EFFECTS OF ALOE VERA EXTRACT IN DRINKING WATER ON BROILER PERFORMANCE

A THESIS

By

MD. MIRAJIL ISLAM RAJIB

Registration No. 1105119

Session: 2011-2012

Semester: July-December/2013

MASTER OF SCIENCE (MS)

IN

ANIMAL SCIENCE

DEPARTMENT OF ANIMAL SCIENCE AND NUTRITION

HAJEE MOHAMMAD DANESH SCIENCE AND TECHNOLOGY

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Submitted to

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Chairman

DEPARTMENT OF ANIMAL SCIENCE AND NUTRITION
HAJEE MOHAMMAD DANESH SCIENCE AND TECHNOLOGY
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DEDICATED
TO MY
BELOVED PARENTS

ACKNOW LEDGEMENTS

All the praises, gratitude and thanks are due to the almighty Allah, who has created us to explore the hidden facts of the nature for the benefits of mankind and enabled me to successfully complete the assignment.

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The author

ABSTRACT

This experiment was conducted to evaluate the effects of dietary supplementation of aloe vera extract (w/v) on growth performance of broiler. The present study explored the potentials of medicinal plants *Aloe barbedensis* mixture in broiler performance. For this purpose 120 day old chicks were randomly assigned into five treatment groups, namely T_0, T_1, T_2, T_3 and T_4. Each treatment group contained 24 chicks .The chicks were purchased from a local chick hatchery named Nourish Poultry & Hatchery Ltd. Birds were brooded up to 10 days and then reared in separate flock for 35 days in an open sided house. Each treatment group was further replicated into three sub-groups and each contained eight birds. Experimental birds in T_1, T_2, T_3 and T_4 were provided with aloe vera extract (w/v) @ 05, 10, 15 and 20 ml per liter of drinking water while T_0 was maintained as control group. Relevant data were recorded throughout the experimental period and subjected to statistical analysis. The data on growth parameters (body weight gain, feed consumption, feed efficiency, water intake) and feed cost and gross return per broiler were evaluated. 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. Water intake, feed intake and abdominal fat deposition of broilers given aloe extract in drinking water were not different among each other. So, 15 ml/L aloe vera aqueous extract may be given to the broilers drinking water.

Keywords: Aloe vera extract, broilers, growth performance.

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INTRODUCTION

CHAPTER I

INTRODUCTION

The contribution of livestock sub-sector was 2.5% in 2011-12 fiscal year. According to Bangladesh Economic Review 2013, the economic growth has been estimated 3.49% in livestock sub-sector. Although the contribution of livestock sub-sector is not a large portion, it plays a vital role to meet our demand of animal protein, expansion of job market, exporting facilities and ensure food security. There are 65,902 registered poultry farms in 64 districts of Bangladesh till February, 2013.

In Bangladesh, the total poultry population was estimated as 293.24 million whereas chickens were 246.60 million and ducks were 46.67 million (Bangladesh Economic Review 2013). The total meat production of livestock and poultry were 2.51 million tones whereas 5134.7 million pieces of eggs were produced by chickens and ducks. Poultry production is moving toward the 21st century with the potential for increased development being greater than any other sector of the agricultural industry. It is considered one of the most common and very promising agricultural enterprises especially for low income farm families.

Broiler is an efficient feed converter into poultry meat in only 35 days, giving a quick return of investment that would allow 5-6 production cycles in a year. World poultry meat consumption consists of three major segments: broilers, turkeys, and other poultry which includes spent egg layers, spent breeder

hens/males, ducks, geese, guinea-fowl, pheasants, quail, ratites, ostriches and emus. Broilers clearly dominate the world poultry consumption contributing about 70 % to the world poultry market. Turkeys account for about 8 % while other poultry provides the balance of 22 % (Roenick, 1998). The small-scale broiler farm is becoming a role-player that needs to be serviced by the poultry industry (Fourie, 2000).

The provision of quality protein in the shortest period of time in the form of meat and eggs is the major contributing role of poultry birds in human nutrition. This is only possible when birds are provided quality feed and hygienic environment. Antibiotic and other feed additives are frequently given in feed as well as in drinking water to achieve the targeted nutritional and health status of the birds. The frequent use of drugs as feed additives in poultry ration resulted in resistant to pathogenic microorganism, affecting the feed efficiency and growth performance of poultry birds. Therefore, the scientists has been giving their attention on medicinal plants (like aloe vera, neem, mulberry leaves etc.) to achieve the targeted nutritional and health status of poultry.

The consumption and demand for medicinal plants have been adopted in many countries because of low cost, easy availability, affordability for a common farmer, good antimicrobial natured, reduced diseases associated risks, lowering blood cholesterol level and diversified functions in improving performance, growth rate, feed efficiency and weight gain in birds.

Medicinal plants are used in pharmaceuticals, neutraceuticals, cosmetics, and food supplements and even as traditional source of medicines because of their anti-tumor, anti-arthritic and anti-thrombosis functions. Furthermore, researchers are trying to combat against fatal diseases in poultry through the use of medicinal plants, containing the most active ingredients to promote growth, weight gain, and immune-stimulant.

Aloe vera (*Aloe barbadensis*) is one of the semi-tropical house plant, has a long and illustrious history dating from biblical times. It has been mentioned throughout recorded history and given a high ranking as an all-purpose herbal plant. Aloe's thick, tapered, spiny perennial leaves grow from a short stalk near ground level. It is not a cactus, but a member of the tree lily family. Aloe is related to other members of the lily family such as onion, garlic and turnip families. Aloe's relationship to the lily family is evident from the tubular yellow flowers produced annually in the spring that resemble those of the Easter lily.

There are over 250 species of aloe grown around the world. However, only two species are grown today commercially, with *Aloe barbadensis* and *Aloe aborescens* being the most popular. The aloe plant is grown in warm tropical areas and cannot survive freezing temperatures. In the United States, most of the aloe is grown in the Rio Grande Valley of South Texas, Florida and Southern California. Internationally, aloe can be found in Mexico, the Pacific Rim countries, Indian-subcontinent, South America, Central America, the Caribbean, Australia and Africa. The leaves of the aloe plant grow from the base in the

rosette pattern. Mature plants can grow as tall as 2 and a half inches to 4 feet with the average being around 28 to 36 inches in length. It is native to the eastern and southern part of Africa but it has spread throughout many of the warmer regions of the world. The leaves are lancelate, thick and fleshy with thorny edges and with color ranging from deep green to grey green.

This aloe vera gel, beginning in the 50's, has gained respect as a commodity used as a base for nutritional drinks, as a moisturizer, and a healing agent in cosmetics. Chemical analysis has revealed that this clear gel contains amino acids, minerals, vitamins, enzymes, proteins, polysaccharides and biological stimulators. The claims made to the consumer about uses and effectiveness of aloe was exaggerated. Aloe vera gel, like most natural juices, both fruit and vegetable, is an unstable product when extracted and is subject to discoloration and spoilage from contamination by microorganisms. The great success of aloe as a commodity for use in nutritional foods and cosmetics is due to the proper stabilizing procedures that enable processors to store and ship the aloe gel without fear of spoilage throughout the market places of the world.

Research conducted around the world leaves little doubt that certain biochemical properties of aloe will be proven facts. Such attributes as moisturizing and penetrating properties are known, but the attributes such as its healing abilities and analgesic action to bacterial activity has not been clearly defined and documented through properly controlled scientific research and testing.

Aloe vera's mucopolysaccharides are long-chain sugars found in large amounts in the plant and properly prepared whole leaf aloe juice and juice concentrates. We have just known last few years to recognize the major role that mucopolysaccharides play in human and animal health. This unique mechanism of this major active ingredient of the aloe vera plant that plays a crucial role in performing physiological functions by:

1. Forming a lining throughout the colon to keep toxic waste from re-entering the body
2. Providing a life saving barrier against microbial invasion for each cell (especially viruses)
3. Providing critical lubrication of joints
4. Helping to maintain the capacity of movement of fluids
5. Allowing the transfer of gases in the lungs
6. Facilitating absorption of water, electrolytes and nutrition in the GI tract

1.1 Aloe vera used in broiler production:

Feed contribute 60-65% in the cost of poultry production. There is an immense demand to reduce feeding cost and to efficiently utilize nutrients for higher economic return. Different natural feed additives have gained considerable attention during last few decades to enhance feed utilization and growth performance of poultry birds. Moreover, these natural products are safe for broilers with no residual effect. Generally, medicinal plants improve apparent

whole tract and ideal digestibility of the nutrients. Aloe vera (*Aloe barbedensis*) gel has been reported to possess anti-inflammatory activities (Davis *et al.,* 1994).

Aloe vera, a medicinal plant, could be an effective substitute for its chemical nature and antimicrobial activities. Aloe gel has been used as antibiotics (Swaim *et al.*, 1992), wound healing (Davis *et al.*, 1994), anti inflammatory anti coccidial (Mwale *et al.*, 2005) and anti ulcer (Koo, 1994) agent.

Some researchers argued that herbs can stimulate appetite and endogenous secretions which in turn improve performance. Several studies have shown antimicrobial properties of herb extract which can improve intestinal micro flora population an enhance health of broilers digestive system through reduction in number of diseases making bacteria.

However, there is a limited research works have been conducted on the effect of aloe vera aqueous extract on production performance of broiler. Therefore the study has been under taken with the following objectives.

1. To determine the influence of aloe gel on growth performance of broilers.
2. To evaluate the cost and return analysis after using the different level of aloe gel in broiler production.

CHAPTER II

REVIEW OF LITERATURE

CHAPTER II

REVIEW OF LITERATURE

2.1 Aloe vera

Aloe vera is being used as medicinal plant since many years (Subramanian *et al.*, 2006). Leaves of this plant are green resembles with cactus leaves and filled with a clear gel like fluid, which is viscous in nature (Singh *et al.,* 2007). In addition to its medicinal values, it is also employed in poultry and dairy as insecticide. Different type of anthraquinones, polysaccarides, vitamins, essential and non-essential amino acids, enzymes and inorganic compounds are present in aloe vera (Volger *et al.,* 1999).

Figure 1: Aloe vera medicinal plant

Leaves are the main part, which contains most of these compounds (Volger *et al.,* 1999). Locally aloe vera is known as "Ghritokumari" and is used as an ingredient of herbal formulation. Choi *et al.,* (2001) isolated aloe-emodin and different form of aloins (aloin A and B) from freeze dried aloe vera leaves. They found significant decrease in blood glucose levels along with protective effect on insulin producing β cells.

It can be concluded that these compounds are major contributors for ant diabetic activity of aloe Vera. Due to the presence of gibberellins like active substances, it showed anti-inflammatory activity in diabetic animals (Davis *et al.,* 1989). Protective effects of its extract on β cells make it more suitable for the treatment of type I diabetes. It should be noted that before using any medicinal plant it should be checked for any kind of phyllosphere toxicity.

2.2 Aloe gel as growth enhancer in chickens

Although the demand is high, the industry could hardly make up with the requirement due to high prices of commercially and imported feeds. Thus, the poultry industry particularly on the part of the raisers, continuously find means to lessen their cost of production. One way is to look for alternative source of feed supplement that is not only cheap and can boost the growth of chickens but most important is organic and readily available. In the recent study of Mr. Feliciano R. Bejar of the Samar State College of Forestry, the University of Eastern Philippines was particularly addressed using extracts from aloe Vera. Unknown

too many, this plant is not only valued for its medicinal components but it also plays an important role in promoting growth in chickens.

Mr. Bejar conducted a 42 day experiment to study the growth performance of 90 broilers whose drinking water was mixed with aloe extract. The chickens subjected to this study were randomly distributed into five aloe extracts treatments: 5 ml, 10 ml, 15 ml, 20 ml per gallon of drinking water, and plain water as control. The method followed a complete randomized design (CRD), which was replicated three times. In order to determine the effects aloe vera on growth performance of the chickens, the researchers used five parameters to measure growth performance of broilers: (i) body weight (ii) feed consumption (iii) feed conversion ration (iv) water consumption and (v) return of investment. They also determined sensory evaluation of the broilers given to the drinking water supplemented with the aloe vera extract. A sensory evaluation was conducted to evaluate the meat for its color, desirability, intensity, texture, tenderness, juiciness, and general acceptability. Broilers given with aloe extracts as drink supplement (5-20 ml) significantly improved their growth rates compared to those broilers given plain water, which showed the highest final weight gain in weight. In terms of feed consumption, broilers given the 15 ml and 20 ml of aloe extracts in their drinks rated the highest (average of 3387.78 g and 3148.89 g, respectively) while those given the plain water rated the least (2737.22 g). This result, according to the researchers implied that the final weight and live weight gain in weight were strongly influenced by the feed intake of the chicken.

Meanwhile, no significant results were found in the feed efficiency of broilers although numerically, those chicken given the aloe extracts showed slightly better feed efficiency than those given plain water. Likewise, aloe vera supplementation did not significantly affect the carcass and sensory characteristics of the broiler meat, retaining the acceptability and sale ability of the product.

For the dressing percentage (weight of the carcass and organs after the treatment was applied) again those given the aloe extract supplementation command the highest dressing percentage while the un-supplemented ranked the least. This means that the heavier the final weight, the better is the dressing percentage in chickens. For the economic competency, analysis showed that chicken whose drink was supplemented with aloe extracts showed the best return of investment among the treatments with 30% return of investment compared to the 7.5% of the un-supplemented.

2.3 Active components with its properties

Aloe vera contains 75 potentially (Amar *et al.,* 2008) active constituents: vitamins, enzymes, minerals, sugars, lignin, saponins, salicylic acids and amino acids.

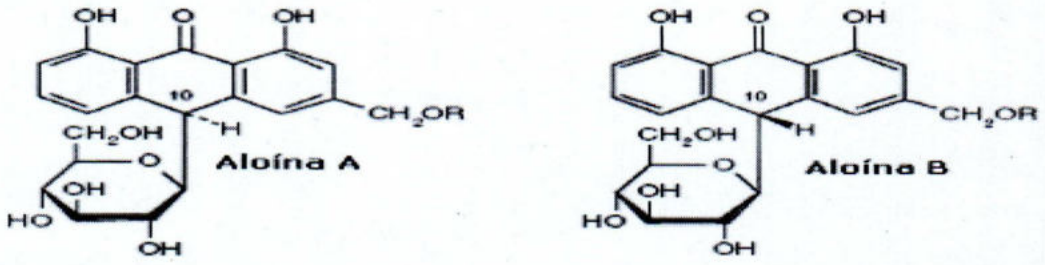

Figure 2: Chemical structure of aloein.

i. **Vitamins:**

It contains vitamins A (beta-carotene), C and E, which are antioxidants. It also contains vitamin B_{12}, folic acid, and choline. Antioxidant neutralizes free radicals.

ii. **Enzymes:**

It contains 8 enzymes: aliiase, alkaline phosphatase, amylase, bradykinase, carboxypeptidase, catalase, cellulase, lipase, and peroxidase. Bradykinase helps to reduce excessive inflammation when applied to the skin topically, while others help in the breakdown of sugars and fats.

iii. **Minerals:**

It provides calcium, chromium, copper, selenium, magnesium, manganese, potassium, sodium and zinc. They are essential for the proper functioning of various enzyme systems in different metabolic pathways and few are antioxidants.

iv. **Sugars:**

It provides monosaccharides (glucose and fructose) and polysaccharides (glucomannans/polymannose). These are derived from the mucilage layer of the plant and are known as mucopolysaccharides. The most prominent monosaccharide is mannose-6-phosphate and the most common polysaccharides are called glucomannans. Recently, a glycoprotein with antiallergic properties, called alprogen, an anti inflammatory compound, C-glucosyl chromone, has been isolated from aloe vera gel.

v. **Anthraquinones:**

It provides 12 anthraquinones, which are phenolic compounds traditionally known as laxatives. Aloin and emodin act as analgesics, anti bacterial and anti viral.

vi. **Fatty acids:**

It provides 4 plant steroids cholesterol, campesterol, β-sisosterol and lupeol. All these have anti inflammatory action and lupeol also possesses antiseptic and analgesic properties.

vii. **Hormones:**

Auxins and gibberellins that help in wound healing and have anti inflammatory action.

viii. **Others:**

It provides 20 of the 22 human required amino acids and 7 of the 8 essential amino acids. It also contains salicylic acid that possesses anti inflammatory and antibacterial properties. Lignin, an inert substance, when included in topical preparations, enhances penetrative effect of the other ingredients into the skin.

2.4 Vitamins

Vitamins play a significant role in the development of chicken immune system and thus enabling them to fight against various stresses (Ajakaiye *et al.*, 2011). Essential nutrients such as vitamins may affect both humoral and cell mediated immune responses. Vitamin A differentiates the epithelial cells, which is highly essential for maintaining the integrity of mucosal surface of intestine (Chew *et al.,* 2004). Deficiency of vitamin A increases the chances of enteric diseases like coccidiosis and it also impairs the local immune defenses within the gut lymphoid tissues of broiler chickens (Dalloul *et al.*, 2002). Due to this effect, there was a significant reduction in intraepithelial lymphocyte subpopulations, mainly CD4+ T cells. The alteration in intraepithelial lymphocyte subpopulation leads to lower the ability of resistance against *E. acervulina*. Furthermore, it was reported (Dalloul *et al.*, 2002) that the deficiency of vitamin A also affects the systemic immune system by reducing the ability of splenic T lymphocytes to respond to in vitro mitogen stimulation, which resulted in lower IFN-gamma secretion. In fact dietary vitamin A levels can affect gut immunity in broiler

chickens, and its deficiency may lead to immune suppression at those sites that make the birds more susceptible to coccidiosis.

2.5 Mechanism of actions

i. Healing properties

Glucomannan and gibberellin interacts with growth factor receptors on the fibroblast, thereby stimulating its activity and proliferation, which in turn significantly increases collagen synthesis. Aloe gel not only increased collagen content of the wound but also changed collagen composition (more type III) and increased the degree of collagen cross linking. Due to this, it accelerated wound contraction and increased the breaking strength of resulting scar tissue.

ii. Effects on skin exposure to UV and gamma radiation

Aloe vera gel has been reported to have a protective effect against radiation damage to the skin. Exact role is not known, but following the administration of aloe vera gel, an antioxidant, protein metallothionein, is generated in the skin, which scavenges hydroxyl radicals and prevents suppression of superoxide dismutase and glutathione peroxidase in the skin. It reduces the production and release of skin keratinocyte derived immunosuppressive cytokines such as interleukin-10 and hence prevents UV induced suppression of delayed type hypersensitivity.

iii. Anti inflammatory action

Aloe vera inhibits the cyclooxygenase pathway and reduces prostaglandin E_2 production from arachidonic acid. Recently, the novel anti inflammatory compound called C-glucosyl chromone was isolated from gel extracts.

iv. Effects on the immune system

Alprogen inhibit calcium influx into mast cells, thereby inhibiting the antigen-antibody-mediated release of histamine and leukotriene from mast cells. In a study on mice that had previously been implanted with murine sarcoma cells, acemannan stimulates the synthesis and release of interleukin-1 and tumor necrosis factor from macrophages in mice, which in turn initiated an immune attack that resulted in necrosis and regression of the cancerous cells. Several low molecular weight compounds are also capable of inhibiting the release of reactive oxygen free radicals from activated human neutrophils.

v. Laxative effects

Anthraquinones present in latex are a potent laxative. It increases intestinal water content, stimulates mucus secretion and increases intestinal peristalsis.

vi. Antiviral and anti tumor activity

These actions may be due to indirect or direct effects. Indirect effect is due to stimulation of the immune system and direct effect is due to anthraquinones. The anthraquinone aloin inactivates various enveloped viruses such as herpes simplex, varicella zoster and influenza. In recent studies, a polysaccharide

fraction has shown to inhibit the binding of benzopyrene to primary rat hepatocytes, thereby preventing the formation of potentially cancer initiating benzopyrene DNA adducts. An induction of glutathione S transferase and an inhibition of the tumor promoting effects of phorbol myristic acetate has also been reported which suggest a possible benefit of using aloe gel in cancer chemoprevention.

vii. Moisturizing and anti aging effect

Mucopolysaccharides help in binding moisture into the skin. Aloe stimulates fibroblast which produces the collagen and elastin fibers making the skin more elastic and less wrinkled. It also has cohesive effects on the superficial flaking epidermal cells by sticking them together, which softens the skin. The amino acids also soften hardened skin cells and zinc acts as an astringent to tighten pores. Its moisturizing effects has also been studied in treatment of dry skin associated with occupational exposure where aloe vera gel gloves improved the skin integrity, decreases appearance of fine wrinkle and decreases erythema. It also has anti acne effect.

viii. Antiseptic effect

Aloe vera contains 6 antiseptic agents Lupeol, salicylic acid, urea nitrogen, cinnamonic acid, phenols and sulfur. They all have inhibitory action on fungi, bacteria and viruses.

2.6 Clinical uses

The clinical use of aloe vera is supported mostly by anecdotal data. Though most of these uses are interesting, controlled trials are essential to determine its effectiveness in all the following diseases.

i. Uses based on scientific evidence

These uses have been tested in humans or animals. Safety and effectiveness have not always been proven. Conditions like Seborrheic dermatitis, psoriasis vulgaris, genital herpes, skin burns, diabetes (type II), HIV infection, cancer prevention, ulcerative colitis wound healing (results of aloe on wound healing are mixed with some studies reporting positive results and others showing no benefit or potential worsening) pressure ulcers, mucositis, radiation dermatitis, acne vulgaris, lichen planus, frostbite, aphthous stomatitis, and constipation.

ii. Uses based on tradition or theory

The below uses are based on tradition or scientific theories. They often have not been thoroughly tested in humans, and safety and effectiveness have not always been proven. Conditions like Alopecia, bacterial and fungal skin infections, chronic leg wounds, parasitic infections, systemic lupus erythematosus, arthritis and douloureux.

2.7 Side effects

i. Topical

It may cause redness, burning, stinging sensation and rarely generalized dermatitis in sensitive individuals. Allergic reactions are mostly due to anthraquinones, such as aloin and barbaloin. It is best to apply it to a small area first to test for possible allergic reaction.

ii. Oral

Abdominal cramps, diarrhea, red urine, hepatitis, dependency or worsening of constipation. Prolonged use has been reported to increase the risk of colorectal cancer. Laxative effect may cause electrolyte imbalances (low potassium levels).

iii. Contraindication

Contraindicated in cases of known allergy to plants in the liliaceae family.

iv. Pregnancy and breast feeding

Oral aloe is not recommended during pregnancy due to theoretical stimulation of uterine contractions, and in breastfeeding mothers, it may sometime causes gastrointestinal distress in the nursing infant.

2.8 Interactions

Though aloe vera has wide spectrum of the properties and uses, some of them could be myths and some of them could be real magic. In future, controlled studies are required to prove the effectiveness of aloe vera under various conditions. Aloe vera is commonly incorporated in most of the poultry herbal

medicines like liver tonics, anti stress, antioxidants, antitoxic and growth promoting preparations. Apart from these benefits, the herb is used for various functions like antibacterial, antiseptic, anti inflammatory, nematocidal and immune modulatory properties.

CHAPTER III

MATERIALS AND METHODS

CHAPTER III

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3.1 Study area

The farm was recognized as small scale broiler farm, keeping 500- 1000 broilers per batch situated in North Western District of Bangladesh, named Dinajpur. The experiment was conducted from mid April to mid May of 2013 at experimental farm named Rahman Poultry Farms in Dinajpur. During the experiment, the average daily mean temperature was 27°C (mean of highest temperatures 32°C and of the minimum 22°C) and average relative humidity was 60%.

3.2 Dietary treatments and management

The experiment has been approved by Department of Animal Science and Nutrition, Hajee Mohammad Danesh Science and Technology University. One hundred and twenty day old Ross 308 chicks of approximately same body weight were purchased from Norish Poultry Ltd. The chicks were divided into five treatment groups with three replicates (twenty four chicks for each treatment) on a completely randomized design. The control group (To) was provided with plain water along with required diet. For the next four treatment groups (T_1, T_2, T_3 and T_4) were provided with 5, 10, 15 and 20 ml per liter of aloe vera gel respectively. Experimental diets were fed from 11 days to 35 days of age. Nutritional requirement of birds in different experimental periods were extracted

from table 1 provided for farming Ross 308 chicks. Broilers were fed *ad libitum* throughout the experimental period.

All broilers were reared in flooring an open sided house under similar environment. Temperature, humidity, light and ventilation were the same for all treatments. Vaccination was not administered for evaluating the diseases status and mortality rate of broilers. All other management practices such as hygiene and sanitation were followed strictly.

3.2.1 Housing

The house of indoor system was made with a concrete floor and windows were being built with upper fans for ventilation. Empty feed bags were used as curtains. Ventilation system was limited by flat roofing which made the inside air movement contained within the house as there was no air space on the top. Fresh and dried rice husk was used as litter of about 5 cm depth.

3.2.2 Lighting

During this study, the birds received a lighting regimen of 23 h light: 1 h darkness. Thermostatically electric brooders were used to provide additional heat during brooding. Brooding temperature was initially set to 33±1°C and was gradually reduced over 3 wks to acclaim chicks to outdoor temperatures.

3.2.3 Feeding

Feed and water were provided *ad libitum.* Starter diets were provided from day 1 day to 16 days of age and finisher diets from day 17 to 35 days of age. On the first week of feeding, chick feds as spread on old sheets of newspaper. For the rest of the feeding period, feeds were placed on the feeding trough. Starter crumble feed was given up to the 16 days of the feeding period. Feeding was done three times a day at 6:00 am, 11: a.m. and 4:00 p.m. respectively. *Ad libitum* water was supplied available at all times in water trough.

3.3 Preparation of 10% aloe gel infusion

Aloe vera plants were purchased from local horticulture centre and nurtured them in front of the open land of poultry farm. Aloe gel infusion was prepared accordingly to the method of Durrani *et al.* (2008). Fresh aloe leaves were collected from garden for the extraction of gel. The aloe gel was extracted from the leaf manually by making a cut, using a pocket knife. Latex of the leaf was removed and gel was collected in a beaker. A 10% (w/v) concentrated infusion was prepared by taking 100 g of fresh gel in a glass bottle and one liter of boiled water at room temperature was poured on it. The bottle was shacked for 5-7 minutes to ensure thorough mixing and was then kept for 6-8 hours at room temperature prior to use. The P^H of aloe vera gel was 4.49. It was a colorless gel with negative microbial load.

3.4 Data collection

Records were collected from 11 days to 35 days in mid April to mid May in 2013. Birds of each treatment was randomly selected and weighed on a schedule basis for live weight gains. Electronic weighing scale was used for sample group weighing to determine the live weights. Feed intake was estimated by calculating the required amounts offered in gm and refused amounts on the schedule basis according to the manual of nutrient requirement for poultry Bureau of Indian Standard (B. I. S., 1992). Feed intake, live weight gains, mortality and feed efficiency were taken from 11 days to 35 days of age in each treatment group of broilers. Daily and cumulative feed intake was determined by offering known amount of feed and measuring refusal feed (Feed intake = Feed offered – Feed refused). Similarly, feed efficiency was measured by the following formula. (Feed Efficiency = Total feed intake ÷ Total weight gain).Chicks' weight and feed consumption were recorded for each experimental unit as schedule time intervals. After 35 days, two birds from each replicate was selected, slaughtered (12 h after feed withdraw). After sacrificing, carcasses were immerged into hot water (56°C for 120 s) and then plucked and manually eviscerated to obtain the ready to cook carcass. The carcass, stomach, abdominal fat, breast meat and leg meat were weighed. Percent of eviscerated carcass was calculated as the ratio between the eviscerated carcass and live weight after fasting broilers and feed were weighed at 11, 22 and 35 days of age for determination of live weight and feed efficiency. Livability was recorded as a percentage of live birds.

3.5 Statistical analysis

The data were statistically analyzed By MSTAT-C software with the standard procedures of analysis of variance (ANOVA), using completely randomized design. Means were compared for significance of differences by DMRT suggested by Steel and Torrie (1981).

Table 1: Ingredients and chemical composition of the basal diets[1]

Ingredients (%)	Starter (0-16 d)	Grower (17-35 d)
Corn	54.87	61.78
Soybean meal	36.72	26.36
Fish meal	1.31	4.50
Vegtable oil	3.00	4.00
Limestone	1.15	1.05
Dicalcium phosphate	1.94	1.49
Vit. and min. premix1	0.50	0.50
Salt	0.30	0.30
DL-methionine	0.21	0.02
Total	100.00	100.00

Calculated chemical composition		
ME (kcal/kg)	2900	3100
CP (%)	21.44	19.37
Calcium (%)	1.05	1.00
Phosphorus (%)	0.51	0.50
Sodium (%)	0.16	0.14
Arginine(%)	1.41	1.23
Methionine + Cystine (%)	0.91	0.69
Lysine (%)	1.20	1.10
Tryptophan (%)	0.31	0.26

[1] provide per kilogram of diet: vitamin A, 15000 IU; vitamin D_3, 8000 IU; vitamin K_3, 3 mg; B_{12}, 15 μg; niacin, 32 mg; choline, 840 mg; biotin, 40 μg; thiamine, 4 mg; B_2 (riboflavin), 6.6 mg; pyridoxine, 5 mg; folic Acid, 1 mg; Zn, 80 mg; Mn, 100 mg; Se, 200 mg; Fe, 80 mg; Mg (magnesium oxide), 12; Cu, 10 mg; Ca (calcium pontatenate), 15 mg; iodeine,1 mg.

Table 2: Each 25 ml of Aloe vera juice contains the following vitamins and minerals:

Nutrients	Quantity
Vitamin A	1.0 IU
Vitamin C	35.0 mg
Vitamin D	< 1.0 IU
Vitamin E	1.0 IU
Vitamin K	<1 µg
Thiamin	0.5 µg
Riboflavin	0.5 µg
Niacin	1.0 µg
Vitamin B6	2.2 µg
Vitamin B12	0.005 µg
Foliate	2.3 µg
Biotin	0.3 µg
Pantothenic acid	0.5 µg
Iodine	<1.0 µg
Magnesium	0.7 mg
Zinc	14.4 µg
Selenium	<1.0 µg
Copper	7.3 µg
Manganese	7.6 µg
Chromium	<1.0 µg
Molybdenum	1.0 µg
Chloride	8.0 mg

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CHAPTER IV

RESULTS AND DISCUSSION

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4.1 Body weight gain

The live weight of broilers fed on 15 ml/L aloe vera aqueous extract in drinking water showed significantly higher live weight gain ($P<0.05$) than those of the broilers provided the clean water (Table 3). The broilers of T_3 gained 1410 g whereas the treatment groups of T_1, T_2, T_4 gained 1258 g, 1345 g, 1396 g respectively. The live weight was increasing up to 15 ml/L of aloe gel and then decreased slightly provided with 20 ml/L of aloe vera aqueous extract in drinking water. Changkang *et al.,* (2007) found that 600 mg of aloe vera gel water extract results in significant increased live weight gain in third and sixth weeks. The birds of T_3 group provided 15 ml/L aloe vera extract, revealed higher ($P<0.05$) live weight gain as compared to other groups. Similar findings have been reported by Jiang *et al.*, (2005), Guo *et al.,* (2004) and Durrani *et al.*, (2008).

Swaim *et al.,* (1992) found that broilers took 10 ml aqueous extract of aloe vera per liter of drinking water showed better performance due to diversified antimicrobial activities of aloe gel. Broilers are prone to various environmental stresses that negatively affect bird's immunity and minimize their resistance to different diseases probably due to oxidative damage of lymphoid tissues that result in impaired antibodies production. The antioxidant nature of medicinal plants (Botsoglou *et al.*, 2001) can alleviate the negative influence of

environmental stresses and can improve immune function to combat different types of diseases resulting increased growth performance. Figure 2 showed the effect of aloe vera extract in drinking water on live weight. In this line diagram, Y axis showed the live weight in grams and X axis showed the experimental period on day 11, day 22 and day 35 respectively.

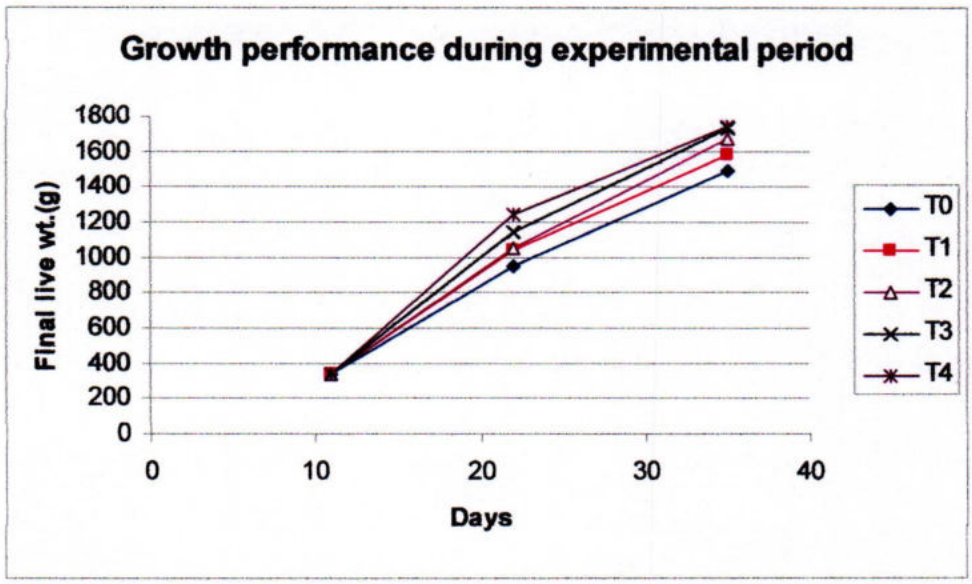

Figure 3: Effect of aloe vera extract in drinking water on growth performance during experimental period

But Mehala and Moorthy (2008) recorded no significant differences among the treatment groups due to dietary inclusion of aloe vera and Curcuma longa and its combinations for live weight gain. Since the main polysaccharide contained in aloe vera gel is acemannan, the enhanced live weight gain in groups treated by aloe vera gel compared to the control group may be attributed to antibacterial properties of aloe vera gel which can improve intestinal microflora. Furthermore, the acemannan contained in aloe vera gel can stimulate immune system and

improve body resistance against bacteria and viruses. This, in turn, improves growth performance.

Table 3: Mean body weight gain, feed and water intake, feed efficiency, feed cost and gross return from broilers given aloe extract in drinking water

Parameters	T_0 0 ml/L	T_1 5 ml/L	T_2 10 ml/L	T_3 15 ml/L	T_4 20 ml/L	Level of Sign.
Initial Live wt. (g)	336±13	338±16	335±18	337±14	334±15	-
Final live wt. (g)	1496^{a}±28	1589^{b} ±31	1674^{c}±26	1747^{d}±38	1725^{cd}±22	*
Live wt. gain(g)	1160^{a}±14	1258^{b}±16	1345^{c}±17	1410^{d}±23	1396^{cd}±21	*
Feed intake g/25 d	2297±42	2305±54	2314±62	2315±36	2321±58	NS
Water intake ml/25 d	5623±32	5646±34	5655±37	5658±33	5656±35	NS
Feed efficiency	1.98^{a}±0.03	1.83^{b}±0.07	1.72^{c}±0.05	1.64^{d}±0.07	1.66^{d}±0.08	*
Feed cost (Tk./chick)	123±8	125±5	128±7	127±11	126±9	NS
Gross return (Tk./chick)	52±2	53±4	54±7	54±5	53±3	NS
Dressing %	69	71	72	74	71	NS
Abdominal fat (g)	24	26	25	27	27	NS

NS Means in row with different superscripts were significantly different at $P<0.05$, S= statistically not significant, *= statistically significant

4.2 Feed intake

The total feed intake of experimental period of the broilers in all treatment groups were not significantly differs from one another. However, the broilers of T_3 group took containing 15 ml/L aloe vera gel water showed higher feed intake, due to the phytogenic substance in aloe vera that may stimulate appetite and endogenous secretion which in turn improved performance (Windisch *et al.*, 2008). Olupona *et al.*, (2010) 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. Figure 4 showed the average feed intake in grams along with different treatment groups. In this diagram T_3 showed higher feed intake among all treatment groups. The total feed consumption of each treatment group was gradually increased up to 15 ml/L of aloe vera mixed drinking water and then become went down slightly.

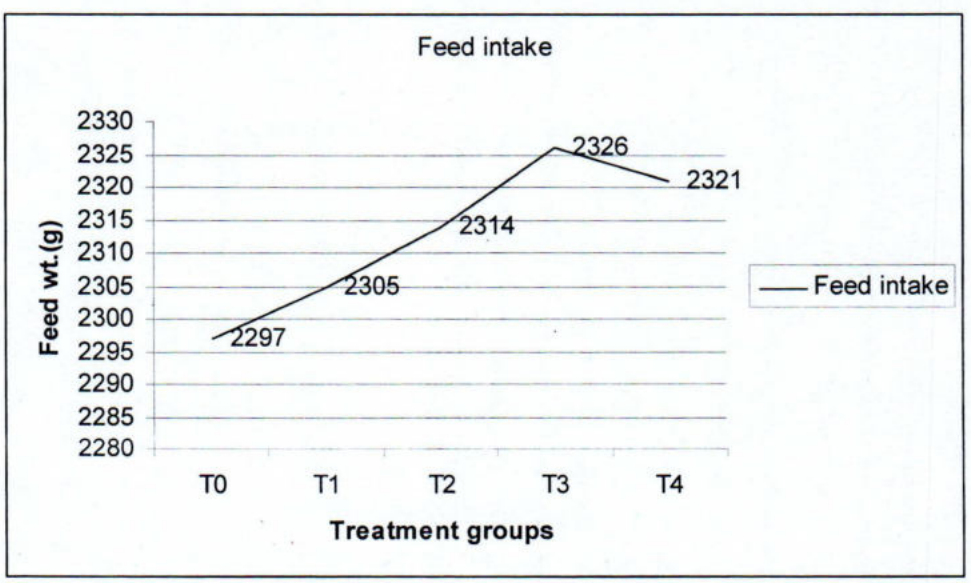

Figure 4: Effect of aloe vera extract in drinking water on feed intake

4.3 Water intake

No significant difference in mean water intake was found among all treatment groups. Odo *et al.,* (2010) reported no significant difference (P> 0.05) on water intake. Water intake was recorded at the end of experiment.

4.4 Feed efficiency

At the experimental period, the broilers of T_3 groups took containing15 ml/L aloe gel converted feed to meat most efficiently. The feed efficiency of T_0 was significantly (P<0.05) lower than the treatment groups (Table 3). The feed efficiency of the broilers took 15 ml/L and 20 ml/L aloe vera aqueous extract in drinking water were significantly (P<0.05) higher than the broilers took 5 ml/L and 10 ml/L aloe vera aqueous extract in drinking water . The feed efficiency were increased with increasing level of aloe vera aqueous extract in drinking water up to 15 ml/L, but 20 ml/L aloe gel showed slightly decreased feed efficiency. Mehala and Moorthy (2008) found that no significant difference among the treatment groups due to dietary inclusion of aloe vera and cucumber longa and its combination on feed efficiency. Guo *et al.,* (2004) found higher feed efficiency in broilers treated with Chinese herbs on the days 21 through 28. A poorer feed efficiency may be obtained possibly attribute to poorer utilization of ingested energy.

4.5 Abdominal fat and dressing percentage

Mean abdominal fat and dressing percentage was measured on 35 days by digital weight balance. Results on dressing percentage on day 35 were not significant,

the relatively the heavier dressing percentage was observed in T_3 (74%) than other treatments T_0 (69%). T_1 (71%), T_2 (72%) and T_4 (71%) respectively. Abdominal fat deposition were T_0 (24 g), T_1 (26 g), T_2 (25 g), T_3 (27 g) and T_4 (27 g) respectively. This finding favorably compared with earlier reports of Sinurat *et al.,* (2002) who stated that supplementation of fresh aloe vera gel (0.25 g/kg) and dry aloe vera gel (1.0 g/kg) in broiler diet from 1 day old to 5 weeks of age showed no significant effect on abdominal fat levels.

4.6 Feed cost and gross return

Mean feed cost and gross return per broiler was not affected by giving aloe extract to broilers in drinking water. Among the treatment groups mean feed cost were T_0 (Tk.123), T_1 (Tk.125), T_2 (Tk.128), T_3 (Tk.127) and T_4 (Tk.126) respectively. Although, not significant, the relatively higher gross return per broiler in T_2 and T_3 (Tk.54), than in other treatment group T_0 (Tk.52), T_1 (Tk.53), T_4 (Tk.53) respectively .This result revealed the importance of aloe extract given to broilers in drinking water.

CHAPTER V

SUMMARY AND CONCLUSION

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The study was conducted to make an inventory on using aloe vera aqueous extract (w/v) in drinking water on growth performance of broiler. The experiment was conducted at the local commercial small scale broiler farmer in Dinajpur District during a period from mid April to mid May 2013. The study was conducted with 120 Ross 308 commercial broiler chicken. The experiment was aimed at determining the influence of aloe vera gel on growth performance of broilers such related with body weight gain, feed efficiency, feed intake, and water intake. Providing 0%, 0.5%, 1.0%, 1.5% and 2.0% of aloe vera gel in drinking water had no significant ($P>0.05$) effect on feed intake, water intake. Similarly, it had no significant ($P>0.05$) effect on abdominal fat, breast, thigh and offal weight, feed cost and gross return. But, live weight gain and feed efficiency were significantly ($P<0.05$) better than control group. In case of live weight gain and feed efficiency, 1.5% inclusion level of aloe vera gel is more appreciated for satisfactory performance whereas other inclusion level earned poor score.

Moreover, there is no adverse effect on broiler production performance due to the intake of aloe vera extract in drinking water. So, the aloe vera aqueous extract 10% (w/v) up to 1.5% may be efficiently utilized in drinking water for broilers during 25 days long from 11 days to 35 days.

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