DIETARY AND ANTIBACTERIAL EFFECT OF BASAK (*ADHATODA VASICA*) LEAVES ON PERFORMANCE OF SONALI CHICKEN

A Thesis

By

ARUN KUMAR RAY
Registration No. 1705454
Semester: July-December, 2018

MASTER OF SCIENCE (M.S.)
IN
POULTRY SCIENCE

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

DECEMBER, 2018

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Submitted to the
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Hajee Mohammad Danesh Science and Technology University, Dinajpur,
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DEPARTMENT OF DAIRY AND POULTRY SCIENCE
HAJEE MOHAMMAD DANESH SCIENCE AND TECHNOLOGY UNIVERSITY, DINAJPUR-5200

DECEMBER, 2018

DEDICATED

TO MY

BELOVED PARENTS

AND

FAMILY

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The author express all praise due to the "GOD" who has created us to explore the hidden fact of the nature for the benefit of mankind and enabling the author to pursue his higher study and to submit his thesis for the degree of Master of Science in Poultry Science.

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The author

ABSTRACT

This study was conducted at the department of Dairy and Poultry Science, Hajee Mohammad Danesh Science and Technology University, Dinajpur. An experiment was conducted to evaluate the performance and antibacterial effect of basak on sonali chicken. A total of 120 day old chicks were randomly divided into five treatment groups namely (T_0, T_1, T_2, T_3 and T_4) having three replications in each treatment group. Brooded chicks were randomly separated into replications wise separate pen to rear up to 8 weeks. Each treatment group contains 27 birds whereas each replication contains 09 birds. Experimental birds in T_1, T_2 and T_3 were provided basak leaves powder meal @ 1.5%, 3% and 4.5% of feed while T_4 provided growth promoter and T_0 was provided only normal feed was considered as control group. The results of this study was indicated that final live weight gain and feed efficiency of birds was significantly ($p<0.05$) higher in T_1 group (735.78±6.39g) that received @1.5%basak leaves powder meal compared to control T_0 group (620.26±3.78g). This result also indicated that body weight gain, and feed efficiency were increased at dose rate 1.5% basak leaves meal. In case of meat yield parameters there was no significant ($P>0.05$) difference among treatment groups except carcass weight, breast meat weight and dressing percentage. The breast meat weight, carcass weight and dressing percentage was significantly ($p<0.05$) higher in treatment T_1 group compared to control group. In bacteriological test *E. coli* and *Salmonella* load was decreased significantly in treatment group as compared to the control group. The lowest feed cost was found in T_1 and highest in T_4 group. Net profit Tk. was found maximum in T_1 (40.9±2) followed by T_2 (27±4), T_3 (22.4±4) T_0 (20.7±3.2) and T_4 (19.7±2.0) respectively. Based on the result it could be concluded that basak leaves meal @ 1.5% can be used as growth promoter for production of chicken.

Keywords: Basak, Sonali chicken, growth performance, *E. coli*, *Salmonella spp.*

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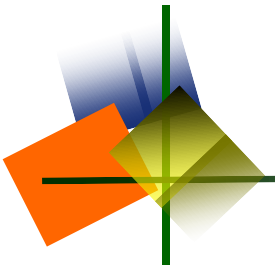

CHAPTER I

INTRODUCTION

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1.1 General Background

Bangladesh is considered as one of the most appropriate countries in the world for rearing poultry. The poultry industry plays a crucial role in economic growth and simultaneously, creates numerous employment opportunities (Shamsuddoha and Sohel, 2003). Poultry plays a vital role in the rural socio-economic system as maximum households are directly involved in domestic rearing 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 low price. 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 protein to the people. The poultry sector in Bangladesh is dynamic and has potential for rapid poverty reduction through income generation and employment creation. As commercial poultry farming gains in popularity, employment opportunities are created for rural farmers, retailers, traders, service providers, entrepreneurs etc. (Saleque, 2009; Dolberg, 2008).

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 basak, Aleovera, Black ashwagandha (*Withania somnifera*) Neem etc. The use of medicinal plants as feed additives is gaining popularity worldwide.

The poultry industry creates numerous employment opportunities (Shamsuddoha and Sohel, 2003). Peoples in our country reared desi chicken for egg and meat purpose and consumer have high demand on its, but the production performance of desi chicken could not fulfill consumer demand. As like desi sonali chicken are reared recent year. The Sonali is a cross-bred of Rhode Island Red (RIR) male and Fayoumi female and has a similar phenotypic appearance to the 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 local 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).

Adhatoda vasica plant has a vital medicinal role in our country. This plant has been used commonly in ayurvedic system of medicine. The review reveals that a wide range of phytochemical constituents isolated from the vasaka plants and its possesses various activities like antifungal, antiviral, hepatoprotective, antitussive, antibacterial, anti-inflammatory and antiulcer, abortifacient, thrombolytic, radiomodulation, cardiovascular protection, hypoglycaemic, antitubercular, antioxidant, antimutagenic, reproductive action have been reported (Singh *et al.,* 2017).

1.2 Research objectives

From the view point, the study was undertaken with the following objectives:

- To evaluate the growth performance and carcass characteristics of Sonali chicken.
- To examine the effects of basak leaves meal on bacterial load count in faeces of sonali chicken.

CHAPTER II

REVIEW OF LITERATURE

CHAPTER II

REVIEW OF LITERATURE

Now a 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. Basak leaf have antifungal, antibacterial, hepatoprotective, antitussive, antiviral, anti-inflammatory and antiulcer, abortifacient, thrombolytic, radio modulation, cardiovascular protection, hypoglycaemic, antitubercular, antioxidant, antimutagenic, reproductive action have been reported (Singh *et al.,* 2017) 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 Description of basak Plant

Adhatoda vasica (L.) Nees (Synonym – *Adhatoda zeylanica; Justicia adhatoda*) popularly known as Malabar Nut belonging to family Acanthaceae is a biologically active plant with a deluge of medicinal applications. The plant is distributed throughout India which is cropped as a hedgerow plant (Mehta, 2016). Generally, the plant is immune to grazing by goats and other animals due to its malodorous aroma. The plant is pharmacologically important with multitudinous biological effects which is used traditionally to cure various diseases from time immemorial (Kumar *et al.,* 2013). Due to its cosmopolitan distribution, the plant has the following local names in different geographic entities. The plant is perennial, evergreen and branched highly with vexing odour and bitter taste. It is a shrub 1.0 m to 2.5 m in height, with opposite ascending branches with leaves retained throughout the year. The leaves are cauline, opposite, decussate, petiolate, lanceolate or ovate-lanceolate, entire, leathery with acute apex (Sharma and Kumar, 2016). The stomata are elongated-oval in shape and surrounded by crescent shaped cells, the long axis of which is at right angles to the ostiole. The epidermis bears simple one to three celled warty hairs and small glandular hairs with a Quadricellular secreting gland. Inflorescence is dense, short pedunculate spike, bracteates with long bracts and spike axial and terminal. The corolla is large and white with lower lip streaked purple or pink. Fruits are 4 seeded non fleshy, dehiscent, a

capsule which is longitudinally channeled with hook like out growths, called retinacula (GoI, 1990; Ghosh and Karmakar, 2012).

2.2 Nutritional and Chemical composition of basak

Basak leaves are highly nutritional value ash, moisture, crude fat, crude protein, crude fiber and carbohydreates (Kumar *et al.,* 2013).

Nutritional composition	**Percentage (%)**
Crude protein	6.5
Crude fiber	6.4
Crude fat	1.6
Ash	5.2
Moisture	15.3
Carbohydrates	6.5

The plant is rich in essential oils, fats, resins, sugar, gum, amino acids, proteins and vitamin C (Dymock, 1972). The presence of pyrroquinazoline alkaloids viz. Vasicine and Vasicinone (Chihara, 1997); adhatonine, vasicinol and vasicinolone (minor alkaloids); vasicoline, adhatodine, casicolinone and anisotine (quinazoline alkaloids); Sitosterol, β-glucoside-galactose and deoxyvasicine (from roots) (Jain *et al.,* 1980) and 2'-4- dihydroxychalcone- 4-glucoside (from flowers) (Bhartiya and Gupta, 1982) was also well established (Lone *et al.,* 2013). Moreover, the presence of l-vasicinone, deoxyvasicine, maiontone, vasicinolone and vasicinol, 1, 2, 3, 9-tetrahydro-5-methoxypyrrolo [2,1-b] quinazoline-3-ol (Chowdhury and Bhattacharyya, 1985); kaempferol and quercetin (Rawat *et al.,* 1994); 3-hydroxy-D-friedoolean-5-ene, epitaraxerol and peganidine (Rahman *et al.,* 1997) was also reported.

Leaf	Flowers	Roots	Other
Quinazoline Alkaloids	b-sitosterol-D-glucoside	vasicinolone	odorous volatile principle
Vasicine – 45-95% (the mucolytic drug bromhexine was developed from this alkaloid)	kaempferol	vasicol	organicadhatodic acid.
N-oxides of vasicine	glycosides of kaempferoland	peganine	
Vasicinone	Queretin	hydroxyl oxchalcone	
Deoxyvasicine		Glucosyl oxyoxchalcone	
oxyvasicinine			
maiontone			
essential oil			

2.3 Uterine activity of basak

The uterotonic activity of vasicine was studied in detail both by in vitro and in vivo methods employing the uteri under different hormonal influences and of different species of animals. The uterotonic activity seemed to be similar to that of oxytocin and methyl ergometrine. The abortifacient effect of vasicine like its uterotonic effect was more marked under the priming influence of oestrogens (Gupta *et al.,* 1978). Vasicine-induced abortion was studied in rats, guinea pigs, hamsters and rabbits. Study showed that vasicine acted through the release of PGs Synthesized vasicine and vasicinone derivatives in invitro studies were found to have oxytocic activity at the dose above 1 mg/ml (Rao *et al.,* 1982).

2.4 Antibacterial activity of basak

A leaf extract was investigated for antibacterial activity using the paper disc and dilution methods. In-vitro screening showed a strong activity of Adhatoda's alkaloids against the bacteria *Pseudomonas aeruginosa*. Significant antibacterial activity against the Gram-positive bacteria strains *Streptococcus faecalis, Staphylococcus aureus*, Staph epidermidis and the gram-negative *E. coli* were also noted (Patel *et al.,* 1984).

Preliminary phytochemical and antibacterial investigations were carried out of the crude extracts obtained from the leaf of *Adhatod avasica*, using solvents of varied polarity. The presence of phenols, tannins, alkaloids, anthraquinones, saponins, flavanoids, amino acids and reducing sugars was indicated by the tests conducted. The effect of ethanol, petroleum ether and water extracts were tested on *Staphylococcus aureus, Staphylococcus epidermidis, Bacillus subtilis, Enterococcus faecalis, Escherichia coli, Pseudomonas aeruginosa, Proteus vulgaris, Klebsiella pneumoniae and Candida albicans*. The minimum inhibitory concentration of the crude extracts was determined for various organisms (Karthikeyan *et al.,* 2009). The findings of Sheeba and Mohan (2012) revealed that *Adhatod avasica* plant extract exhibited antibacterial activity against pathogens like *Staphylococcus aureus, Streptococcus pyogens, Escherichia coli, Pseudomonas aeruginosa*, *Proteus vulgaris* and *Klebsiella pneumoniae*. The broad spectrum of antimicrobial activity of the plant was also reported by Rashmi and Linu (2012).

2.5 Antimicrobial Activity of basak

Adhatoda vasica leaves for its phytochemical composition and antioxidant activity. Antioxidant activity of methanol extract of *A. vasica* was estimated by total antioxidant activity, 2, 2 diphenyl-1-picrylhydrazyl radical scavenging activity, reducing power potential and iron chelating activity. Antimicrobial activity was performed by agar well diffusion method. Estimation of total phenolic content was measured by Folin- Ciocalteu reagent method and estimation of total flavonoid content was performed by aluminum chloride method. Leaves of *A. vasica* were found to possess saponins, oils and fats, phytosterol, phenolic compounds, tannins, carbohydrate, alkaloids, flavanoids and proteins. Extract showed high antioxidant activity in various antioxidant experiments. The extract of *A. vasica* showed presence of high levels of polyphenolic compounds (phenolic compounds and flavonoids), which could be the possible reason behind the antioxidant activity of the plant. In addition extract demonstrated moderate antimicrobial and cytotoxic activity (Vankata *et al.,* 2013).

2.6 Antioxidant activity

Adhatoda vasica Nees and *Sesbania Grandiflora* (L.) Pers are the two important medicinal plants native to India. The aqueous leaf extracts of these two plants have been analysed for their free radical-scavenging activity in different in vitro systems, e.g.

DPPH radical scavenging activity, hydroxyl radical-scavenging activity in Fe_3^+/ascorbate/EDTA/H_20_2 system, inhibition of lipid peroxidation induced by $FeSO_4$ in egg yolk, metal chelating activity. The free radical scavenging activities were compared with standard antioxidants like butylatedhydroxy toluene (BHT), ascorbic acid and EDTA. Total antioxidant activity was measured, based on the reduction of Mo (VI) to Mo (V) by the extract and subsequent formation of green phosphate/Mo (V) complex at acid pH and reducing power by Fe_3^+ - Fe_2^+ transformation in the presence of extracts. The content of total phenolics (expressed as mg of gallic acid equivalents/gm) and total flavonoids (expressed as mg of quercetin equivalent/gm) and ascorbic acid were determined along with antioxidant enzymes. The results indicated that A. vasica and S. Grandiflora showed significant antioxidant activity in vitro. The enzymatic and non-enzymatic antioxidants in A. Vasica were found to be more than that of S. grandiflora, similarly the antioxidant and radical scavenging activities of A. vasica were found to be more significant than S. Grandiflora (Padmaja *et al.,* 2011).

2.7 Anti-inflammatory effect of basak

Adhatoda vasica (L.) Nees is a well-known plant drug in Ayurvedic and Unani medicine. It has been used for the treatment of various diseases, particularly for the treatment of inflammatory and cardio vascular diseases. However, the scientific rationale and mechanisms by which it functions in these diseases is not known. This study was designed to explore the inhibitory activity of *Adhatoda vasica* aqueous and butanolic fractions on arachidonic acid (AA) metabolism. For this purpose aqueous and butanolic fractions of *Adhatoda vasica* were screened for the presence of activities against arachidonic acid (AA) metabolites and their effectiveness was further evaluated by studying platelet aggregation induced by a AA, adenosine diphosphate (ADP), platelet activating factor (PAF), and collagen. AA metabolism was studied by thin layer chromatography system while platelet aggregation was measured by dual channel Lumiaggrego meter. Aqueous fraction of *Adhatoda vasica* but not of butanolic fraction inhibited the AA metabolites through COX pathway (TXB2) and LOX pathway (LP1 and 12-HETE). However, in platelet aggregation studies butanolic extract of *Adhatoda vasica* showed strong inhibition against AA, PAF and collagen induce aggregation but not against ADP (Ahmed *et al.,* 2013).

2.8 Antitussive effect of basak

The effect of the ethanol extracts of *Glycyrrhizaglabra* and *Adhatoda vasica* on SO_2 gas induced cough in experimental animals have very significant effects at the level of $P<0.01$ in inhibiting the cough reflex at a dose of 800 mg/kg and 200 mg/kg body wt. p.o., in comparison with the control group. Mice showed an inhibition of 35.62%, in cough on treatment with *Glycyrrhiza glabra* and 43.02% inhibition on treatment with *Adhatoda vasica* within 60 min of the experiment. The antitussive activity of the extract was comparable to that of codeine sulphate (10, 15, 20 mg/kg body wt.), a standard antitussive agent. Codeine sulphate, as a standard drug for suppression of cough, produced 24.80%, 32.98%, and 45.73% inhibition in cough at a dose of 10 mg/kg, 15 mg/kg and 20 mg/kg respectively, whereas, codeine sulphate (20 mg/kg) showed maximum 45.73% ($P<0.001$) inhibition at 60 min of the experiment (Jahan *et al.,* 2012).

2.9 Hepato protective Activity of basak

Pandit *et al.* (2004) provided conclusive evidence for the hepatoprotective effect of A. vasica against carbon tetrachloride induced hepatotoxicity. The plausible mechanism of the hepatoprotective action might be due to its antioxidant effect. The hepatoprotective activity of Ethyl acetate extract of *Adhatoda vasica* was investigated against CCl4 induced liver damage in Swiss albino rats. At the dose of 1ml/kg, CCl4 induced liver damage in rats as manifested by statistically significant increase in serum Alanine aminotransferase, (ALT), Aspartate aminotransferase (AST), Alkaline Phosphatase (ALP) and also in serum Bilirubin. Pre-treatment of rats with the ethyl acetate Extract of *Adhatoda vasica* (100mg/kg and 200mg/kg) prior to the CCl4 dose at 1ml/kg statistically lowered the three serum level enzymes and also Bilirubin. Histopathological observations also coincided with the above results, however 200mg/kg dose was found to be more active. Current results suggest that Ethyl acetate extract of *Adhatoda vasica* has potent hepatoprotective effect against CCl_4 - induced liver damage (Ahmad *et al.,* 2013).

2.10 Antiviral activity of basak

The influenza viruses are major etiologic agents of human respiratory infections, and inflict sizable health and economic burden. The present study reports the in vitro antiviral effect of *Justicia adhatoda* crude extracts against influenza virus by Hemagglutination (HA) reduction in two different layouts of simultaneous and post

treatment assay. The aqueous and methanolic extracts were used for antiviral activity in the noncytotoxic range. Methanolic extract showed 100% reduction in HA in the simultaneous and post treatment assays at the concentration of 10mg/ml. The aqueous extracts at concentrations of 10mg/ml and 5mg/ml reduced the HA to 33% and 16.67%, respectively, in the simultaneous assay These results suggest that extracts have strong anti-influenza virus activity that can inhibit viral attachment and/or viral replication, and may be used as viral prophylaxis (Chavan *et al.,* 2014).

2.11 Thrombolytic Activity

As a part of discovery of cardio-protective drugs from natural sources the extractives of *Adhatoda vasica* were assessed for thrombolytic activity and the results are presented in Table 1. Addition of 100µl SK, a positive control (30,000 I.U.), to the clots and subsequent incubation for 90 minutes at 37°C, showed 80.65% lysis of clot. At the same time, distilled water was treated as negative control which exhibited negligible lysis of clot (4.08%). In this study, the methanolic fraction (MF) exhibited highest thrombolytic activity (53.23%) (Shahriar *et al.,* 2013).

Chavan and Chowdhary (2014) enumerated that the extracts of A. vasica have strong anti-influenza virus activity that can inhibit viral attachment and/or viral replication, and recommended the plant for viral prophylaxis. The inhibitory activity of HIV-protease by the plant extract was also noted (Singh *et al.,* 2010).

2.12 Antifungal Activity of basak

Antifungal activity and the mode of action of alkaloid extract from the leaves of *Adhatod avasica* was well studied (Ramachandran and Sankaranarayanan, 2013). The antifungal effect of the plant against *Fusarium oxysporum* Schlecht the causal agent of Fusarium wilt disease in tomato was also reported (Neela *et al.,* 2014). Plants have been proven as promising sources of new and biologically active natural products exhibiting higher activity in medicinal applications. The usage of natural products and active plant extracts has been increased recently and new drugs are discovered using new technological advancements. The present elucidates the phytochemical constituents of *Adhatoda vasica* and their effective agent's human pathogenic fungus. The minimum inhibition activity of the phytochemical extract is identified. Further study is carried out with the extract for the partial characterization by TLC and antifungal determined by agar disc diffusion and

germ tube formation inhibition activity. The aim of the current study on the effect of A. Vasica on *Aspergillus ruber* and *Trichophyton rubrum* pathogenic fungus was to conclude the antifungal activity of the A. Vasica (Ramachandran *et al.,* 2013).

2.13 Anthelmintic activity of basak

The main objective of this study was to evaluate the anthelmintic activity of *Adhatoda vasica* (Acanthaceae) in vitro against the gastrointestinal nematodes of sheep. The aqueous and ethanolic extracts of *Adhatoda vasica* aerial parts were evaluated by egg hatching and larval development assays. The aqueous and ethanolic extracts at 25-50 mg/ml concentrations exhibited ovicidal and larvicidal ($P<0.05$) activity against gastrointestinal nematodes. The plant extracts showed dose-dependent inhibition ($P<0.05$). The ethanolic extract at the concentration of 50.0 mg/ml was more effective in inhibiting egg hatching and larval development of gastrointestinal nematodes. The effective dose (ED50) of aqueous and ethanolic extracts were determined graphically from linear regression equation with probit scale, y=5. The results of this study suggested that *Adhatoda vasica* extracts may be useful in the control of gastrointestinal nematodes of sheep (Al-Shaibani *et al.,* 2008).

2.14 Insecticidal activity of basak

Adhatoda vasica has been used as an insecticide even from prehistoric times (Haifa and Ali, 2016) scrutinized the insecticidal effect of acetone and methanol crude leaf extract of A. vasica with high mortality percentage in (nymphs and adults) of Brevicory nebrassicae, and recommended that the plant can be used as insecticide. Several studies have shown the plant has an antifertility effect against several insect species by causing blockage of the oviduct. Research has also proven Adhatoda's effectiveness as an insect repellent (Saxena *et al.,* 1986).

2.15 Abortifacient and uterotonic activity of basak

Adhatoda vasica has abortifacient and uterotonic properties, making it useful for inducing abortion and for stimulating uterine contractions in order to speed childbirth (Claeson *et al.,* 2000). Studies on human subjects have shown that the alkaloid vasicine has significant uterotonic activity. This action appears to be influenced by the presence or absence of certain estrogens. In research on the activity of vasicine in stimulating uterine contractions, human myometrial strips taken from the uterusi of both pregnant

and non-pregnant women were treated with Adhatoda. The herb was found to induce uterine contractions, with effectiveness similar to the drug oxytocin (Pahwa *et al.,* 1987).

2.16 Enzyme activity of basak

The decoction of the leaves of the plant activated the trypsin (Vijaya and Vasudevan., 1994) an enzyme found in the digestive system of many vertebrates, where it hydrolyses proteins.

2.17 Anti-allergy activity

The extract containing the alkaloid vascinol and 20% vasicine inhibited ovalbumin-induced allergic reactions by about 37% at a concentration of 5 mg (Paliwa *et al.,* 2000). Vasicinone has been shown to be a potent anti-allergen in tests on mice, rats and guinea pig (Wagner *et al.,* 1989).

2.18 Antidiabetes activity of basak

'Diabetic encephalopathy' refers to diabetes associated cognitive decline (DACD), which involves oxidative nitrosative stress, inflammation and cholinergic dysfunction. Current study was designed to investigate the effect of *Adhatoda vasica*, a known anti-inflammatory, antioxidant, anti-cholinesterase and anti-hyperglycemic plant, on diabetic encephalopathy. Streptozotocin (STZ)-induced diabetic Wistar rats were treated with *Adhatoda vasica* leaves ethanolic extract (AVEE) for 6 weeks at 100, 200 and 400 mg/kg/day dose. During fifth week of treatment, learning and memory was investigated in single Y-maze and passive avoidance test. At the end of the study biochemical parameters like acetyl cholinesterase (AchE) activity, nitrite levels, tumor necrosis factor-alpha (TNF-α) and oxidative stress was measured from cerebral cortex and hippocampus regions of brain. AchE activity was found increased by 70% in the cerebral cortex of diabetic rat brain. Lipid peroxidation (LPO) levels were increased by 100% and 94% in cerebral cortex and hippocampus of diabetic rats, respectively. Non proteinthiol levels, enzymatic activities of superoxide dismutase and catalase were found decreased in cerebral cortex and hippocampal regions of diabetic rat brain. Nitrite levels in both regions of diabetic brain were increased by 170% and 137% respectively. TNF-α, a pro-inflammatory cytokine, was found significantly increased in diabetic rats. Conversely, animal groups treated with AVEE significantly attenuated these behavioral and biochemical abnormalities. The results suggest a protective role of *Adhatoda vasica* Nees

against diabetic encephalopathy, which may be sum of its anti-oxidant, anti-cholinesterase, anti-inflammatory and glucose lowering action (Mohan *et al.,* 2014).

2.19 Anti-tuberculosis Activity of basak

The extraction and determination of alkaloids was performed and confirmed by phytochemical analysis. Six different quinazoline alkaloids (vasicoline, vasicolinone, vasicinone, vasicine, triterpenes and anisotine) were found in the leaf of *Justicia adhatoda* (*J. adhatoda*). The presence of the peaks obtained through HPLC indicated the diverse nature of alkaloid present in the leaf. The enzyme β-ketoacyl-acylcarrier protein synthase III that catalyses the initial step of fatty acid biosynthesis (FabH) via a type II fatty acid synthase has unique structural features and universal occurrence in Mycobacterium tuberculosis (*M. tuberculosis*). Thus, it was considered as a target for designing of anti-tuberculosis compounds. Docking simulations were conducted on the above alkaloids derived from *J. adhatoda*. The combination of docking/scoring provided interesting insights into the binding of different inhibitors and their activity. These results will be useful for designing inhibitors for M. tuberculosis and also will be a good starting point for natural plant-based pharmaceutical chemistry (Jha *et al.,* 2012). A chemical constituent of Adhatoda alkaloids, vasicine, produces bromhexine and ambroxol – two widely-used mucolytics. Both of these chemicals have a pH-dependent growth inhibitory effect on Mycobacterium tuberculosis. Indirect effects of Adhatoda on tuberculosis include increased lysozyme and rifampicin levels in bronchial secretions, lung tissue and sputum, suggesting that it may play an important adjunctive role in the treatment of tuberculosis (Narimaian *et al.,* 2005 and Grange *et al.,* 1996).

2.20 Anticestodal activity of basak

The result indicated800 mg/kg double dose of extract has profound efficacy against mature worms, where the EPG count was reduced by 79.57% and percentage worm recovery rate by 16.60%. These effects were better than treatment with 5 mg/kg single dose of praziquantel, the standard drug. In case of efficacy against immature worms, the extract showed a significant reduction in worm recovery rate (from 100%in control to 20.00% at 800 mg/kg dose of extract) (Arun *et al.,* 2008).

2.21 Electrophoresis

A new method of capillary electrophoresis was developed for the quantitative determination of vasicine and vasicinone from *Adhatoda vasica* (L.) Nees. The electrophoretic separation was performed using a 47cm-50 mm ID (38.5 cm effective length) fused silica capillary. The samples were injected by pressure for 3 s at 50 mbar and the running voltage was 19 kV at the injector end of the capillary. The capillary temperature was maintained at 40^0C. The separation of the two alkaloids has been achieved within 11 min with good repeatability. The method was validated in terms of reproducibility, linearity, accuracy and applied for the quantitative determination of vasicine and vasicinone in *A. vasica* plant samples/extracts. Parameters affecting the resolution such as pH, temperature, organic modifier, buffer concentration and capillary dimensions were reported (Avula *et al.,* 2008).

2.22 Hepato suppression

Liver disorder is one of the common thrust area declared by the Indian Council of Medical Research, New Delhi in the reviewed research on traditional medicine. *Adhatoda vasica* have been reported to exhibit varying degrees of hepatoprotection against the CCl_4 induced liver dysfunction in rats. The present work was carried out to investigate the potential hepatoprotective action of *Adhatoda vasica* whole plant powder against CCl_4 induced liver damaged Wister rat model. Blood and tissue biochemical parameters of liver have been examined for evaluating the hepato protection action. These biochemical markers are GOT, GPT, Alkaline phosphate, glucose, bilirubin, Triglycerides, γ GT, cholesterol, DNA, RNA, total protein, The effect of *Adhatoda vasica* whole plant powder is compared with Silymarin by standard protocol and is found to have better hepatoprotective action, thus *Adhatoda vasica* indicating protection in liver may prove promising effect against liver disorders. Thus it may act even in humans as a potent liver tonic (Shirish S Pingale *et al.,* 2009).

2.23 Radio modulatory of basak

The radio modulatory influence of ethanolic extract of *Adhatoda vasica* Nees leaf extract against radiation-induced hematological alterations in peripheral blood of Swiss albino mice was studied at various post-irradiation intervals between 6 h to 30 days. Conversely, animals pre-treated with *A. vasica* leaf extract showed 81.25% survival till

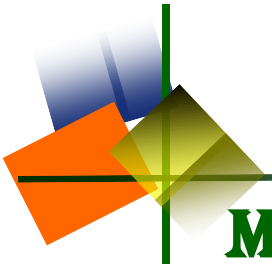
30 days after exposure and a gradual recovery was noted in the hematological values. However, these hematological values remained significantly below the normal even till day 30. A significant decrease in blood reduced glutathione (GSH) content and increase in lipid peroxidation (LPO) level was observed in control animals (Radiation alone). However, *A. vasica* leaf extract pretreated irradiated animals exhibited a significant increase in GSH content and decrease in LPO level. A significant increase in the serum alkaline phosphatase activity and decrease in acid phosphatase activity was observed in *A. vasica* leaf extract pretreated irradiated animals during the entire period of study (Wasserman *et al.,* 1991).

2.24 Immuno modulatory activity of basak

Methanolic, chloroform and diethyl ether extracts of leaves of Indian medicinal plant *Adhatoda vasica* Linn. Were pharmacologically validated for its immune modulatory properties in experimental animals. Oral administration of extracts at a dose of 400 mg/kg in adult male Wister rats significantly increased the percentage neutrophil adhesion to nylon fibers ($P<0.001$). It extracts were also found to induce Delayed Type Hypersensitivity reaction by sheep erythrocytes ($P< 0.001$). The observed results at different doses were significant when compared to control groups. These findings suggested that the extracts of this plant, *A. vasica* Linn positively modulates the immunity of the host (Apooshan *et al.,* 2011).

2.25 Effect on reproductive organs

The possible abortive effect of an extract of *Adhatoda vasica* leaf spissum, was studied in rats. The principal alkaloid detected in the extract was vasicine (0.85 ± 0.03%). The extract (325 mg/kg/day) was administered with a gastric cannula to a group of 5 pregnant females between day 1 and 9 of pregnancy. In another experiment 9 pregnant females received in the water 0.25 and 2.5% of *Adhatoda vasica* between day 1 and 9 of pregnancy. It was concluded that the administration of *Adhatoda vasica* did not produce abortion in any of the treated groups (Burgos *et al.,* 1997).



CHAPTER III

MATERIALS AND METHODS

CHAPTER III

MATERIALS AND METHODS

3.1 Location of the study

The experiment was conducted at the Dairy and Poultry Science farm of Hajee Mohammad Danesh Science and Technology University, Dinajpur, during the period from 14th February to 11thApril, 2018. The commercial Sonali chicken was used in this experiment for a period of 9 weeks to find out the dietary effects of basak powder meal on the performance of sonali chicken.

3.2 Experimental birds

One hundred thirty five (135) vigorous day-old Sonali chicks were collected from a local hatchery.

3.3 Layout of the experiment

The experiment was conducted in complete randomized design (CRD)**.** The chicks were randomly distributed to five dietary treatment groups (T_0, T_1, T_2, T_3 and T_4) having three replications in each treatment. The chicks were reared in separated pens according to treatments and replications, each dietary treatment group contains of 9 birds. The layout of the experiment is shown in the following table bellow:

Table 3.1: Layout of the experiment

Dietary Treatment	No. of chicks in each replication			Total number of chicks in each treatment
	R_1	R_2	R_3	
T_0	9	9	9	27
T_1	9	9	9	27
T_2	9	9	9	27
T_3	9	9	9	27
T_4	9	9	9	27
Total				135

Where,

T_0: Control group,

T_1: 1.5% basak leaves meal

T_2: 3% basak leaves meal

T_3: 4.5% basak leaves meal and

T_4: Growth promoter (amino vit)

3.4 Preparation of the experimental house

HSTU poultry farm was used for rearing experimental birds to evaluate the efficacy of basak leaves meal on growth performance and antibacterial effect. Experiment shed was constructed with compartment of housing for nine birds. Each compartment was 54x42 inches 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 were thoroughly cleaned and subsequently disinfected with bleaching powder, then the room was kept closed for two weeks. After that, the house was again disinfected with virocid solution 1ml/3liter water. At the same time, all feeders, waterers and other necessary equipment were also properly cleaned, washed and disinfected with bleaching powder. After proper drying, the house was used for the birds rearing.

3.5 Collection of basak leaves

Green basak leaves were collected from Rajbari, sadar upazila of Dinajpur and Thakurgaon sadar.

Fig. 3.1 Collection of basak leaves

3.6 Drying and Grinding of leaves

The collected green leaves were dried directly under sunlight and grinded with a blander.

Fig. 3.2 Drying of basak leaves

Fig. 3.3 Grinding of leaves

Fig. 3.4 Powder meal of basak leaves

3.7 Experimental diet

The experimental diet was divided into two phages (Sonali-starter, Sonali-grower). Sonali starter was provided 1 to 14 days and Sonali grower was provided from 15 days to end day of experiment. Ready made sonali-starter feed was provided upto 14 days of age experimental diet was purchased. Then, the rest of the feed named Sonali-grower was made by own to keep free from external antibiotics. All the ingredients were taken at proper rate according to their standard composition. All the treatments were provided through drinking water during experimental period.

Table 3.2 Nutrient Composition of Sonali Starter.

Chemical composition	Starter (Upto 14 days)
Moisture (%)	11-12
Crude protein (%)	21
Crude fiber (%)	5
Crude fat (%)	-
Ether extract (%)	4
Calcium (%)	1
Available phosphorus (%)	0.5
ME (Kcal/Kg)	2850

Table 3.3 Ingredients amount of formulated ration of Sonali Grower with their chemical Composition.

Ingredients (Kg)	Treatment				
	T_0	T_1	T_2	T_3	T_4
Maize	56.5	55	53.5	52	56.5
Soybean	25	25	25	25	25
Rice Polish	5	5	5	5	5
Wheat Bran	5	5	5	5	5
Meat and Bone Meal	2	2	2	2	2
Basak meal	0	1.5	3	4.5	0
CGM (Corn Gluten Meal)	1.5	1.5	1.5	1.5	1.5
Propec	1	1	1	1	1
Soybean Oil	1.5	1.5	1.5	1.5	1.5
DCP	0.5	0.5	0.5	0.5	0.5
Oyster Shell	0.9	0.9	0.9	0.9	0.9
Limestone	0.75	0.75	0.75	0.75	0.75
Salt	0.35	0.35	0.35	0.35	0.35
Total	**100**	**100**	**100**	**100**	**100**
Chemical composition of Sonali Grower					
ME (Kcal/Kg)	2869.55	2819.85	2770.14	2720.45	2869.55
Crude Protein (%)	19.172	19.138	19.103	19.063	19.172
Crude Fiber (%)	3.13	3.226	3.22	3.418	3.13
Ether Extract (%)	4.63	4.63	4.63	4.63	4.63
Calcium (%)	0.67	0.67	0.67	0.67	0.67
Phosphorus (%)	0.7343	0.7343	0.7343	0.7343	0.7343
Lysine (%)	1.0127	1.0127	1.0127	1.0127	1.0127
Methionine (%)	0.31745	0.31745	0.31745	0.31745	0.31745

*** Added vitamin-mineral premix @ 250gm, Lysine @ 50gm, Methionine @ 50gm, Toxin Binder @ 150gm, Anti-Salmonella @ 150gm, Enzyme @ 50gm, Emulex @ 50gm and Maduramysin @ 50gm per 100 kg feed.

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.

3.9 Litter Management

Fresh and dried rice husk was used as litter at a depth of 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 upto the last day of experimental period.

3.10 Floor Space

Each pen was 4.5×3.5 sq. ft. allocated for feeding, watering, and housing for 09 experimental birds.

3.11 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 entrance of day old chicks, fresh dried litter was provided at depth 3 inches then covered by newspaper. Pre-heating the brooding space and temperature adjust at 33±2^{0}C. After entrance, day old chicks were provided vitamin C and glucose, one-hour later feed was provided. At first day temperature was maintained 33± 2^{0}C then gradually decreased 1^{0}C per day. Temperature and humidity were recorded by using clinical thermometer and hygrometer.

Fig. 3.5 Preparation of brooding house

Fig. 3.6 Brooding management

Fig. 3.7 Preparation of shed

3.12 Lighting Management

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

3.13 Feeding and drinking

Provide adlibitum feed and water through the experimental period.

Fig. 3.8 Mixing of feed

Table 3.4 Vaccination

Name of Vaccine	Name of diseases	Age (Days)	Route of administration
IB+ND	Infectious Bronchitis & New Castle	5th	One drop in one eye
IBD	Gumboro	10th	One drop in one eye
IBD	Gumboro	17th	Through drinking water
ND	New Castle	22nd	Through drinking water
ND	New Castle	42nd	Through drinking water

Vaccine, prepared by Intervet International, Netherland, was applied as per recommendation of the manufacturer.

3.14 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.

3.15 Temperature and relative Humidity measure

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

3.16 Debeaking

Debeaking of the birds was done successfully by electric debeaker at the age of 42-45 days to reduce cannibalism and other external injuries.

Fig. 3.9 Debeaking of birds

3.17 Slaughtering of the Birds

Prior to slaughtering the birds were fasted for 10 hours, but water was provided adlibitum. Two birds 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 45^{0}C 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.

Fig. 3.10 Live weight

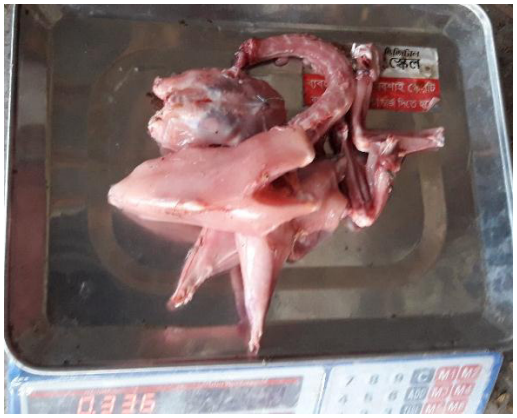


Fig. 3.11 Carcass weight

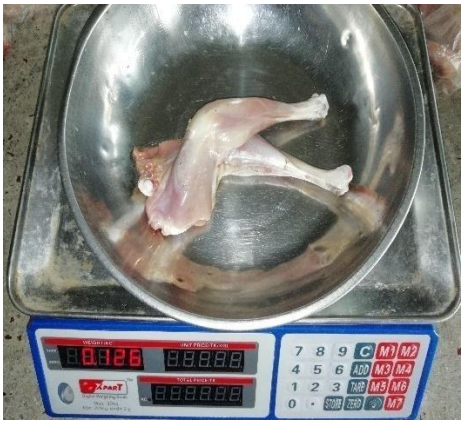


Fig. 3.12 Thigh meat weight

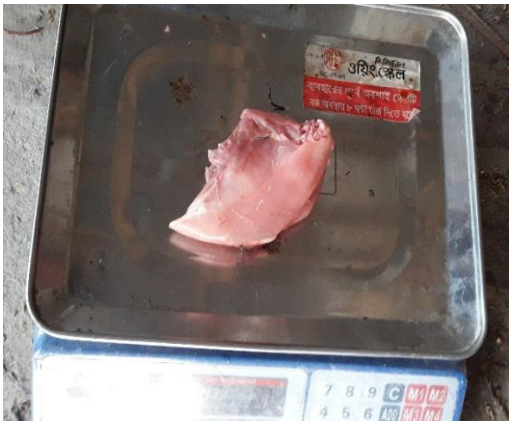


Fig. 3.13 Breast meat weight

3.18 Collection of faeces

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

3.19 Storage, Transport and culture of faecal sample

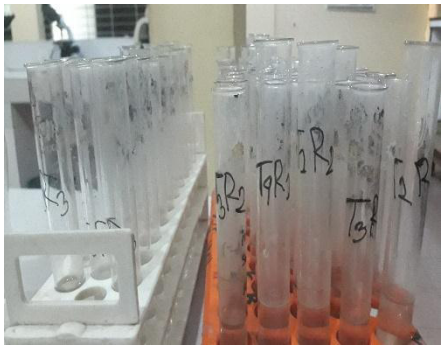


Fig. 3.14 Dilution of sample

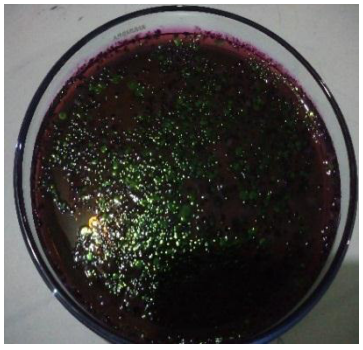


Fig. 3.15 Bacterial culture

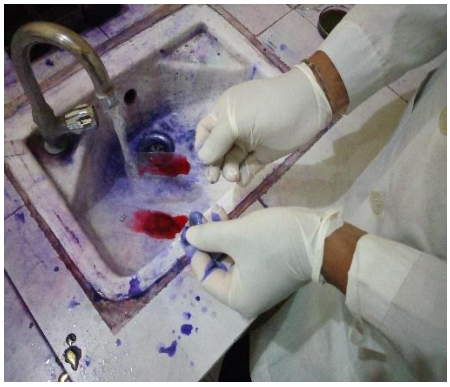


Fig. 3.16 Preparation of slide

Fig. 3.17 Counting bacterial colony

After collection of feces it was kept air tight polythine bag then store at 40 ^{0}C. Feces sample were send to microbiology Laboratory 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 tube. Form the last dilution a loopful of inoculum was streaked on the media and then incubated at 37 ºC for 24 hours to screen to ensure the presence of *E. coli* as per the standard method.

3.20 Calculation

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

Weight gain (gm) = 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.

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 = 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. This includes the cost of stocks, feeds, commercial antibiotics and vitamins, electricity, and materials used.

9. Gross income. 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. This was obtained by subtracting the cost of production from the gross income.

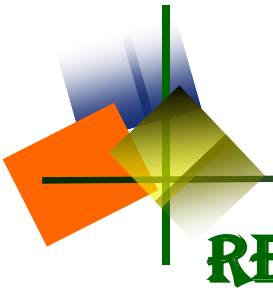
Net income = Gross income – Cost of production

3.20 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 in a day.

3.21 Statistical analysis

The data of feed consumption, growth performance, carcass characteristics and bacterial count were recorded and analyzed by SPSS version-22 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 were compared among the treatment groups at the 0.5 level of significance by using Duncan multiple test.



CHAPTER IV

RESULTS AND DISCUSSION

CHAPTER IV

RESULTS AND DISCUSSION

This experiment was conducted to evaluate the efficacy of basak leaves powder meal 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. Basak has been safely used in Asia for hundreds of years. There are no established contraindication of basak 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.

Day old chicks were randomly divided into 5 groups (T_0, T_1, T_2, T_3 and T_4) after 7 days for assessing the efficacy of basak leaves extract as growth promoter on sonali birds.

4.1 Weekly Body weight gain

At the start of the experiment, the average body weight of the birds did not differ significantly among the treatment group. 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} and 4^{th} weeks did not significantly ($P<0.05$) vary among the treatment groups. The efficacy of supplementation of basak @ 1.5%, 3% and 4.5% with feed and growth promoter (amino vit) @ 2ml/litre drinking water upto 4^{th} weeks showed increased live weight gain compared to the control (T_0) group. At 4^{th} weeks the highest values was found in T_1 (285.85±2.78g) in basak group that was received @ 1.5% basak leaves meal and the lowest values was found in T_0 (269.56±2.01g) that received only feed. Within the basak group respective treatment @ 1.5%, 3% and 4.5% in feed and 2ml/L (amino vit) in drinking water live weight was found (285.85±2.78g), (278.22±3.07g), (280.37±3.12g) and (282.26±2.89g). The result of this study clearly showed that 1.5% basak leaves powder meal increase live weight upto 9 weeks of age. Live weight of 5^{th}, 6^{th}, 7^{th}, 8^{th} and 9^{th} weeks significantly ($p<0.05$) differed among the treatment groups. Live weight gain was significantly ($p<0.05$) highest in T_1 and T_4 group compared to T_0, T_2 and T_3 group. However the inclusion level of 1.5% basak leave meal was showed maximum live weight (735.78±6.39g) and minimum live weight was showed (620.26±3.78g) in T_0 treatment group at the terminal stage of experiment. Within treatment group 4.5% was represented lowest live weight gain whereas, 1.5% treatment group represent highest live weight gain. It is clearly stated that

1.5% basak leaves meal help to increase live weight of sonali chicken. The significant effect of basak leaves powder meal on body weight gains were found higher in treated group compared to non-treatment control group (Table 1).

Similarly, Kannan *et al*. (2017) reported the best feed conversion ratio was observed in the group fed with 1.5% of basak leaf powder.

4.2 Body weight gain

In (Table 1) initial body weight of sonali chicks fed on different dietary treatments was similar ($p>0.05$). 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 basak leaves powder meal 1.5% of feed. However, treatment group T_1 was significantly ($p<0.05$) higher body weight gain compared to control group T_0. Within basak group treatment T_1 was significant ($p<0.05$) compare to treatment group T_2 and T_3. The result of this study was indicated that basak leaves powder meal 1.5% (T_1) of feed induces highest body weight gain compared to control group at the end of feeding trial. Kannan *et al*. (2017) reported that feed intake and body weight gain were not significantly affected by dietary supplementation of *A. vasica* leaf powder up to 1.5% level when compared with the control feed. The best feed conversion ratio was observed in the group fed with 1.5% of *A. vasica* leaf powder.

Table 4.1 Effect of supplementation of basak leaves meal on weekly body weight and body weight gain of sonali chicken

Parameter	T_0	T_1	T_2	T_3	T_4	Level of significant
Initial live wt.(g)	35.30 ±2.2	36.02±2.1	36.40±3.0	35.60±3.20	35.60±4.50	NS
1st week	83.5±3.2	85.33±4.0	86.00±5.22	86.65±4.66	87.05±2.89	NS
2nd week	142.67±3.44	157.96±2.33	145.63±1.83	142.96±2.63	157.03±1.78	NS
3rd week	182.07±2.24	203.04±7.21	188.96±2.73	190.33±2.75	194.62±3.86	NS
4th week	269.56±2.01	285.85±2.78	278.22±3.07	280.37±3.12	282.26±2.89	NS
5th week	305.70±3.28	379.70±3.74	324.78±3.13	332.26±2.70	371.07±2.89	*
6th week	370.05 ± 2.53^{d}	455.40 ± 3.08^{a}	415.21 ± 3.49^{c}	410.65 ± 3.32^{c}	442.78 ± 3.87^{b}	*
7th week	462.76 ± 2.34^{e}	565.56 ± 2.98^{a}	525.18 ± 3.28^{c}	512.56 ± 4.06^{d}	545.18 ± 4.60^{b}	*
8th week	530.96 ± 4.16^{e}	650.11 ± 4.95^{a}	594.70 ± 3.58^{c}	583.78 ± 3.28^{d}	615.74 ± 4.11^{b}	*
9th week	620.26 ± 3.78^{e}	735.78 ± 6.39^{a}	680.78 ± 3.22^{c}	669.89 ± 4.44^{d}	709.78 ± 6.34^{b}	*

The mean values with different superscript (a to e) within the same row differs significantly, at least ($p<0.05$). All values indicate Mean±Standard Error of mean.
NS means statistically not significant, *Means significant at 5% level of significance ($P<0.05$).

4.3 Feed intake

In (Table 2) the cumulative feed intake of sonali chicken in different dietary treatment during experimental periods was almost statistically similar and the differences were insignificant ($p>0.05$). However, the lowest feed intake (2102.29±6.5g) was found T_0 group. The birds of T_3 group showed higher feed intake (2119.36±9.44g) compared to others groups.

4.4 Feed efficiency

Feed efficiency of different treatment groups during the experimental period statistically significant ($P<0.05$). The birds of T_1 groups containing 1.5% basak leaves powder meal converted feed to meat most efficiently. The feed efficiency of T_1 treatment groups was statistically significant ($P<0.05$) with T_0 group. T_1 and T_3 treatment group was also significant. From (Table 2) feed efficiency was higher at the level of 1.5% (T_1) basak leaves meal in dietary feed. Highest feed efficiency (2.86±0.01) was found in T_1 groups and lowest feed efficiency (3.38±0.02) was found in T_0 groups. The second highest feed

efficiency (2.98±.009) was found in T_4 groups. It was found that 1.5% of basak leaves powder meal induce higher feed efficiency. This result agree with Kannan *et al.* (2017) who found the best feed conversion ratio (1.66) was observed in the group fed with 1.5% *of A. vasica* leaf powder.

Table 4.2 Effect of basak leaves meal on feed intake, feed efficiency and mortality of Sonali chicken

Parameter	**T_0**	**T_1**	**T_2**	**T_3**	**T_4**	**Level of significant**
Feed intake (g)	2102.29±6.5	2109.62±8.9	2113.8±2.9	2119.36±9.44	2115.44±1.44	NS
Weight gain (g)	$620.32±3.1^{e}$	$735.49±1.8^{a}$	$680.52±1.9^{c}$	$669.53±2.17^{d}$	$709.42±2.27^{b}$	*
feed efficiency	$3.38±0.02^{a}$	$2.86±0.01^{c}$	$3.10±.012^{b}$	$3.16±.02^{b}$	$2.98±.009^{c}$	*
Mortality	1.0	0	0	0	1.0	
Mortality%	1.35	0	0	0	1.35	

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

NS means statistically not significant, *Means significant at 5% level of significance ($P<0.05$).

4.5 Dressing percentage

After slaughtering, defeathering and eviscerating and removing all edible and nonedible by-products, dressing percentage of different treatment group showed in **Table 3**. The table indicated that, there were significant differences among the treatment group. Relatively the heaviest dressing percentage was observed in T_1 (51.43±.51%) than other treatments T_2 (50.00±0.50%), T_3 (49.13±.81%), T_4 (50.63±1.4%) and T_0 (48.50±.86%) respectively. The highest dressing percentage was found (51.43±.51%) in T_1 treatment group and lowest was found (48.50±.86%) in T_0 group.

4.6 Breast meat

Breast meat obtained (Table 3) was statistically significant (P<0.05) among the different treatment group. Supplementation of basak leaves powder 1.5% was significant (P<0.05) compare to control group. However, highest weight was found (120.40±3.40g) that receive basak leaves powder 1.5% and lowest was found (88.87±6.21g) in untreated group **T_0**. In group T_1 near about T_4 group containing amino vit growth promoter.

Table 4.3 Effect of basak leaves meal on meat yield parameters of Sonali chicken

Parameter	**T_0**	**T_1**	**T_2**	**T_3**	**T_4**	**Level of significant**
Final Live wt. (g)	$620.26±3.78^{e}$	$735.78±6.39^{a}$	$680.78±3.22^{c}$	$669.89±4.44^{d}$	$709.78±6.34^{b}$	*
Carcass wt (g)	$298.11±5.58^{d}$	$372.91±1.83^{a}$	$336.05±3.43^{c}$	$326.73±6.32^{c}$	$358.75±11.86^{b}$	*
Dressing (%)	$48.50±.86^{c}$	$51.43±.51^{a}$	$50.00±.50^{abc}$	$49.13±.81^{b}$	$50.63±1.48^{ab}$	NS
Breast meat wt(g)	88.87±6.21	120.40±3.40	101.51±1.86	96.43±.81	114.53±1.16	NS
Thigh (g)	118.46±1.06	131.33±2.52	122.91±3.15	124.70±1.65	128.51±3.14	NS
Heart (g)	4.50±.60	5.60±.20	5.23±.06	4.90±.44	5.56±0.40	NS
Liver (g)	19.67±.58	23.33±.58	20.67±.58	20.67±58	22.40±0.65	NS

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

NS means statistically not significant, *Means significant at 5% level of significance (P<0.05).

4.7 Thigh meat

Thigh meat of sonali chicken was statistically non-significant ($p>0.05$) among the different treatment group (Table 3). Best result was observed in supplementation of basak leaves meal treated group T_1 (131.33±2.52g) whereas nutritional commercial group T_2 (122.91±3.15g) then T_3 (124.70±1.65g) T_4 (128.51±3.14) and T_0 (118.46±1.06g) respectively.

4.8 Liver weight

Liver weight of sonali chicken in different dietary treatment groups was statistically insignificant ($p>0.05$). From (Table 3) it was seen that liver weight maximum in T_1 treatment group (23.33±.58g) and minimum in T_0 treatment group (19.67±0.58g). Liver weight among the treatment group T_1 also higher.T_4 group which contained growth promoter obtained (22.40±0.65g) near about T_1 group.

4.9 Heart weight

Heart weight of sonali chicken in different dietary treatment groups was statistically insignificant ($p>0.05$). From (Table 3) it was seen that heart weight found maximum in T_1 group (5.60±.20g) and minimum in T_0 treatment group (4.50±0.60g). Heart weight of T_1 found higher among the treatment groups. T_4 group which contained growth promoter obtained (5.56±0.40g) near about T_1 group.

4.10 Faecal total bacterial count

The effect of basak leaves powder 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 treated 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 (207.00±2.89) in T_0 group and lowest E. coli count was found (185.00±2.89) in T_1 group. Highest salmonella count was found (204.66±7.26) in T_0 group and lowest was count (152.33±8.81) in T_1 group. However one log reduction was noticed in the group T_1. The findings of Sheeba and Mohan (2012) revealed that *Adhatod avasica* plant extract exhibited antibacterial activity against pathogens like *Staphylococcus aureus*, *Streptococcus pyogens, Escherichia coli, Pseudomonas aeruginosa, Proteus vulgaris*

and Klebsiella pneumoniae. The broad spectrum of antimicrobial activity of the plant was also reported by Rashmi and Linu (2012).

Table 4.4 Effect of basak leaves extract 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	T_4 2ml/L	Level of sign.
Salmonella	204.66 ± 7.26^b	152.33 ± 8.81^a	152.95 ± 1.66^a	156.66 ± 7.26^a	195.23 ± 6.12^b	0.001*
E. coli	207.00 ± 2.89^a	185.00 ± 2.89^b	187.66 ± 4.41^b	186.58 ± 5.93^b	203.12 ± 2.5^a	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 ($P<0.05$)

4.11 Cost benefit analysis of production

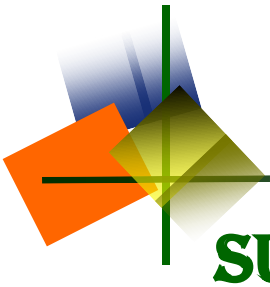
Production cost of sonali chicks in this study are presented in (Table 5). Spending on feed, chick, vaccine, medicine, litter, amino vit, basak, miscellaneous (labour, electricity, transport cost) were constituted cost/chick and cost/kg live weight. Lowest total production cost per kilogram weight gain was (129.0±2Tk.) found in T_1 group and highest was found (143.52±3Tk.) in T_4 group. Total feed cost per chick in different dietary treatment was found non-significant ($p>0.05$). However, the total feed cost was lowest in the group that received basak leaves meal 1.5% whereas increased total feed cost in T_4 group that received 2 ml/L growth promoter (amino vit). The highest profit (46.0±2Tk.) was found in T_1 group and lowest (31.48±2.0Tk.) was found in T_4 group.

Table 4.5 Cost benefit analysis of different dietary treatments

Parameters (Tk.)	**T_0 0 %**	**T_1 1.5%**	**T_2 3%**	**T_3 4.5%**	**T_4 2ml/L**	**Level of sign.**
Chick cost	16	16	16	16	16	NS
Litter cost/chick	5	5	5	5	5	NS
Vaccine + medicine	10	10	10	10	10	NS
Dietary treatment cost/ chick	0	3	4.5	6	15	NS
Miscellaneous cost/ chick	5	5	5	5	5	NS
Feed cost/ kg production	118.3±1.18	100.1±1.39	108.5±1.09	110.6±1.15	100.2±1.15	NS
Total cost Tk./kg production	154.3	134.1	149.0	152.6	155.3	NS
Selling price Tk./kg	175	175	175	175	175	NS
Net profit Tk./kg	20.7	40.9	26	22.4	19.7	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 ($P<0.05$).



CHAPTER V

SUMMARY AND CONCLUSION

CHAPTER V

SUMMARY AND CONCLUSION

The experiment was conducted to evaluate the efficacy of basak leaves powder meal on production performance, dressing yield and *E. coli* and Salmonella bacterial count of sonali chicken. A total of 135 one day old chicks were purchased. After 7 days of brooding the chick were randomly divided into five treatment groups namely (T_0, T_1, T_2, T_3 and T_4) having three replication in each treatment group. Experimental birds in T_1, T_2 and T_3 were provided basak leaves powder @ 1.5%, 3%, and 4.5% and T_4 provided growth promoter (amino vit) while T_0 was provided only normal feed. At the terminal stage of experiment the cumulative body weight gain of different treatment groups was T_0 (620.26±3.78g), T_1 (735.78±6.39g), T_2 (680.78±3.22g), T_3 (669.89±4.44g), and T_4 (709.78±6.34) respectively. Birds that received basak leaves powder meal 1.5% was gained highest (735.78±6.39g) body weight and lowest was found (620.26±3.78g) in control group.

The feed intake among different treatments were non-significant ($p>0.05$). The cumulative maximum feed intake was observed in treated T_3 group (2119.36±9.44g) and minimum in non-treatment group T_0 (2102.29±6.5g). All treatment groups showed significant difference ($p>0.05$) to control groups. Feed efficiency of different treatment was statistically significant ($P<0.05$) compared to T_0 control group. Respective feed efficiency was found T_0 (3.38±0.02), T_1 (2.86±0.01), T_2 (3.10±.012), T_3 (3.16±.02) and T_4 (2.98±.009). But basak treated group (T_1) converted feed to meat most efficiently compared to T_2, T_3, T_4 and T_0 treatment respectively.

Obtained data on meat yield parameters there was no significant ($P>0.05$) difference among treatments groups except carcass weight, breast meat weight and dressing percentage. The breast meat weight, carcass weight and dressing percentage was significantly ($p<0.05$) higher in T_1 group compared to control group T_0. Among the groups highest dressing percentage (51.43±.51%) was observed in 1.5% basak leaves group and lowest (48.50±.86%) in control group. In case of breast meat highest weight (120.40±3.40g) was found in 1.5% basak leaves group and lowest (88.87±6.21g) in control group.

Data obtained on *E. coli* and Salmonella bacteria count were statistically significant ($P<0.05$) among treatments group. The lowest *E. coli* count (185.00±2.89) was shown in supplementation of basak group (T_1) and highest (207.00±2.89) was found in control group (T_0). In Salmonella count the highest value (204.66±7.26) was found in control group (T_0) and lowest value was found (152.33±8.81) in T_1 group that added with 1.5% of basak leaves.

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, amino plus, aloe vera, miscellaneous (labour, electricity, transport cost) were constituted cost/chick and cost/kg live weight. Total production cost per kilogram weight gain was found (134.1±1.09Tk.) found in T_0 group and highest was found (155.3±1.15Tk.) in T_4 group.

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APPENDICES

APPENDICES

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	18-02-18	27	30	25
2	19-02-18	25	30	28
3	20-02-18	29	31	30
4	21-02-18	31	32	32
5	22-02-18	29	30	27
6	23-02-18	28	31	29
7	24-02-18	29	33	29
8	25-02-18	30	32	29
9	26-02-18	29	32	29
10	27-02-18	28	33	30
11	28-02-18	29	33	31
12	01-03-18	30	34	30
13	02-03-18	32	33	30
14	03-03-18	32	33	29
15	04-03-18	29	31	29
16	05-03-18	30	32	31
17	06-03-18	25	23	24
18	07-03-18	26	22	23
19	08-03-18	22	25	24
20	09-03-18	27	29	28
21	10-03-18	31	32	30
22	11-03-18	28	32	29
23	12-03-18	30	32	29
24	13-03-18	31	33	30
25	14-03-18	29	32	31
26	15-03-18	29	33	30
27	16-03-18	30	34	30

Sl. No	Date	7 AM	2 PM	7 PM
28	17-03-18	29	33	30
29	18-03-18	28	32	29
30	19-03-18	29	31	30
31	20-03-18	30	33	29
32	21-03-18	27	32	29
33	22-03-18	30	33	31
34	23-03-18	28	30	29
35	24-03-18	29	31	28
36	25-03-18	30	32	30
37	26-03-18	27	31	28
38	27-03-18	28	30	29
39	28-03-18	29	31	30
40	29-03-18	30	33	31
41	30-03-18	26	29	28
42	31-03-18	27	30	28
43	01-04-18	29	31	29
44	02-04-18	30	32	30
45	03-04-18	29	31	28
46	04-04-18	28	32	29
47	05-04-18	27	30	27
48	06-04-18	29	31	30
49	07-04-18	28	32	29
50	08-04-18	30	33	30
51	09-04-18	28	30	29
52	10-04-18	27	31	28
53	11-04-18	30	33	29
54	12-04-18	29	33	30
55	13-04-18	28	31	29
56	14-04-18	27	30	28

Appendix II: Average body weight gain per birds (gm)/week

Parameter	**T_0**	**T_1**	**T_2**	**T_3**	**T_4**	**Level of significant**
Initial live wt.(g)	35.30±2.2	36.02±2.1	36.40±3.0	35.60±3.20	35.60±4.50	NS
1st week	83.5±3.2	85.33±4.0	86.00±5.22	86.65±4.66	87.05±2.89	NS
2nd week	142.67±3.44	157.96±2.33	145.63±1.83	142.96±2.63	157.03±1.78	NS
3rd week	182.07±2.24	203.04±7.21	188.96±2.73	190.33±2.75	194.62±3.86	NS
4th week	269.56±2.01	285.85±2.78	278.22±3.07	280.37±3.12	282.26±2.89	NS
5th week	305.70±3.28	379.70±3.74	324.78±3.13	332.26±2.70	371.07±2.89	*
6th week	370.05±2.53^{d}	455.40±3.08^{a}	415.21±3.49^{c}	410.65±3.32^{c}	442.78±3.87^{b}	*
7th week	462.76±2.34^{e}	565.56±2.98^{a}	525.18±3.28^{c}	512.56±4.06^{d}	545.18±4.60^{b}	*
8th week	530.96±4.16^{e}	650.11±4.95^{a}	594.70±3.58^{c}	583.78±3.28^{d}	615.74±4.11^{b}	*
9th week	620.26±3.78^{e}	735.78±6.39^{a}	680.78±3.22^{c}	669.89±4.44^{d}	709.78±6.34 ^{b}	*

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

NS means statistically not significant ,*Means significant at 5% level of significance ($P<0.05$).