USE OF ALOE VERA AS NATURAL GROWTH PROMOTER ON PRODUCTION PERFORMANCE OF SONALI CHICKEN

A THESIS

BY

Md. Jahid Hasan
Registration No. 1605477
Semester: July – December, 2017

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

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

DECEMBER 2017

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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

DECEMBER 2017

Dedicated to
My
Beloved Parents

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The author

ABSTRACT

This study was conducted to evaluate the efficacy of dietary supplementation of Aloe vera gel on production performance, dressing yield and hematological parameters of sonali chicken. For this purpose 180 day old chicks were randomly assigned into five treatment groups namely (T_0, T_1, T_2, T_3 and T_4) having three replication in each treatment group. Chicks were brooded upto 7 days then randomly separate into replication wise in separate pen for rearing 8 weeks. Each treatment group contain 36 birds where as each replication contain 12 birds. Experimental birds in T_2, T_3 and T_4 were provided aloe vera gel @ 7.5,15, and 22.5 gm per litre drinking water while T_0 was provided only plain water and T_1 provided 1ml amino plus per litre water those are maintained 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 that received @22.5gm/L aloe vera gel compared to control T_0 while insignificant in commercial growth promoter group. This result also indicated that body weight gain, feed intake and feed efficiency were increased along with increasing dose of aloe vera gel. Meat yield parameters there were no significant difference among the treatment group except breast meat weight. Blood parameters (RBC, PCV, Hb and Total WBC) there were significant ($p<0.05$) difference among the treatment groups except the total white blood cells (WBC) count. Among the treatment lowest feed cost was seen in aloe vera treated group and best profit was found in commercial growth promoter group. Based on the result it could be concluded that the supplementation of Aloe vera gel upto @22.5g/L drinking water has potential used as growth promoter for production of Sonali chicken.

Keywords: Aloe vera, Sonali chicken, production performance, and blood parameters.

CHAPTER I

INTRODUCTION

INTRODUCTION

1.1 General background

Bangladesh is considered as one of the most suitable countries in the world for rearing poultry for its geographical location. The poultry industry plays a crucial role in economic growth and simultaneously, creates numerous employment opportunities (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 dehsi 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 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).

Nutrition is one of the most important consider in poultry enterprise for successful production. It is very essential for bird life to regulate normal physiological function, inadequate supply of nutrient causes serious problem to the birds life, eventually death occur in some case. Its survival is dependent on the avaibility of feedstuffs. The unavailability of grains and the high cost of imported ingredients have made the price of commercial animal feed to increase day by day. Feed cost of Sonali chicken production contributes 65-70 percent of total cost. The high cost of conventional feedstuff has already sent a lot of livestock farmers out of business, thus leading to reduction in overall animal protein production. Hence it is necessary to improve the efficiency of feed at a minimum cost. Many farmers a number of feed additives are use in poultry to maintain nutritional requirement like nutritional growth promoter, antibiotic growth promoter enzymes for improving feed efficiency, and growth performance of birds. Growth promoters can play a vital role in poultry industries to shorten the time period required for attaining the market weight by stimulating growth (Bunyan *et al.* 1977). The frequent

use of drugs, antibiotic growth promoter and feed additives in poultry ration resulted in resistant to pathogenic microorganism affecting the feed efficiency and growth performance of poultry and also adverse residual effect on human health. Therefore, the researchers have been giving their attention on medicinal plants like, Aloe vera to achieve the targeted nutritional and health status of poultry. Locally Aloe vera is known as Ghritokumari and is used as medicinal purpose. In many countries, aloe vera plants have been adopted because of easy aviability, low cost unconventional feedstuff, good antimicrobial activity, good antioxidant, reduce diseases associated risks, high nutritional value, anticancer, antidiabetes, low P^H, finally consumer have high demand to get herbs product because of its have no side effect on animal and human body. Aloe vera is rich in vitamins and minerals source. Specific vitamins include: Vitamin A (Beta-Carotene), Vitamin B1 (Thiamine), Vitamin B2 (Riboflavin), Vitamin B3 (Niacin), Vitamin B5, Vitamin B6 (Pyridoxine), Vitamin B12, Vitamin C, Vitamin E, Choline, and Folic Acid. Among the important minerals found in aloe vera are: calcium, chromium, copper, iron, magnesium, manganese, potassium, phosphorous, sodium, and zinc. These minerals are essential for good health and are known to work in synergistic combinations with each other. Aside from vitamins and minerals, aloe vera is rich with enzymes (Gluconase, Amylase, Protease), amino acids (Essential and non essential amino acid) that are basic building blocks of proteins in the production of muscle tissue (Amar *et al*. 2008). Aloe vera can stimulate hemopyotic system to produce blood cells and supplementation of aloe vera gel in drinking water increase feed efficiency, final body weight gain, carcass weight and blood parameters (RBC, WBC, PCV & ESR) in broiler (Olupona *et al.* 2010). However, there is a limited research works have been conducted to evaluate the efficacy of Aloe vera gel on production performance and blood hematological parameters of Sonali chicken.

1.2 Statement of Problem

Achieving maximum health and production performance of sonali chicken requires nutritionally balanced diets. One of the common issues with regard to small flocks relates to poor or inadequate feeding programs that can lead to vitamin and mineral deficiencies in the birds. Since vitamins and minerals are very important to normal physiological functioning of birds, inadequate supply of these nutrients will pose a serious problem to birds. It is also costly to use commercial produced (Amino Plus) vitamins and minerals hence increasing the cost of poultry production.

1.3 Justification of the Study

As indicated above, vitamin and mineral deficiencies can produce numerous health problems for sonali chickens including death in some cases. Thus, to prevent nutritional deficiencies, or to correct when deficiency symptoms are noted, feeding a balanced poultry ration with the required vitamins and minerals like (Amino Plus) should be practiced. The use of Aloe vera in Sonali chicken production is a step in the right direction since they are of potential sources of these essential nutrients that are necessary for normal well being, growth and development of birds. So research undertake to find out efficacy of Aloe vera as natural growth promoter compared to commercial growth promoter.

1.4 Research objectives

From the view point the research program was been undertaken with the following objectives:

i. To evaluate the effect of aloe vera gel on production performance, dressing yield, meat yield parameters and cost on the production of sonali chicken.

ii. To determine the hematological parameters of sonali chicken.

CHAPTER II

REVIEW OF LITERATURE

REVIEW OF LITERATURE

Aloe vera is well known for its numerous medicinal properties. This plant is one of the richest sources of vitamins, minerals, enzyme, sugars, lignin, saponins, salicylic acid, amino acid etc. This plant cultivated commercially and also grow ornamentally in the world. Active ingredients of Aloe vera are used to different treatment purposes in animal and human being. A review of work which is already taken on different medicinal and other aspects of aloe vera is described below.

2.1 Physio-chemical Properties of Aloe vera

The botanical name of aloe vera is *Aloe barbadensis* miller. Aloe vera in Bangladesh is called 'Ghritokumari". It belongs to the Liliaceae family small succulent, pea-green colour plant. Aloe vera also known as to aloe or medicinal aloe. The plant has triangular, fleshy leaves that contain three layers, inner, middle, and outer layer. The inner layers of aloe vera that contain clear gel, gel contain 99% water. The dry matter of aloe vera 0.5-1%, Average ph value is 4.49

Fig: 1 Aloe vera plant

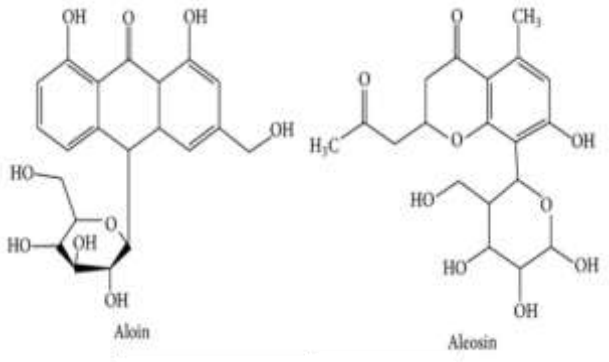

Fig: 2 Chemical structure of Alion and Aleosin

Summary of the chemical composition of Aloe vera leaf pulp and exudate (Ni and Tizard, 2004, Dagne *et al*, 2000, Choi and Chung, 2003)

Anthraquinones	Aloe-emodin, aloetic-acid, anthranol, aloin A and B (or collectively known as barbaloin), isobarbaloin, emodin, ester of cinnamic acid
Carbohydrates	Pure mannan, acetylated mannan, acetylated glucomannan, glucogalactomannan, galactan, galactogalacturan, arabinogalactan, galactoglucoarabinomannan, pectic substance, xylan, cellulose
Chromones	8-*C*-glucosyl-(2'-*O*-cinnamoyl)-7-*O*-methylaloediol A, 8-*C*-glucosyl-(*S*)-aloesol, 8-*C*-glucosyl-7-*O*-methyl-(*S*)-aloesol, 8-*C*-glucosyl-7-*O*-methylaloediol, 8-*C*-glucosyl-noreugenin, isoaloeresin D, isorabaichromone, neoaloesin A
Enzymes	Alkaline phosphatase, amylase, carboxypeptidase, catalase, cyclooxidase, cyclooxygenase, lipase, oxidase, phosphoenolpyruvate carboxylase, superoxide dismutase
Inorganic compounds	Calcium, chlorine, chromium, copper, iron, magnesium, manganese, potassium, phosphorous, sodium, zinc
Miscellaneous including organic compounds and lipids	Arachidonic acid, γ-linolenic acid, steroids (campestrol, cholesterol, β-sitosterol), triglicerides, triterpenoid, gibberillin, lignins, potassium sorbate, salicylic acid, uric acid
Non-essential and essential amino acids	Alanine, arginine, aspartic acid, glutamic acid, glycine, histidine, hydroxyproline, isoleucine, leucine, lysine, methionine, phenylalanine, proline, threonine, tyrosine, valine
Proteins	Lectins, lectin-like substance
Sachharides	Mannose, glucose, *L*-rhamnose, aldopentose
Vitamins	Thiamin, riboflavin, pyridoxine, cyanocobalamin, β-carotene, vitamin E, vitamin C choline, folic acid, α-tocopherol

2.2 Effects of Aloe vera on body growth, feed intake, and feed efficiency

Greater body weight gain and better feed efficiency are among important economic goals in poultry farming. The bans on application of different growth promoter have affected this goal, resulting in poor growth performance and resistance of drug in poultry. Many studies have examined potential effects of feed additives, like antibiotic growth promoter, prebiotics, probiotics, organic acids, and herbs on growth performance of poultry compared to those of antibiotics.

Singh *et al*. (2017) reported that supplementation of Aloe vera at different inclusion level (0.1%, 0.2% and 0.3%) result of this study (up to 6 weeks) indicated that growth performance was increased significantly ($P< 0.05$) that receive (0.1%, 0.2% and 0.3%) Aloe vera compared to the control group in broiler.

Islam *et al.* (2017) evaluated that the effects of dietary supplementation of Aloe vera extract (w/v) @ 05, 10, 15 and 20 ml per liter of drinking water while T_0 provide plain water. The results of the study revealed that the Aloe vera supplemented groups showed higher live weight gain than untreated group. Aloe vera supplemented groups showed more live weight gain in the terminal stages of the experiment. Aloe vera (w/v) extract supplemented groups performed the best feed efficiency. The live weight gain and feed efficiency were significantly ($P<0.05$) better in the broilers provided water containing 15 ml/L Aloe vera aqueous extract.

Darabighane *et al*. (2011b) reported the comparing effects of Aloe vera gel and AGP (virginiamycin) that are provide with feed, indicated that AGP (virginiamycin) resulted in better growth performance compared to the performance of groups that received Aloe vera gel at 1.5%, 2%, and 2.5%, and the control group while no significant difference was observed between the antibiotic group and the 2% Aloe vera gel group in terms of body weight gain and FCR. In the same vein, Mmereole (2011) proposed that Aloe vera leaf powder (1%) can be used as a proper alternative for AGP (Teramycin). Body weight and body weight gain significantly higher that receive aloe vera supplement compare to the control group in broiler.

Mehala and Moorthy (2008) reported that broilers fed with Aloe vera powder (0.1% and 2%) and Curcuma longa powder (0.1% and 0.2%) and a mixture these two powders have

no significant difference in body weight gain and FCR, except for first week of treatment. In addition, no difference was observed in terms of feed intake and growth performance of broilers.

Olupona *et al*. (2010) observed that supplementation of Aloe vera with drinking water in broilers. Result showed an increase in final body weight, weekly body weight gain, and average feed intake in the groups that received Aloe vera at 15, 20, 25, 25, and 30 cm^3 per dm^3. In addition, improvement in FCR was observed for broilers treated with Aloe vera compared to the control group, but the difference was not significant.

Hassanbeigy- Lakeh *et al*. (2012) showed that supplementation of Aloe vera gel in broiler at (0.6, 1.2, 1.8, 2.4, and 3 ml per liter) water. Result found that Aloe vera gel had no effect on feed intake over the total experiment period, and that the largest body weight gain and the smallest FCR was observed in the 1.8 ml per liter Aloe vera gel group.

Sinurat *et al.* (2002) reported that different forms of Aloe vera (fresh gel, dry gel, fresh whole leaf or dry whole leaf) and antibiotic. The Aloe vera was supplemented into the feed with concentrations of 0.25, 0.5 and 1 g/kg (equal to dry gel). Standard diets with or without antibiotics were also included as control. The diets were fed to broilers from day old to 5 weeks and the performances were observed. Results showed that the aloe bio-actives did not significantly affect final body weight of broilers as compared with the control. Supplementation of 0.25 g/kg fresh gel, 0.25 and 1.0 g/kg dry gel significantly improved feed conversion by 4.7, 4.8 and 8.2%, respectively as compared with the control. Moreover, supplementation of whole Aloe vera leaves could not improve feed conversion in boilers. It is concluded that the bio-actives of Aloe vera could be used as feed supplement to improve feed efficiency in broilers with no deleterious effect on weight gain, carcass yield, abdominal fat levels and internal organs. The effective concentrations of Aloe vera gel as a feed supplement based on dry matter conversion were from 0.25 g/kg fresh gel, 0.25 and 1.0 g/kg dry gel.

Amaechi and Iheanetu (2014) evaluated that the effects of dietary inclusion of Aloe vera to substitute antibiotic growth promoter (Enramycin) on performance, carcass characteristics and intestinal micro flora of broiler chicks. The results obtained found that Aloe vera powder groups and antibiotic group brought about higher body weight gain and feed intake compared to the control group. However, significant differences

($P<0.05$) were observed in feed conversion ratio between the groups treated by Aloe vera powder, antibiotic Enramycin and the control group.

Since coccidiosis may compromise growth performance, Yim *et al.* (2011) examined potential effects of Aloe vera on improving growth performance in broilers with coccidiosis and found that Aloe-vera powder at 0.1%, 0.3%, and 0.5% added to the feed of these broilers does not lead to significant difference in terms of body weight gain. Darabighane and Zarei (2011) observed that adding 1.5%, 2%, and 2.5% Aloe vera gel to the feed of broilers with coccidiosis improved FCR for these broilers compared to the control group. Effects of Aloe vera on growth performance are inconsistent and these discrepancies can be attributed to the form of supplement (leaf powder, gel powder, or fresh gel), dosage, or whether Aloe vera is added to feed or drinking water.

Yang *et al.* (2009) explained that particular attention must be paid to anti-bacterial activities and improvement in immune response as these two factors may contribute to better growth performance in broilers, and previous studies confirm these two properties (anti-bacterial effect and improvement in immune response) for Aloe vera. Effect, anti-bacterial properties of Aloe-vera improve intestinal micro-flora and reduce pathogens, thereby changing intestinal morphology and improving growth performance. On the other hand, by improving immune response in broilers and increasing body resistance, Aloe vera indirectly affects growth performance.

Bolu *et al*. (2013) concluded that the growth parameters, such as survival, weight gain, feed conversion efficiency were significantly ($P<0.05$) higher in poults given 30 ml/l Aloe vera gel (0% mortality, 17.18g/day and 2.89), respectively. Histological results of the organs (breast muscle, liver, spleen and ileum) showed normal morphological pattern for poults subjected to 20 ml/l Aloe vera gel while those kept on 30 ml/l showed normal organ architecture for breast muscle, spleen and ileum but not for the liver. Similarly, birds raised on commercial antibiotics showed normal organ morphology compared to the positive control.

Singh *et al.* (2013) Suggested that Aloe vera has potential to be a growth promoter in broiler chicks and its growth promoting effects are comparable to that of antibiotic growth promoter (AGP).

Eevuri and Putturu (2013) observed that Aloe vera supplementation in broilers ration increased the body weight gain, feed efficiency and decreased the feed intake.

2.3 Effect on carcass characteristics

Darabighane *et al*. (2011) Showed that the groups treated by Aloe vera gel found that heavier dressing percentage compared to the control group. Furthermore, among the different groups, the antibiotic group experienced heavier dressing percentage compared to other groups, showing no significant difference from the 2% Aloe vera gel group.

Singh *et al.* (2013) reported that Aloe vera has potential to be a growth promoter in broiler chicks and its growth promoting effects are comparable to that of antibiotic growth promoter (AGP). Group that was given Aloe vera showed numerically higher dressing percentage as compared to control group and drug control group.

Eevuri and Putturu (2013) indicated that Aloe vera supplementation in broilers decreased the fat accumulation, increased dressing percentage, liver weight, spleen weight and whole giblet weights.

Fallah (2015) evaluated that the effects of supplementing different levels of Aloe vera gel and garlic powder in broiler. Found that no significant difference ($P>0.05$) in internal organs weight like gizzard, spleen, bursa of fabricius, proventriculus and abdominal fat at 42 days of age between control and treated groups. In addition this investigation showed that broilers receiving Alo*e* vera gel and garlic powder had lower abdominal fat relative weight compared to control group. However, the highest thighs, breast and total carcass weights were observed with supplementation of Aloe vera gel + garlic powder than other groups. Although, there was no significant difference ($P>0.05$) between the control and treated groups in neck, wing and head relative weight. The highest relative weight of liver, spleen, gizzard, thighs and breast were observed in group 4 at 42 days of age.

Amaechi and Iheanetu (2014) suggested that broiler fed with aloe vera and antibiotic, the antibiotic group showed better dressing weight than the Aloe vera powder and the control groups. There was no significant difference ($P>0.05$) seen between the group treated with 1.5% Aloe vera powder and the antibiotic group regarding body weight gain and dressing weight.

2.4 Effect on haemato- biochemical parameters

Valle Paraso *et al*. (2006) concluded that oral supplementation of Aloe vera on broiler, result showed that 2% solution was a significant ($P<0.05$) increase in total WBC count along with absolute differential count of monocytes, lymphocytes and heterophils.

Altug *et al*. (2010) supplementation of Aloe vera and β-glucan on dogs, Result of this study observed that there was increase in platelet count, WBC's, peripheral blood mononuclear lymphocyte counts, peripheral blood polymorph nuclear lymphocyte counts, neutrophils, monocytes, PCV, haemoglobin concentration. The CD3, CD4 and CD8 T-lymphocyte and B-lymphocyte ratio as well as serum IgG and IgM concentration were also increased.

Ajabnoor (1990) investigated the effect of Aloe vera on blood glucose levels in normal and alloxan diabetic mice. There was a highly significant ($P<0.05$) decrease in serum glucose level after intra-peritoneal administration of bitter principle of Aloe vera.

Rajasekaran *et al*. (2001) investigated that oral administration of Aloe vera gel in alloxan induced diabetes mellitus in rabbits. Result showed that Aloe vera gel at a concentration of 500 mg/Kg body weight significantly ($P<0.05$) decrease in blood glucose level and serum lipid profile confirming the hypoglycemic and hypolipaemic effects of Aloe vera.

Akinmoladun and Akinloye (2004) observed that effect of Aloe vera on lipid profile and fasting blood sugar concentration of rabbits fed with high cholesterol diet. They showed that total plasma cholesterol and fasting blood glucose levels were decreased as compared to control group and indicating hypoglycemic and hypolipaemic effects of Aloe vera.

Zhang *et al*. (2007) indicated that Supplementation Aloe vera and propolis preparation result showed tha*t* there were significantly ($P<0.05$) higher contents of serum globulins, dextrose, urea nitrogen and calcium as well as activity of SGOT in broilers that receive Aloe vera.

Madan *et al*. (2008) evaluated that oral administration of Aloe vera extract to Swiss albino mice (300 mg/kg i.p.) daily for five days, significantly ($P<0.01$) increases the total white blood cells count. Further, it increases humoral immune response, as

demonstrated from the increase in plaque-forming cells in the spleen and circulating antibody titer. In addition hand, assessment of blood parameters showed an increase in total white blood cell and lymphocyte counts on days 37 and 52 for broilers that received 2% Aloe vera gel (mixed with drinking water) compared to the control group (Valle-Paraso *et al*. 2005).

Eevuri and Putturu (2013) observed that oral supplementation of Aloe vera in broilers significantly reduced the serum cholesterol, serum triglycerides and increased the humoral response against NCD vaccine.

Darabighane *et al*. (2011a) observed that different form of aloe vera (dry and gel) are fed in broiler reported that an increase in total white blood cell count result of adding Aloe vera gel to broiler feeds. In another study that used Aloe vera gel powder in broiler feeds, a significant increase was observed in total white blood cell count, red blood cell count, and haemoglobin in groups treated with Aloe vera gel powder compared to the control group, with the 1% Aloe vera gel powder group showing the highest haemoglobin, red blood cell, and white blood cell count.

Bolu *et al*. (2013) showed that there were no adverse effects of Aloe vera gel on turkey poults health, as determined from the analysis of various haematological parameters and serum metabolites. The results indicated that Aloe vera gel inclusion at 20 ml/liter in drinking water could successfully replace antibiotics in turkey poults rearing.

Mmereole (2008) reported that increase TEC, PCV, TLC, MCH, MCV, MCHC values in Aloe vera treated group that receive (1% aloe vera leaf powder) as compared to antibiotic supplemented group that receive in broiler.

Singh *et al.* (2013) reported that higher Hb, PCV, TLC, total plasma glucose and serum calcium values in Aloe vera treated group that receive (ALG) @ 20g/L in drinking water compared to control group in broiler.

2.5 Effects on immune response

An important property of Aloe vera that has been the subject of many in vivo and in vitro experiments is improvement in immune response, probably due to the acemannan contained in Aloe vera (Harlev *et al. 2012*, Djeraba and Quere, 2000).

Improved or reinforced immune response in poultry creates resistance against diseases, and health of a flock, which can be the result of preparedness of immune system against pathogenic agents, is an important factor in improving long life, homogeneity and growth performance of birds. Therefore, greater emphasis has been placed by researchers on improving immune response.

Guo *et al.* (2004) observed that the polysaccharides contained in medicinal herbs and mushrooms can improve the response of immune system. Acemannan contained in Aloe vera gel is a β (1-4)-linked acetylated mannan containing mannose that can attach to mannose receptors in macrophages and activate these macrophages was observed by (Karaca *et al*. 1995). Added Aloe vera gel powder at (0.5%, 0.75%, and 1%) to broiler feeds and reported an increase in antibody titer against NDV (Alemi *et al.* 2012). Moreover, another study reported by (Jiang *et al.* 2005) an improvement in antibody titer in broilers against NDV as a result of adding acemannan containing Aloe vera (0.1% and 0.05%), polysaccharide (0.1%), and Aloe vera-gel (0.1%) to broiler feed.

Besharatian *et al*. (2012) investigated an increase in total immunoglobulin of 35-day-old broilers that received Aloe vera leaf powder (0.5% and 1% mixed with feed) and aqueous extract of Aloe vera leaf (15 and 30 ml/l, added to drinking water).

Waihenya *et al*. (2002) reported that loss and clinical symptoms, in infections by NDV, as a result of using Aloe secundiflora in broilers. In addition to Aloe vera effects on antibody titer against NDV, researchers have investigated antibody titer against sheep red blood cells (SRBC).

Akhtar *et al*. (2012) observed that ethanol and aqueous extracts of Aloe vera pulp orally administered at 300 mg per kg body weight per day for three consecutive days to broilers increased antibody titer against SRBC compared to the control group.

Darabighane *et al*. (2012) reported an increase in antibody titer against SRBC in broilers treated with Aloe vera gel, compared to the control group. The findings of Besharatian *et al*. (2012), Akhtar *et al*. (2012), and Darabighane *et al*. (2012) in connection to effects of Aloe vera on cellular immunity after PHA-P injection indicate improved cellular immune response in broilers that received Aloe vera leaf powder (0.5% and 1%) and aqueous extract of Aloe-vera leaf (15 and 30 ml/l) (Besharatian *et al*. 2012), ethanolic extract of Aloe vera pulp (300 mg/ kg body weight/day for three consecutive days) (Akhtar *et al.*

2012), and 2.5% Aloe-vera gel (Darabighane *et al.* 2012) showed the best performance compared to other groups.

Therefore, Aloe vera can affect humoral and cellular immunity as evidenced by those studies that examined Aloe vera effects on immune response of broilers. On the other hand, assessment of blood parameters showed an increase in total white blood cell and lymphocyte counts on days 37 and 52 for broilers that received 2% Aloe vera gel (mixed with drinking water) compared to the control group (Valle-Paraso *et a*l. 2005).

Darabighane *et al*. (2011a) reported an increase in total white blood cell count of broilers as a result of adding Aloe vera gel to broiler feeds. Mahdavi *et al*. (2012) used Aloe vera gel powder in broiler feeds, a significant increase was observed in total white blood cell count, red blood cell count, and hemoglobin in groups treated with Aloe vera gel powder compared to the control group, with the 1% Aloe vera gel powder group showing the highest hemoglobin, red blood cell, and white blood cell count.

In examining the effects of Aloe vera on lymphoid organs, researchers reported relative weight gain in these organs of broilers (Darabighane *et al*. 2012; Akhtar *et al*. 2012; Feng *et al.* 2011; Jiang *et al*. 2005). Besharatian *et al*. (2012) did not observe a significant difference in weight of lymphoid organs, but reported a weight gain in spleen and bursa. Such relative increase in the weight of lymphoid organs as a result of adding Aloe vera to feed or drinking water suggests immune (humoral and cellular) system readiness against antigens. In addition, the polysaccharides contained in Aloe vera can improve immune system response in chickens that received *B.* avium inactivated vaccine (Sun *et al.* 2011).

Altuğ *et al*. (2010) adding Aloe vera and beta-glucan led to stimulation of humoral and cellular immune response in dogs after vaccination. Many studies have examined immunomodulatory effects of Aloe vera and many researchers have attributed these effects on humoral and cellular immune response to acemannan.

However, one should also take into account indirect immunomodulatory effect resulting from intestinal microflora since Aloe vera can reduce the number of pathogens in intestines, thereby improving immune response and body resistance. Darabighane *et al.* (2012) reported an increase in antibody titer against Newcastle disease virus NDV) on days 24 and 38 by adding Aloe vera gel to broiler feeds (at 1.5%, 2%, and 2.5%).

Valle-Paraso *et al.* (2010) reported that broilers treated with 2% Aloe vera gel (mixed with thwater) showed significant increase in antibody titer against NDV on days 37 and 52, compared to the control group. Alemi *et al*. (2012) added Aloe vera gel powder (at 0.5%, 0.75%, and 1%) to broiler feeds and reported an increase in antibody titer against NDV.

Jiang *et al*. (2005) reported that an improvement in antibody titer in broilers against NDV as a result of adding acemannan (0.1% and 0.05%), polysaccharide (0.1%), and Aloe vera gel (0.1%) to broiler feed.

2.6 Effects on intestinal microflora

Healthy birds are generally characterized as having a well functioning intestinal tract. This is fundamental for the efficient conversion of feed for maintenance of body and growth. Few experiments have been carried out on the impacts of Aloe vera on intestinal micro flora in broilers.

Darabighane *et al.* (2012) indicated that supplemented with different level of aloe vera gel (at 1.5%, 2%, and 2.5%) mixed with feed, leads to increased significantly Lactobacillus colonies count and decreased *E. coli* colonies count compare to the basal diet group and group that receive 15 ppm virginiamycin antibiotic in broiler. In addition, an increase in Lactobacillus count and Bifidobacteria count as well as a reduction in *E. coli.* count when acemannan at 0.1% and 0.05%, polysaccharide (0.1%), and Aloe-vera gel (0.1%) were added to broiler feed (Jiang *et al*. 2005). In the same vein, Dai *et al*. (2007) showed that herbs and polysaccharide contained in Aloe-vera can reduce *E. coli* count while increasing the number of Lactobacillus and Bifidobacteria. Although the exact mechanism through which Aloe vera affects intestinal microflora in broilers is unknown, it is likely that this effect is similar to the anti-bacterial effects of some herbs and mushrooms that improve intestinal microflora. It is also likely that the polysaccharide contained in Aloe vera (acemannan) follows a mechanism like that of prebiotics since studies found prebiotic-like impacts of polysaccharides contained in medicinal herbs and mushrooms was observed by Guo *et al*. (2003)

2.7 Effects on Protozoa

Coccidiosis is one of the most common protozoal diseases in poultry farming industry with detrimental impacts on growth performance. An excellent way to control coccidiosis is to use anticoccidial drugs. However, high treatment costs and heightened resistance against these drugs have shifted attentions toward herbs for controlling the disease.

Application of Aloe-vera for treatment of poultry diseases is not limited to large-scale farming (industrial applications) for example, different species of Aloe can be found in Zimbabwe, and in Mushagash, smallholder farmers use Aloe vera and Aloe spicata to treat broilers with coccidiosis (Mwale *et al.* 2005).

Akhtar *et al.* (2012) reported in their studies that fecal oocyst shedding in broilers orally administered with ethanol and aqueous extracts of Aloe vera pulp at 300 mg per kg body weight per day for three consecutive days was significantly lower compared to the infected control group. In an *in vitro* experiment to compare the effects of Aloe vera and Aloe spicata on inhibition of the sporulation of avian coccidia oocysts, (Mwale *et al*. 2006) observed that increase in Aloe vera and Aloe spicata content significantly decreases coccidian oocyst count.

Yim *et al*. (2011) reported that broilers that received Aloe vera powder at 0.1%, 0.3%, and 0.5% had smaller fecal oocyst shedding count compared to infected group fed with the standard diet. Moreover, broilers that received aqueous extract of Aloe-vera pulp had the lowest mean score lesion in caeca and intestine in comparison to the control group and the group that received ethanol extract of Aloe vera pulp. In addition broiler receiving 2.5% Aloe vera gel added to their feed had the smallest fecal oocyst shedding among all groups (Darabighane and Zarei, 2011). Since Aloe vera positively affects immune response and previous studies well established the role of immune system in treatment of coccidiosis in poultry, the anticoccidial effects of Aloe vera are attributable to stimulation of immune system.

Akhtar *et al*. (2012) argued that attributed anticoccidial effects of Aloe vera to production of antibody against coccidiosis, which probably reduces the number of fecal egg and increases weight gain. Yim *et al*. (2011) observed that through cellular mediated response, Aloe vera can provide a more favorable effect compared to antibody response.

In general, and based on the findings of the previous studies, Aloe vera is regarded as a proper alternative for treating coccidiosis in a more econo mical way.

Durrani *et al.* (2008) Concluded that giving aloe extract in different inclusion levels the better antibody titer against IB and IBD and lower coccidia oocysts count in bedding material of the broilers was found in birds, receiving aloe extract @15 ml/liter of drinking water

2.8 Effect on mortality and cost of production

Moorthy *et al.* (2009) found that a significant ($P<0.05$) difference in return over feed cost in 0.1 percent Aloe vera fed group compared to other treatment groups. In addition no significant difference was found in feed consumption, percent hen day egg production and percent broken eggs. It can be concluded that inclusion of 0.1 percent Aloe vera in white leghorn diet is economical compared to its combination with turmeric and probiotic at 0.1 percent level.

Eevuri and Putturu (2013) reported that combined effect of (Tumeric, Tulsi, Amla and Aloe vera) in broiler. Result was found that decreased mortality rate and cost of feed has been decreased from 6.2% to 13.5%.

CHAPTER III

MATERIALS AND METHODS

MATERIALS AND METHODS

3.1 Location of the study

The experiment was conducted at the Dairy and Poultry Science farm of HSTU, Dinajpur during the period from mid July to September 2017. Commercial sonali chick was used in this study for a period of 9 weeks to find out the effects of Aloe vera leaf gel on performance of Sonali chicken.

3.2 Experimental birds

One hundred eighty vigorous day- old Sonali chicks were procured from Polly hatchery limited, Joypurhat.

3.3 Layout of the experiment

The experiment was conduct 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 contain of 12 birds. The layout of the experiment is shown in the following table:

Table 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	12	12	12	36
T_1	12	12	12	36
T_2	12	12	12	36
T_3	12	12	12	36
T_4	12	12	12	36
Total				180

Where,

T_0: control

T_1: commercial growth promoter 1ml/L drinking water (Amino plus)

T_2: Aloe vera gel 7.5 gm/L drinking water

T_3: Aloe vera gel 15 gm/L drinking water

T_4: Aloe vera gel 22.5 gm/L drinking water

3.4 Preparation of the experimental house

HSTU poultry farm was used for rearing experimental birds to evaluate the efficacy of aloe vera gel. Experimental shed was constructed with compartment for housing for twelve birds. Each compartment was dimensions 54×42 inch 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 feederer, watarer 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 Aloe vera gel

Aloe vera leaves were collected from the local market of Dinajpur. Aloe vera gel was prepared accordingly to the method of Durrani *et al*. (2008*)*. The Aloe gel was extracted from the leaf manually by making a cut, using a knife. The gel was collected and measured by electric balance and a blender was used to mix properly with the water.

Fig.3 Collection of Aloe vera

Fig. 4 Measuring Aloe vera gel

Fig. 5 Blending Aloe vera gel

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. The experimental diets were purchased from local market in Dinajpur, namely company (ACI Agro-vet Limited). Commercial growth promoter was purchased from local market in Dinajpur namely (Amino plus) Animal health limited. Aloe vera was purchased from local market in Dinajpur. All treatment was provided through drinking water during experimental period.

3.7 Chemical composition of basal diet

Chemical composition	Starter	Grower
Moisture %	11-12	11-12
Crude protein %	21	21
Crude fiber %	5	4
Crude fat %	-	5
Ether extract %	4	-
Calcium %	1	1
Available phosphorus %	0.5	0.5
ME (Kcal/Kg)	2950	3100

3.8 Chemical composition of commercial growth promoter (Amino Plus)

Ingridients	Amount
DL-Metheonin	510mg
L-Lysin	170 ml
L-Tryptophan	50mg
L-Histidin	60mg
L-Valine	136 mg
L- Glutamic Acid	136 mg
L-Threonine	79 mg
L-Phynyl alanine	119 mg

L-Leucine	187 mg
L-Isoleucine	350 mg
L-Arginine	142 mg
Vitamin A	1000000 IU
Vitamin D3	80000 IU
Vitamin B1	200 mg
Vitamin B2	12 mg
Vitamin B6	12 mg
Vitamin B12	12 mg
Vitamin K3	400 mg
Vitamin C	10 mg
Vitamin E	600 mg
Calcium	7000 mg
Elemented Phosphorus	3500 mg
Digestive Stimulant	2000 mg
Nicotinamide	150 mg
Methylparaben	175 mg
Propylparaben	35 mg

3.9. Routine Management

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

3.9.1 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 provide as same depth. The litter was stirred one time per day from four weeks to upto end day of experimental period.

3.9.2 Floor Space

Each pen 4.5×3.5 sq. ft. was allocated for feeding, watering, and housing for 12 birds.

3.9.3 Brooding management

Brooding is the first management of day old chick. In brooding electric brooder was used to provide heat in chick. 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 $^{\circ}$C. After entry day old chick provided vitamin C and glucose latter one hour feed was provided. At first day temperature maintain 33± 2°C then gradually decrease 1°C per day. Temperature and humidity recoded by using clinical thermometer and hygrometer.

3.9.4 Lighting management

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

3.9.5 Feeding and drinking

Provide ad libitum feed and water through the experimental period.

3.9.6 Vaccination

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

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

3.9.7 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.

3.10 Temperature and relative humidity measure

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

3.11 Slaughtering of the birds

Prior to slaughtering the birds were fasted for 8 hours, but water was provided ad libitum. 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 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.

Fig.6 After slaughtering

Fig. 7 Dressing yield

Fig.8 Breast meat weight

Fig. 9 Thigh meat weight

3.12 Collection of blood

For hematological analysis two birds were randomly selected in per replication. Blood was collected from wing vein by sterile syringe.

Fig: 10 Blood collection from wing vein

3.13 Storage and Transport of blood sample

After collection of blood it was kept in evacuated EDTA tube then store at 4^0C. Then the blood sample was send in Taufiqe Agro Vet Laboratory Rangpur for analysis.

3.14 Calculation

1. Total gain in weight (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

3.15 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 end 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. Hematological parameters (RBC, PCV, WBC and Hb) were recorded replication wise in each treatment group after laboratory examination. Temperature and relative humidity was recorded three times daily.

3.16 Statistical analysis

The data of feed consumption, growth performance, carcass characteristics and hematological parameters 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

RESULTS AND DISCUSSION

This experiment was conducted to evaluate the efficacy of Aloe vera gel on production performance in terms of weekly body weight gain, final live weight gain, feed intake, feed efficiency, dressing percentage, meat yield parameters, blood parameters and cost analysis of Sonali chicken at different dietary treatments are showed.

4.1 Weekly Body weight gain

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}, 6^{th} and 7^{th} weeks did not significantly ($P<0.05$) vary among the treatment groups. The efficacy of supplementation of Aloe vera gel @ 7.5 gm/L, 15 gm/L and 22.2 gm/L in drinking water upto 7 weeks increase live weight gain day by day compared to the control T_0 group. In commercial growth promoter group T_1 similar to the treatment group T_3, slightly higher than treatment T_0 and T_2 whereas slightly lower than treatment T_4 group. In 7^{th} weeks the highest weight was found (612.6±11.8g) in Aloe vera group that was received @ 22.5 gm/L water and the lowest weight was found (532.7±18g) that receive plain water T_0. Within the Aloe vera group respective treatment @ 7.5 gm/L, 15 gm/L and 22.2 gm/L in drinking water live weight was found (604.6±14g) , (578.5±16 g) and (612.6±11.8 g). The result of this study clearly showed that increase inclusion level of Aloe vera gel increase live weight upto 7 weeks of age. Live weight of 8^{th} and 9^{th} weeks there were a significant ($p<0.05$) differences among the treatment group. Supplementation of Aloe vera @ 22.5 gm/L was showed the maximum live weight gain and statistically significant ($p<0.05$) compare to plain water group and Aloe vera group $T_{2,}$ but similar result was found with T_1 treatment group. However the highest inclusion level of Aloe vera gel 22.5 gm/L drinking water was showed maximum live weight (841.8±29 g) and minimum live weight was showed (726.5±20g) in T_0 treatment group at the terminal stage of experiment. Within Aloe vera treatment group 7.5 gm/L drinking water group was represented lowest live weight gain whereas, 22.5 gm/L drinking water treatment group represent highest live weight gain. It is clearly stated that increase inclusion level of Aloe vera increase live weight. The significant effect of Aloe vera gel on

body weight gain was in agreement with the findings of some previous studies Singh *et al*. (2017) who reported that supplementation of Aloe vera at different inclusion level (0.1%, 0.2% and 0.3%) result of this study (up to 6 weeks) indicated that growth performance increase significantly that receive (0.1%, 0.2% and 0.3%) Aloe vera compared to the control group in broiler. Islam *et al.* (2017) who showed that the live weight gain and feed efficiency were significantly ($P<0.05$) better in the broilers provided water containing 15 ml/L Aloe vera aqueous extract compare to control.

4.2 Body weight gain

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 ALG 22.5 g/L drinking water. This was followed by amino plus 1 ml/L drinking water, ALG 15 g/L drinking water, ALG 7.5g/L drinking water and only basal diet group respectively (Table 1). However, treatment groupT_4 was significantly ($p<0.05$) higher body weight gain compared to control group T_0 while non-significant ($p>0.05$) to commercial growth promoter group. Within Aloe vera group treatment T_4 was significant ($p<0.05$) compare to T_2 treatment. The result of this study was indicated that higher inclusion level of ALG showed highest body weight gain compared to control group at the end of feeding trial. The highest body weight gain was observed in Aloe vera treated group may due to phytogenic effect of Aloe vera. This study agree with Bolu *et al*. (2013) who found that the growth parameters, such as survival, weight gain, feed conversion efficiency were significantly ($P<0.05$) higher in poults given 30 ml/L Aloe vera gel in broiler. Darabighane *et al*. (2011b) who was observed that resulted in better growth performance of groups that received Aloe vera gel at 1.5%, 2%, and 2.5%, compare to control group. In the same vein, (Mmereole 2011) who found that significantly higher body weight and body weight gain that receive (1%) Aloe vera compare to the control group in broiler.

Table 1. Effect of supplementation of Aloe vera gel on weekly body weight gain of sonali chicken

Parameters (g)	**T_0 0 ml/L**	**T_1 1 ml/L**	**T_2 7.5 gm/L**	**T_3 15 gm/L**	**T_4 22.5gm/L**	**Level of Sign.**
Initial live wt.	28.5±3.7	28.7±2.9	28.9±4.1	28.6±3.4	28.2±2.3	NS
1st week	77.00±3.0	77.80±4.0	77.45±3.6	77.74±3.5	77.54 ± 3.0	NS
2nd week	133.7±3.5	135.4±4.0	136.1±3.6	136.5±5.0	141.5±4.0	NS
3rd week	201.1±5.7	203.5±4.6	201.5±4.8	202.6±5.1	217.1±5.8	NS
4th week	284.3±13.1	297.9±11.6	289.8±12.4	293.7±9.3	306.5±9.5	NS
5th week	384.3±13.5	389.1±11.4	388.4±15.6	392.2±10..3	411.8±11	NS
6th week	457.4±28.3	490.5±21.4	468.7±26.3	490.1±15.5	501.7±13.3	NS
7th week	532.7±18.0	604.6±14.0	555.2±20.9	578.5±16.0	612.6±11.8	NS
8th week	627.5 ± 21^{a}	707.7 ± 15.8^{bc}	$662.4\pm18.^{ab}$	688.6 ± 15.7^{b}	720.3 ± 14.8^{c}	*
9th week	726.7 ± 20^{a}	798.6 ± 26^{ab}	754.6 ± 27.5^{a}	788.4 ± 18^{ab}	841.8 ± 29^{b}	*
Body wt. gain	698.2 ± 18^{a}	770.1 ± 23.2^{ab}	726.1 ± 25^{a}	759.1 ± 15^{ab}	813.3 ± 27^{b}	*

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

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 (1950±41g) was found T_0 group. The birds of T_4 group took containing 22.5 g/L Aloe vera gel showed higher feed intake (2065±43g) due to the phytogenic substance in Aloe vera that may stimulate appetite and endogenous secretion which in turn improved performance from (Table 2) we found that increase inclusion levels of Aloe vera increase feed intake respectively. This study similar to (Windisch *et al.* 2008), Olupona *et al.* (2010) who was reported that the feed intake was higher in the broilers took aloe gel treated drinking water. Total feed intake was gradually increased with increased level of Aloe gel in drinking water.

4.4 Feed efficiency

At the experimental period feed efficiency of different treatment groups statistically significant ($P<0.05$).The birds of T_4 groups took containing 22.5 gm/L Aloe vera gel converted feed to meat most efficiently. The feed efficiency of T_4 treatment groups was statistically significant ($P<0.05$) with T_0 and T_2 treatment group. Commercial growth promoter (Amino plus) 1ml/L was equal to the treatment groupT_3 and significantly ($P<0.05$) higher than the T_0 treatment group. From (Table 2) feed efficiency was increased with increasing level of Aloe vera gel in drinking water. This study agree with Islam *et al. (*2017) who found that supplementation of Aloe vera aqueous extract in drinking water feed efficiency significantly ($P<0.05$) higher than the untreated group. Amaechi and Iheanetu (2014) who observed that significant differences ($P<0.05$) were observed in feed conversion ratio between the groups treated by Aloe vera powder, antibiotic (Enramycin) and the control group. Aloe vera gel in drinking water increase feed efficiency, final body weight gain, and carcass weight in broiler Olupona *et al.* (2010).

Table 2. Effect of aloe vera gel on feed intake, feed efficiency, mortality, and mortality percentage of sonali chicken

Parameters	**T_0 0 ml/L**	**T_1 1 ml/L**	**T_2 7.5 gm/L**	**T_3 15 gm/L**	**T_4 22.5gm/L**	**Level of Sign.**
Feed intake(g)	1950±41	2009±62	1974 ±67	2006±50	2065±43	NS
Feed efficiency	2.81 ± 0.04^{c}	2.61 ± 0.05^{ab}	2.72 ± 0.07^{bc}	2.64 ± 0.03^{ab}	2.54 ± 0.03^{a}	*
Mortality	1	0	0	0	0	NS
Mortality%	2.77	0	0	0	0	NS

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 Dressing percentage

After slaughtering and eviscerating, remove all edible and non edible by-product, dressing percentage of different treatment group showed in (Table 3). The Table indicated that, there were no significant differences among the treatment group. Relatively the heavier dressing percentage was observed in T_4 (52.6%) than other treatments T_1 (51.27%), T_3 (51.12%), T_2 (50.5%) and T_0 (50.1%) respectively. The highest dressing percentage was found (52.6±0.48%) in T_4 treatment group and lowest was found (50.1±0.35%) in T_0 treatment group. This finding favorably compared with earlier reports Darabighane *et al*. (2011) who found that the groups treated by Aloe vera gel has heavier dressing percentage compared to the control group. In same viewed Singh *et al.* (2013) reported that the group was given Aloe vera showed numerically higher dressing percentage as compared to control group and drug control group. Eevuri and Putturu (2013) who indicated that Aloe vera supplementation in broilers decreased the fat accumulation, increased dressing percentage, liver weight, spleen weight and whole giblet weights.

4.6 Breast meat

Breast meat obtained (Table 3) was statistically significant ($P<0.05$) among the different treatment group. Supplementation of Aloe vera 22.5g/L drinking water was significant ($P<0.05$) compare to control group and T_2 treatment group. However, highest weight was found (126.2±4.8g) that receive Aloe vera gel 22.5g/L drinking water and lowest was found (105.9±4.3g) in untreated group. In commercial growth promoter group T_1 similar to T_3 treatment and close to T_4 treatment group. This result near with Fallah (2015) who found that highest thighs, breast and total carcass weights were observed with supplementation of Aloe vera gel + garlic powder than other 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 group. Best result was observed in supplementation of Aloe vera gel treated group T_4 (75.5g) whereas nutritional commercial group T_1 (71.4g) then T_3 (70g) T_2 (67g) and T_0 (64g) respectively.

4.8 Head, Heart, Liver and Gizzard 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 head weight maximum in T_4 treatment group and minimum in T_0 treatment group. Heart and liver weight was similar while gizzard weight was maximum (30±2g) found in T_4 treatment group.

4.9 Shank weight

Results on shank weight (from Table 3) on day 63 were not significant, the relatively the heavier shank weight was observed in T_4 (38g) than other treatments T_3 (36.4g), T_1 (34.6g), T_2 (33.4g) and T_0 (31.5g) respectively. Aloe vera group was showed better shank weight due to synergistic effect of calcium and phosphorus of Aloe vera gel.

Table 3. Effects of Aloe vera gel on meat yield parameters of sonali chicken

Parameters	**T_0 0 ml/L**	**T_1 1 ml/L**	**T_2 7.5 gm/L**	**T_3 15 gm/L**	**T_4 22.5gm/L**	**Level of Sign.**
Final Live wt. (g)	726.8 ± 20^{a}	798.6 ± 25^{ab}	754.5 ± 27.2^{a}	788.3 ± 18^{ab}	841.8 ± 29.4^{b}	*
Dressing (%)	50.10±0.35	51.27±0.24	50.5±0.43	51.12±0.31	52.1±0.48	NS
Breast meat wt. (g)	105.9 ± 4.3^{a}	120.3 ± 6^{ab}	112.3 ± 3.6^{a}	117.4 ± 5.5^{ab}	128.7 ± 3.8^{b}	*
Thigh meat wt.(g)	64.0±3.0	71.4±4.0	67.0±2.0	70.0±3.0	75.5±3.5	NS
Head (g.)	28±2.0	30±1.5	29±2.0	31±2.0	34±2.0	NS
Heart (g)	3.0±0.03	4.0±0.02	3.0±0.01	4.0±0.02	4.0±0.01	NS
Liver (gm)	20±2	22±1	21±2	22±1	22±1.5	NS
Gizzard (gm)	23±2	28±1	26±2	29±1	30±2	NS
Shank (gm)	31.7±2	34.6±1	33.4±2	36.5±2	38±1.66	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 ($P<0.05$)

4.10 Blood parameters

Supplementation of Aloe vera, the results of the hematological analysis of the experimental birds are present in (Table 4). It was observed that there were significant ($p<0.05$) differences among the treatment groups in all the hematological parameters except the total white blood cells (WBC) count. RBC value with birds on treatments T_3 and T_4 this was significantly ($p<0.05$) higher than the RBC value of birds on treatment T_0 and T_2 due to phytogenic effect of Aloe vera. RBC values of birds on treatments T_3 and T_4 were statistically similar ($p>0.05$). The RBC values of treatment T_0 and T_3 did not differ significantly ($p>0.05$). However, the highest values of RBC found in supplementation of Aloe vera @ 22.5 gm/L drinking water and lowest values was found in control group .Treatment T_3 and T_4 have significant ($p<0.05$) difference compared to control group T_0 while insignificant ($p>0.05$) to T_1 nutritional commercial group.

In case of PCV percentage same trend follow as RBC. In case of WBC count there was no significant ($p>0.05$) difference among the treatment group. In neutrophil percentage the highest value (29.61%) was found in Aloe vera group that receive @ 22.5 gm/L drinking water and lowest value was found (28.8%) in T_0 control group. Lymphocyte percentage in commercial growth promoter group T_1 showed lowest result (64.8%) and highest result found (65.9%) in control group. Eosinophil percentage was higher in T_0 (2.56±0.24%) then T_3 (2.43±0.29%), T_1 (2.41±0.27%), T_4 (2.37±0.32%) and T_2 (2.33±0.30%) respectively. In Monocyte percentage the result of this study was statistically similar among the treatments group. However, highest Monocyt percentage was seen T_4 (1.75±0.18%) and lowest (1.55±0.17%) in control. Basophil percentage of different treatment groups there were no significant effect among the treatment group. In case of Hb concentration there was a significant ($p<0.05$ difference among the different treatment group. supplementation of ALG 22.5g/L drinking water was significantly higher compared to control group T_0 and T_1 and T_2 treatment group. Thus the current study clearly stated that supplementation of Aloe vera through drinking water @ (7.5 gm/L, 15 gm/L and 22.5 gm/L) increase hematological parameters. The similar result obtained from Singh *et al.* (2013) who was reported that Hb, PCV, TLC, total plasma glucose and serum calcium values was higher in Aloe vera treated group that receive (ALG) @ 20g/L in drinking water compared to control group in broiler. Mmereole (2008) reported that increase TEC, PCV, TLC, MCH, MCV, MCHC values in Aloe vera treated group that receive (1% Aloe vera leaf powder) as compared to antibiotic supplemented group in broiler. Provide Aloe vera gel in drinking on broiler result was indicated that significantly increase blood parameters (RBC, WBC, PCV & ESR) Olupona *et al.* (2010). Blood analysis result of sonali chicken was near to normal blood reference values of *Gallus Gallus* domesticus (Jain 1993). This results disagree with (Valle paraso *et al*. 2006) who was found that Aloe vera at 2% solution in broiler there was a significantly ($P<0.05$) increase in total WBC count along with absolute differential count of monocytes, lymphocytes and heterophils.

Table 4. Effect of Aloe vera gel on haematological parameters of sonali chicken

Parameters	T_0 0 ml/L	T_1 1 ml/L	T_2 7.5 gm/L	T_3 15 gm/L	T_4 22.5 gm/L	Level of sign.
RBC (cells 10^6/µl)	2.58±0.04^a	2.86±0.10^{ab}	2.65±0.08^a	3.01± 0.09^b	3.1± 0.08^b	*
PCV %	26.41±0.32^a	27.5±0.25^{ab}	26.9±0.33^a	28.10±0.41^b	28.66±0.39^b	*
WBC (cells 10^3 /µl)	2.16± 0.03	2.18±0.04	2.17±0.042	2.19±0.047	2.2±0.038	NS
Neutrophil %	28.8±1.16	29.79±1.88	29.66±1.85	29.10±1.41	29.61±1.50	NS
Lymphocyte %	65.9±1.7	64.8±1.9	65.4±1.92	65.8±1.3	65.1±1.5	NS
Eosinophil %	2.56±0.24	2.41±0.27	2.33±0.30	2.43±0.29	2.37±0.32	NS
Monocyte %	1.55±0.17	1.58±0.23	1.65±0.24	1.66±0.13	1.75±0.18	NS
Basophil %	1.10±0.04	1.13 ±0.03	0.88±0.02	1.1±0.05	0.91±0.04	NS
Hb (g/dl)	8.13±0.10^a	8.35±0.24^a	8.38±0.17^a	8.61±0.23^{ab}	9.26±0.31^b	*

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 Economic efficiency 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 lowest was (130.33±2Tk.) found in commercial growth promoter group and highest was found (132.66±4Tk.) in control 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 Aloe vera gel 22.5g/L water whereas increased total feed cost in control group. The net profit from per kilogram sonali was statistically similar ($p>0.05$). The highest profit (24.6±2Tk.) was found commercial growth promoter group and lowest (22.43±4Tk.) was found in control group. Aloe vera treatment group net profit higher was found in T_4 (24±3Tk.) thenT_3 (23.68±3.2Tk.) and T_2 (23.14±4Tk.) respectively.

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

Parameters (Tk.)	**T_0 0 ml/L**	**T_1 1 ml/L**	**T_2 7.5 gm/L**	**T_3 15 gm/L**	**T_4 22.5gm/L**	**Level of sign.**
Chick cost	8	8	8	8	8	NS
Litter cost/chick	4	4	4	4	4	NS
Vaccine + medicine	10	10	10	10	10	NS
Dietary treatment cost/ chick	0	6	3	6	9	NS
Feed cost/ kg production	107.16±4	99.33±5	103.86±5.5	100.32±5.7	97.00±6.0	-
Miscellaneous cost/ chick	3.5	3	3	3	3	NS
Total cost Tk./kg production	132.66±4	130.33±2	131.86±3	131.32±3	131±3	NS
Selling price Tk./kg	155	155	155	155	155	NS
Net profit Tk./kg	22.43±4	24.6±2	23.14±4	23.68±3.2	24±2.5	-

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 ($P<0.05$)

From the above discussion, it is said that body weight gain, feed efficiency, blood parameters (RBC, PCB and Hb) was significantly better with increased level of Aloe vera gel. Dressing percentage and feed intake was increased along with increase dose.

CHAPTER V

SUMMARY

SUMMARY AND CONCLUSION

The experiment was conducted to evaluate the efficacy of Aloe vera gel on production performance, dressing yield and blood parameters of sonali chicken at Hajee Mohammad Danesh Science and Technology University poultry farm, Dinajpur from mid July to September 2017. 180 day old sonali chick were randomly distributed into five dietary treatments with three replication each contains 12 birds. Treatments are namely, T_0 (control), T_1 (Amino plus 1 ml/L), T_2 (7.5g ALG/L), T_3 (15g ALG/L), T_4 (22.5ALG/L) drinking water. At the terminal stage of experiment the cumulative body weight gain of different treatment groups was T_0 (726.5±20g), T_1 (798.6±26gg), T_2 (754.6±27.5), T_3 (788.4±27g), and T_4 (841.8±29g) respectively. Birds that received aloe vera gel 22.5g/L drinking water was gained highest (841.8±29 g) body weight and lowest (726.5±20 g) in control group. Within aloe vera group increased live weight along with increase dose. The feed intake among different treatments were statistically similar ($p>0.05$). The cumulative maximum feed intake was observed Aloe vera treated T_4 group (2065±43g) and minimum in control group (1950±41g). Feed efficiency of different treatment was statistically significant ($P<0.05$) compared to T_0 control group. Respective feed efficiency was found T_0 (2.81±0.04), T_1 (2.61±0.05), T_2 (2.72±0.07), T_3 (2.64±0.03) and T_4 (2.54±0.03). Aloe vera treated group T_4 converted feed to meat most efficiently then T_1, T_3, T_2 and T_0 treatment respectively.

Obtained data on meat yield parameters and dressing percentage there was no significant ($P>0.05$) difference among treatments group except breast meat weight. The breast meat weight was significantly ($p<0.05$) higher in treatment T_4 group compare to control group and 7.5g/L aloe vera group. Among the treatment highest dressing percentage (52.1±0.48%) was observed in 22.5/L drinking water group and lowest (50.1±0.35%) in control group.

Data obtained on blood parameters (RBC, PCV, WBC and Hb) were statistically significant ($P>0.05$) among treatments group except the total WBC count ($P>0.05$). The highest WBC (2.2×10^3 cells/µl) was observed in supplementation of aloe vera group T_4 and lowest (2.16×10^3 cells/µl) in control group. In neutrophil percentage the highest value (29.61%) was found in Aloe vera group that receive @ 22.5 gm/L drinking water and lowest value was found (28.8%) in T_0 control group.

Lymphocyte percentage in commercial growth promoter group T_1 showed lowest result (64.8%) and highest result found (65.9%) in control group. Eosinophil percentage was higher in T_0 (2.56±0.24%) then T_3 (2.43±0.29%), T_1 (2.41±0.27%), T_4 (2.37±0.32%) and T_2 (2.33±0.30%) respectively. In Monocyte percentage the result of this study was statistically similar among the treatments group. However, highest Monocyt percentage was seen T_4 (1.75±0.18%) and lowest (1.55±0.17%) in control. Basophil percentage of different treatment groups there were no significant effect among the treatment group.

Data obtained feed cost, lowest was seen in aloe vera treated group T_4 and highest in untreated group. Net profit obtained maximum was found in T_1 (24.6±2Tk.) then T_4 (24±2.5Tk.), T_3 (23.68±3.2Tk.), T_2 (23.14±4Tk.) and T_0 (22.43±4Tk.) respectively. Based on the result of present study it may be concluded that aloe vera leaf gel is a good source of natural growth promoter and it has significant effect on body weight gain and feed efficiency on sonali chicken. The result of this study suggests that supplementation of Aloe vera gel up to 22.5g/L drinking water can be used as alternative to commercial growth promoter for the production of sonali chicken. Therefore, more studies are required to determine cost effective doses and form of use.

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APPENDIX

APPENDIX

APPENDIX I: Daily temperature (^{0}C) was recorded by clinical thermometer at 6 AM, 2 PM and 7 PM

Sl. No	Date	6 AM	2 PM	7 PM
1	25-7-17	27	30	25
2	26-7-17	25	30	28
3	27-7-17	29	31	30
4	28-7-17	31	32	32
5	29-7-17	29	30	27
6	30-7-17	28	31	29
7	31-7-17	29	33	29
8	1-8-18	30	32	29
9	2-8-18	29	32	29
10	3-8-18	28	33	30
11	4-8-18	29	33	31
12	5-8-18	30	34	30
13	6-8-18	32	33	30
14	7-8-18	32	33	29
15	8-8-18	29	31	29
16	9-8-18	30	32	31
17	10-8-18	25	23	24
18	11-8-18	26	22	23
19	12-8-18	22	25	24
20	13-8-18	27	29	28
21	14-8-18	31	32	30
22	15-8-18	28	32	29
23	16-8-18	30	32	29
24	17-8-18	31	33	30
25	18-8-18	29	32	31
26	19-8-18	29	33	30
27	20-8-18	30	34	30
28	21-8-18	29	33	30
29	22-8-18	28	32	29
30	23-8-18	29	31	30
31	24-8-18	30	33	29
32	25-8-18	27	32	29
33	26-8-18	30	33	31
34	27-8-18	28	30	29
35	28-8-18	29	31	28
36	29-8-18	30	32	30
37	30-8-18	27	31	28
38	31-8-18	28	30	29
39	1-9-18	29	31	30
40	2-9-18	30	33	31
41	3-9-18	26	29	28
42	4-9-18	27	30	28
43	5-9-18	29	31	29
44	6-9-18	30	32	30
45	7-9-18	29	31	28

Sl No	Date	6 AM	2 PM	7 PM
46	8-9-18	28	32	29
47	9-9-18	27	30	27
48	10-9-18	29	31	30
49	11-9-18	28	32	29
50	12-9-18	30	33	30
51	13-9-18	28	30	29
52	14-9-18	27	31	28
53	15-9-18	30	33	29
54	16-9-18	29	33	30
55	17-9-18	28	31	29
56	18-9-18	27	30	28

Relative humidity (%) was recorded by digital hygrometer at 6 AM, 2 PM and 7 PM

Sl. No	Date	6 AM	2 PM	7 PM
01	25-7-17	91	90	88
02	26-7-17	92	78	85
03	27-7-17	94	75	84
04	28-7-17	88	71	82
05	29-7-17	87	75	88
06	30-7-17	88	77	87
07	31-7-17	89	76	82
08	1-8-18	94	78	89
09	2-8-18	92	76	86
10	3-8-18	89	77	84
11	4-8-18	86	75	86
12	5-8-18	94	82	86
13	6-8-18	88	72	76
14	7-8-18	79	71	75
15	8-8-18	78	73	78
16	9-8-18	81	75	82
17	10-8-18	85	74	90
18	11-8-18	86	79	90
19	12-8-18	80	82	87
20	13-8-18	90	95	97
21	14-8-18	93	79	84
22	15-8-18	96	77	86
23	16-8-18	85	76	82
24	17-8-18	80	71	85
25	18-8-18	83	78	81
26	19-8-18	81	77	83
27	20-8-18	79	64	78
28	21-8-18	84	73	84
29	22-8-18	82	72	83
30	23-8-18	79	69	79
31	24-8-18	83	73	82
32	25-8-18	88	76	80
33	26-8-18	90	79	81
34	27-8-18	81	74	80
35	28-8-18	77	69	74

Sl. No	Date	6 AM	2 PM	7 PM
36	29-8-18	80	73	77
37	30-8-18	90	79	84
38	31-8-18	78	72	77
39	1-9-18	80	75	80
40	2-9-18	81	73	80
41	3-9-18	79	69	81
42	4-9-18	75	68	77
43	5-9-18	82	72	79
44	6-9-18	85	75	83
45	7-9-18	80	70	81
46	8-9-18	86	79	85
47	9-9-18	73	68	77
48	10-9-18	78	69	75
49	11-9-18	80	71	75
50	12-9-18	79	71	76
51	13-9-18	80	76	78
52	14-9-18	82	72	78
53	15-9-18	85	76	80
54	16-9-18	80	73	81
55	17-9-18	79	75	78
56	18-9-18	80	72	79

APPENDIX II: Normal blood values of (*Gallus Gallus* domesticus)

Parameters	Reference values of Jain (1993)
RBC (cells 10^6/µl)	2.5-3.5
PCV %	22-35
WBC (cells 10^3/µl)	1.2-3
Neutrophil %	15-40
Lymphocyte %	45-70
Eosinophil %	1.5-6
Monocyte %	1-5
Basophil %	Rare
Hb (g/dl)	7-13