some pharmacological and phytochemical investigations on aqueous extract of *Ocimum sanctum* Linn. leaves. Royal Veterinary Journal of India. 3: 137-139.

Mode, S.G., Funde, S.T., Waghmare, S.P. and Kolte, A.Y. (2009). Effect of Herbal Immunodulator on Body weight gain in immunosuppressed broiler birds. Veterinary World, 2(7): 269-270.

Mohpatra, S.C. (2005). Poultry production in India in canged glogal scenario: Opportunities & Challenges. Ind. Poult. Sci. Ass., XXIII Annual Conf. & National Symposium, 3-10.

Mollah, M.R., Rahman, M.M., Akter, F. and Mostofa, M. (2012). Effects of nishyinda, black pepper and cinamon extract as growth promoter in broiler. The Bangladesh Veterinarians, 29: 69-77.

Mondal, S., Bijay, R., Miranda, R.B. and Sushil, C.M. (2009). The Science behind Sacredness of Tulsi (*Ocimum sanctum* LINN.). Indian Journal of Physiology Pharmacology, 53:291-306.

Monga, J., Sharma, M., Tailor, N. and Ganesh, N. (2011). Antimelanoma and radioprotective activity of alcoholic aqueous extract of different species.

Naquvi, J.K., Dohare, L.S., Shuaib, M. and Ahmad, I.M. (2012). Chemical Composition of Voatile Oil of *Ocimum sanctum* Linn. International Journal of Biomed and Advanced Research, 3:129-131.

Nath, D.D., Rahman, M.M., Akter, F. and Mostofa, M. (2012). Effects of tulsi, black pepper and cloves extract as a growth promoter in broiler. Bangladesh Journal of Veterinary Medicine, 10 (1&2): 33–39.

Pandian, C., Sundaersan, A., Omprakash, A. V., Babu, M. and Prabhakaran, R. (2013). Effect of phytobiotic on production performance in Rhode Island Red chicken. Indian Journal Animal Nutrition, 30 (2): 188-190.

Prasannabalaji, N., Muralitharan, G., Sivanandan, R.N., Kumaran, S. and Pugazhvendan, S.R. (2012). Antibacterial activities of some Indian traditional plant extracts. Asian Pacific Journal of Tropical Disease, 2: S291-S295.

Pushpagadan, G. and Sobti, S.N. (1977). Medicinal properties of *Ocimum sanctum* (Tulsi) species and some recent investigation of their efficacy. Indian Drugs 14: 207.

Pakrawan, Abdul Hafiz, Shelke, R.R., Chavan, S. D., Kahate, P.A. and Walke, R.D. (2017). Effect of different herbals feed additives on body weight gain and dressing percentage of Giriraja poultry birds. Res. J. Animal Hus. & Dairy Sci., 8(1) : 8-12 : DOI: 10.15740/HAS/RJAHDS/8.1/8-12.

Rai, V., Iyer, U. and Mani, U.V. (1997). Effect of Tulsi (*Ocimum sanctum*) leaf powder supplementation on blood sugar levels, serum lipids and tissue lipids in diabetic rats. Plant foods for Human Nutrition, 50: 9-16.

Reddy, L.S.S., Thangavel, A., Leela, V. and Raju, K.V.S. (2009). Antioxidant enzyme status in broilers: Role of dietary supplementation of tulsi (*Ocimum sanctum*) and selenium. Tamilnadu Journal of Veterinary & Animal Sciences, 5 (6): 251-256.

Reuveni, R., Fleisher, A. and Putieusky, E. (1984). Fungistatic activity of essential oils from Ocimum basilicum chemotypes. Phytopathology Z, 110:20-22.

Safaei, A., Rahanjam, S.M. and Gharajanlu, M. (2013). Effect of Trigonella foenum-graecum on immune response and some blood parameters of broilers. Scholarly Journal of Agricultural Science, 3 (4): 117-120.

Saleque, M.A. and Saha, A.A. (2013). Production and economic performance of small scale *Sonali* bird farming for meat production in Bangladesh. In *Proceedings of the Seminar, 8th International Poultry Show and Seminar* pp. 20–24. Dhaka, World's Poultry Science Association, Bangladesh Branch.

Samanta, A.R. and Dey, A. (1991). Effect of feeding garlic (A. sativum Linn) as a growth promote in Japanese quails (*C. coturnix japonica*) and its influence on dressing parameter. Indian Journal of Poultry Science. 26: 142-145.

Sethi, J., Sood, S., Seth, S. and Talwar, A. (2004). Evaluation of hypoglycemic and antioxidant effect of *Ocimum sanctum*. Indian Journal of Clinical Biochemistry, 19 (2): 152-155.

Shamsuddoha, M. and Sohel, M.H. (2003). Problems and Prospects of Poultry Industry in Bangladesh: A Study on Some Selected Areas. The Chittagong University Journal of Business Administration, 19: 200.

Shyamala, A.C. and Devaki, T. (1996). Studies on peroxidation in rats ingesting copper sulphate and effect of subsequent treatment with *Ocimum sanctum*. Journal of Clinical Biochemistry & Nutrition.; 20:113-119.

Siddig, R.M. and Abdelati, K. (2001). Effect of dietary vitamin A and N. sativa on broiler chick's performance. In proceeding: 10th International Conference of Association for Tropical Veterinary Medicine and Livestock. Community and Environment, Copenhagen, Denmark.

Simon, J.E., Quinn, J. and Murray, R.G. (1990). Basil: a source of essential oils: 484-489.

Singh, A. and Doley, P. (2012). Immunomodulatory effect of Tulsi (*Ocimum sanctum*) leaves powder supplemented in broilers. International Journal of Science and Research, 3 (8): 1564-1565.

Singh, A., Doley, P., Gogoi, S. and Neeraj (2014). Effect of dietary Tulsi (*Ocimum sanctum*) leaves powder on muscle growth of broiler chicks. International Journal of Biological & Pharmaceutical Research, 5 (1): 1-3.

Singh, S., Taneja, M. and Majumdar, D.K. (2007). Biological activities of *Ocimum sanctum* L. fixed oil- An overview. Indian Journal of Experiment Biology, 45:403-412.

Sirkar, N.N. (1989). Pharmacological basis of Ayurvedic therapeutics. In: Cultivation and utilization of medicinal plants. Editors: Atal CK and Kapoor BM (Published by PID CSIR).

Thakur, R., Pravin, R. and Mandal, A.B. (2008). Poultry meat quality and human health. Poultry times of India,31 (5):22-24.

Vishwabhan, S., Birendra, V.K. and Vishal, S. (2011). A Review on Ethnomedical uses of *Ocimum sanctum* (Tulsi). International Research Journal of Pharmacology, 2:1-3.

Wagner, H., NÕrr, H. and Winterhoff, H. (1994). Plant adaptogens. Phytomedicine; 1:63-76.

WHO. (1997). Antibiotic use in food-producing animals must be curtailed to prevent increased resistance in humans. Press Release WHO/73, October 20th.

APPENDIX

Appendix I: Daily temperature (^{0}C) was recorded by clinical thermometer at 7 AM, 2 PM and 7 PM

SL NO	Date	7 AM	2 PM	7 PM
1	7-11-2017	22	26	23
2	8-11-2017	22	27	24
3	9-11-2017	21	26	23
4	10-11-2017	21	26	23
5	11-11-2017	21	26	24
6	12-11-2017	21	27	24
7	13-11-2017	22	28	24
8	14-11-2017	21	27	24
9	15-11-2017	19	25	23
10	16-11-2017	20	25	23
11	17-11-2017	21	25	24
12	18-11-2017	22	28	25
13	19-11-2017	21	27	24
14	20-11-2017	22	27	24
15	21-11-2017	19	26	22
16	22-11-2017	17	24	20
17	23-11-2017	16	23	19
18	24-11-2017	17	23	20
19	25-11-2017	17	23	21
20	26-11-2017	18	23	21
21	27-11-2017	17	23	20
22	28-11-2017	17	23	20
23	29-11-2017	17	24	21
24	30-11-2017	17	24	21
25	1-12-2017	17	23	20
26	2-12-2017	16	23	21
27	3-12-2017	17	24	21
28	4-12-2017	17	24	21
29	5-12-2017	17	24	21
30	6-12-2017	16	23	20
31	7-12-2017	16	23	20
32	8-12-2017	17	22	20
33	9-12-2017	18	24	21
34	10-12-2017	20	25	21
35	11-12-2017	20	25	22
36	12-12-2017	19	24	22

37	13-12-2017	18	24	20
38	14-12-2017	17	23	20
39	15-12-2017	16	23	20
40	16-12-2017	16	23	20
41	17-12-2017	16	23	20
42	18-12-2017	15	20	18
43	19-12-2017	15	20	18
44	20-12-2017	16	22	20
45	21-12-2017	16	22	19
46	22-12-2017	16	23	20
47	23-12-2017	17	23	20
48	24-12-2017	17	23	20
49	25-12-2017	17	23	19
50	26-12-2017	16	20	18
51	27-12-2017	16	20	18
52	28-12-2017	15	20	17
53	29-12-2017	15	20	18
54	30-12-2017	16	20	17
55	31-12-2017	15	20	17
56	01-01-2018	16	20	18

Table of weekly live weight gain in gram

Parameters	**T_0 0 ml/L**	**T_1 1.5 ml/L**	**T_2 3 ml/L**	**T_3 4.5 ml/L**	**Level of Sign.**
Initial live wt.(g)	29.00±0.00	29.00±0.00	29.00±0.00	29.00±0.00	(NS)
1st week	84.5±3.4	85.33±4	87.5±3.6	84.50±3	(NS)
2nd week	146.00±6.0	147.66±4.54	151.66±5.35	146.66±2.49	.827 (NS)
3rd week	213.86±6.56	220.33±5.1	228.66±7.33	222.00±5.96	.432(NS)
4th week	302.33±4.6	310.00±6.63	315.33±6.84	313.00±6.89	.498(NS)
5th week	400.73±8.70	413.80±10.95	428.00±12.17	425.00±10	.258(NS)
6th week	476.00±12.88	500.00±19.28	508.33±17.11	507.00±16.84	.495(NS)
7th week	574.46±16.3	598.06±18.31	645.00±18.5	617.66±16.93	.043*
8th week	695.73±12.77	708.33±23.52	763.53±20.39	740.33±14.16	.046*
9th week	786.00±21.42	822.66±14.42	865.73±19.52	832.33±18.5	.034*
Body wt. gain	757.00±21.42	793.66±14.42	836.73±19.52	803.40±18.49	.034*

The mean values with different superscript (a to c) within the same row differs significantly, at least ($p<0.05$). All values indicate mean ± Standard error of mean

NS=Non significant, * statistically significant ($P<0.05$).