EFFECT OF ALOE VERA GEL ON BROILER PRODUCTION DURING HOT HUMID CLIMATIC CONDITION OF RANGPUR

A Thesis
By

MD. ZAHURUL HOQUE

Registration No. 1205118

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MASTER OF SCIENCE (M.S.)

IN

ANIMAL SCIENCE

DEPARTMENT OF ANIMAL SCIENCE AND NUTRITION

HAJEE MOHAMMAD DANESH SCIENCE AND TECHNOLOGY UNIVERSITY DINAJPUR -5200, BANGLADESH.

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ABSTRACT

Broiler production has increased rapidly in tropical and subtropical regions in the past and sustained growth is forecast for the future. One of the greatest challenges to efficient production in these regions is reduced performance from warm and hot weather conditions. There are many ways to decrease these detrimental effects of heat on broiler chickens. Aloe vera is one of the oldest known medicinal plants but it is now realized that many of its active constituent may be addressed in different ways by different formulations. Research since the 1986 review has largely upheld the therapeutic claims made in the earlier papers having scientific proof that aloe vera contains constituents such as antioxidants, enzyme, vitamins, mineral, mixtures those are beneficial in alleviating some of the heat stress related to physiological responses and improving thermo tolerance that accelerate growth performance, feed intake, FCR, water intake offal weight of broiler in the stressful environment. It has a wonderful moisturizing agent and penetrates. It was recently proven to stimulate the body's immune system. There are many bioactive compounds present in aloe but there is need of an appropriate and standard method to extract these active components from plant material. Along with conventional methods, numerous new methods have been established but till now no single method is regarded as standard for extracting bioactive compounds from aloe. This study was conducted to determine the efficacy of aloe vera as a growth promoter on the performance of broilers in stressful condition. The experimental day old chicks

(250) were divided into 5 groups. Each group consisting of 50 chicks was designated as group To, T_1, T_2, T_3 and T_4 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, water intake and offal weight(breast muscle, abdominal fat, dressing %). Providing 0 ml, 5ml, 10ml, 15ml and 20ml aloe vera gel was added in per liter drinking water. Similarly, it had no significant ($P>0.05$) effect on liver, gizzard, thigh muscle and heart weight. But body weight gain and feed efficiency were significantly ($P<0.05$) better than control group. In case of body weight gain and feed efficiency 15% inclusion level of aloe vera gel is more appreciated and nutrient quality is satisfactory where other inclusion level earned poor score. So we can recommend with 15% level.

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CHAPTER I

INTRODUCTION

Bangladesh now has a large and rapidly expanding poultry sector. Expansion of poultry industry in Bangladesh is being driven by rising incomes of the consumers and a shift in industry structure towards integrated ownership and coordination of the input, production, and marketing operations involved in poultry production (vertical integration). According to the information available in Banglapedia (National Encyclopedia of Bangladesh), it shows that about 6.5% of national GDP is covered by the livestock sector and its annual rate of productivity is 9%. About 20% of the population of Bangladesh earns their livelihood through work associated with raising cattle and poultry. According to the report, the requirement of animal protein per head per day is 120 g whereas the availability is only 12.51 g (DLS, 2008). The poultry production in Bangladesh currently estimated to be 140 million chicks and 13 million ducks (FAO, 2003). On the other hand more than 130 hatcheries are producing 3.4 millions of day-old-chick (DOC) per week. Thirty thousand commercial broiler and layer farms supplying 0.26 million metric tons of poultry meat and 5,210 millions table eggs per year (Government of the People's Republic of Bangladesh *et al.*, 1999).

In addition to poultry meat alone contributes 37% of the total meat production in the country and 22 to 27% of total animal protein (Ahmed 1988 and Haque; *et al.*, 1992) producing 11500 metric tunes of chicken meat. Nutritional deficiency is very severe among the rural people due to the scarcity of animal protein. To reduce poverty and improve nutritional status, poultry can play a significant role in the subsistence economy of rural people as it provides self-employment for unemployed people (Hai *et al.* 2008).

Broilers are chickens (*Gallus gallus domesticus*) bred and raised specifically for meat production.It 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 percent to the world poultry market.

In addition to, broilers are subjected to frequent stress factors in summer and therefore, it is important to have an effective management program to minimize their effects on the performance and health of the birds (Rosales *et al.*, 1994)**.** Stress is an important cause of reduced performance and increased susceptibility to disease.

Heat stress results from a negative balance between the net amount of energy flowing from the animal's body to its surrounding environment and the amount of heat energy produced by the animal. This imbalance may be caused by variations of a combination of environmental factors (e.g., sunlight, thermal irradiation, and air temperature, humidity and movement), and characteristics of the animal (e.g., species, metabolism rate, and thermoregulatory mechanisms). Environmental stressors, such as heat stress, are particularly detrimental to animal agriculture (Nienaber; Nardone and Renaudeau *et al.,* 2012). The issue of environmental stress has quickly become a great point of interest in animal agriculture, particularly due to public awareness and concerns.

The importance of animal responses to environmental challenges applies to all species. However, poultry seems to be particularly sensitive to temperature-associated environmental challenges, especially heat stress. It has been suggested that modern poultry genotypes produce more body heat, due to their greater metabolic activity (Settar, Deeb, and Cahaner *et al.,* 2001) Understanding and controlling environmental conditions is crucial to successful poultry production and welfare. Therefore, the objective of this review is to compile the current knowledge and evidence available in the scientific (peer-reviewed) literature examining what is known about the importance and impact of heat stress in poultry production, focusing on broilers.

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 performance and increased susceptibility to disease, lowering stressful condition in summer and diversified functions in improving performance, growth rate, feed efficiency and weight gain in birds.

Furthermore, researchers are trying to combat against fatal diseases and stressful condition in hot weather 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 them medicinal plant with active ingredients.

Aloe vera, a medicinal plant, could be an effective substitute controlling adverse environmental condition of broiler production. It has been reported to be an effective tool in increasing density of microvilli and enhancing immunity of broilers (Jinag *et al*., 2005). Aloe gel is one of the readily available herbal extract in Asia that is expected to produce desirable results. The present study was therefore, an effort to use aloe vera gel as natural growth promoter and an effective tool for the control of stress weather in broilers production. The content of the aloe vera leaf is just 0.5 - 1.5% solid. This solid material contains over 75 different nutrients including vitamins and minerals. Aloe vera is the medicinal plant found in tropical regions of India and are 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. Besides, usage of the herb for medicinal preparations, it can also be included in the poultry diet as feed additive to utilize their benefits to the maximum extent.

So, nutritional manipulations, such as the addition of antioxidants, enzyme mixtures and some herbs are reported to be beneficial in alleviating some of the heat stress related to physiological responses and improving thermo tolerance. Vitamin C and E supplementations are reported to be beneficial in alleviating some of the heat stress related to physiological responses and improving thermo tolerance through their antioxidant effects in poultry production **(**Jones, 1996; Sahin and Kucuk, 2001 and Sahin *et al.,* 2006**).**

No research work has yet been conducted on the effect of aloe vera aqueous gel on production performance of broiler under the hot-humid climatic condition in Bangladesh. Therefore the study has been under taken to investigate the effect of different level of aloe vera aqueous gel and its suitable level in broiler production performance during the hot weather in Bangladesh with the following objectives:

1. To determine the effect of aloe vera gel on growth performance of broilers in summer.
2. To evaluate the effect of aloe vera gel on feed intake, feed efficacy and mortality of broiler.

CHAPTER II

REVIEW OF LITERATURE

2.1 Effects of environmental stress on poultry production

Heat stress during the growth period of broilers has been associated with undesirable meat characteristics and quality loss (Lu *et al*., 2007) additionally, transportation of broilers from farms to processing facilities under high temperature conditions have also been shown to cause meat quality losses (Mulder and Dadgar *et al.,* 1995). In laying hens, heat stress has been shown to negatively affect egg production and quality (Bozkurt *et al.,* 2009) .More recently, food safety has become a major issue to the poultry and egg production industry worldwide. In fact, food safety is increasingly being considered an important part of the modern food quality concept. Colonization of birds by food borne pathogens, such as *Salmonella* and *Campylobacter*, and their subsequent dissemination along the human food chain are a major public health and economic concern in poultry and egg production. In fact, consumption and handling of undercooked poultry products constitutes one of the most commonly implicated sources of food borne illness (Gantois and Domingues *et al.,* 2007). There is increasing evidence to demonstrate that stress can have a significant deleterious effect on food safety through a variety of potential mechanisms.

Environmental stress has been shown to be a factor that can lead to colonization of farm animals by pathogens, increased fecal shedding and horizontal transmission, and consequently, increased contamination risk of animal products. For a long time, these aspects of animal infections have been attributed to effects of stress-associated hormones and mediators on the immune system (mostly, due to immunosuppression). However, in recent years, a new perspective has been proposed, based on the direct effect of stress-associated hormones and mediators on bacterial pathogens, known as

"microbial endocrinology" (Lyte M. *et al., 2*011). Many recent studies have demonstrated that bacteria, such as *Salmonella* and *Campylobacter*, are capable of exploiting the neuroendocrine alterations due to the stress response in the host to promote growth and pathogenicity.

Therefore, it is of great importance to be aware that environmental stresses, such as heat stress, can potentially alter the host-pathogen interaction. It is reasonable to speculate that high environmental temperature would not only affect the bacterial levels in the feces of birds, but also the duration and level of contamination in the environment where feces are deposited, potentially leading to increased dissemination.

Charles *et al.* (2002) reviewed that the optimum temperature for performance and concluded that for growing broilers it is between 18 and 22°C. Higher ambient temperature (30°C) was found to depress growth rate and meat yield of commercial broilers as compared with normal ambient temperature (25°C), thus making it a major factor hindering poultry meat production, especially in hot climates (Deeb and Cahaner *et al*., 2001). Exposure of broiler chickens to high ambient temperatures caused a series of physiological changes such as elevated body temperature, panting and respiratory alkalosis and metabolic status elicited by decreased levels of plasma triiodothyronine (Tao *et al.,* 2006).

Al-Fataftah and Abu-Dieyeh, *et al.* (2007) found that, environmental temperature above 25°C has a significant ($P<0.05$) negatively effects on the performance of 4-8 week-old broilers reared in open-sided poultry house particularly, during summer season. They explained that the depression in the growth rate and body weight gain at high environmental temperatures (31.5°C) might be due to many factors which include decreasing feed consumption, inefficient digestion, impaired metabolism, genetic makeup of birds and temperature per second. They added that some of the feed energy

used for muscle contraction associated with panting might be another factor and that, a decrease in growth rate at high environmental temperature is accompanied with a reduction in thyroid size and thyroxin secretion. The rectal temperature was increased to 44 ºC under heat stress versus 42.3 ºC in normal temperature group.

However, in well-fed chickens, that are neither dissipating heat to the environment nor gaining heat from the environment, the upper limit of the circadian rhythm is usually about 41.5ºC nor the lower limit is about 40.5ºC. When birds exposed to a hot environment and/ or performing vigorous physical activity, body temperature might rise by 1 or 2 ºC as heat is stored (Daghir *et al.,* 2008). Lu *et al.* (2007) investigated the effects of heat stress (34°C) and optimal ambient temperature (21°C) on growth, proportion of carcass and fat deposition, and meat quality in chickens. At 34°C, broilers exhibited greatly decreased weight gain and lower breast proportion compared with 21°C. Fat deposition was decreased in heat-exposed chickens.

2.2 Aloe Vera used in growth performance of broiler production

Feed contribute 60-65% in the cost of poultry production. Now there is an immense demand to reduce feeding cost and utilization of nutrients efficiently 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 human beings with no residual effect. Generally, medicinal plants improve apparent whole tract and ideal digestibility of the nutrients (Hernandez, 2004 and Dilshad *et al*., 2010) and increase the effect of pancreatic lipase and amylase (Ramakrishna *et al.,* 2003).

In addition to their antimicrobial activity, they possess biological activities such as antioxidants (Botsoglou *et al*., 2002) and stimulating effect on animal digestive systems (Jamroz and Kamel *et al.* 2002) to increase production of digestive enzymes and improve

utilization of digestive products through enhanced liver functions (Hernandez, 2004 and Sarikhan *et al*., 2010). Aloe vera (*Aloe barbedensis*) gel has been reported to possess anti-inflammatory and antiviral activities (Devaraj and Karpagam *et al.,* 2011). Jinag *et al.* (2005) reported that aloe vera can enhance immunity and growth performance of broilers.

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 agent. It has been reported to be an effective tool in increasing density of microvillus and enhancing immunity of broilers (Jinag *et al*., 2005).

Mr. Bejar *et al.* (2005) 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 liter of drinking water, and plain water as control group. The method followed a complete randomized design (CRD), which was replicated three times. In order to determine if the aloe extract indeed created an effect on the growth of the chickens, the researchers used five parameters to measure growth performance of broilers: 1) body weight; 2) feed consumption; 3) feed conversion ration; 4) water consumption; and 5) return of investment. They also determined sensory evaluation of the broilers given 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 and 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 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 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 FCR 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.

2.3 Effect of heat stress on the immune response of broiler

In Broiler birds are prone to various environmental stressors that negatively affect bird's immunity (Quinteiro-Filho *et al.*, 2010) 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*., 2002) can alleviate the negative influence of environmental stressors and can improve immune function to combat different types of diseases.

In poultry, several studies have investigated the effects of heat stress on the immune response in recent years. In general, all studies show an immuno-suppressing effect of heat stress on broilers and laying hens, although using different measurements. Lower relative weights of thymus and spleen has been found in laying hens subjected to heat stress (Ghazi, S.H.; Habibian *et al.,* 2009). Reduced lymphoid organ weights have also been reported in broilers under heat stress conditions (Quinteiro 2012 and Liu *et al.,* 2009). Additionally, Felver-Gant *et al.* observed reduced liver weights in laying hens subjected to chronic heat stress conditions. Bartlett and Smith observed that broilers subjected to heat stress had lower levels of total circulating antibodies, as well as lower specific IgM and IgG levels, both during primary and secondary humeral responses. Moreover, they

observed significantly reduced thymus, bursa, spleen, and liver weights. Aengwanich year also demonstrated the occurrence of reduced bursa weight in broilers subjected to heat stress, as well as decreased numbers of lymphocytes in the cortex and medulla areas of the bursa.

While reduced systemic humoral immune response has been reported, fewer intraepithelial lymphocytes and IgA-secreting cells in the intestinal tract of laying hens under heat stress have also been observed (Deng W. and Dong X.F *et al;* 2012).

Others **(**Bartlett J.R. and Smith, *et al.;* 2003**)** have also reported reduced antibody response, as well as reduced phagocytic ability of macrophages, in broilers under heat stress. Moreover, reduced macrophages performing phagocytosis, as well as reduced macrophage basal and induced oxidative burst were observed in heat-stressed broilers (Quinteiro-Filho and Ribeiro *et al.;* 2010).Recent studies have also demonstrated that heat stress can alter levels of circulating cells. It has been shown that heat stress causes an increase in heterophil: lymphocyte ratio, due to reduced numbers of circulating lymphocytes and higher numbers of heterophils .Under environmental stressful conditions, as the bird's body attempts to maintain its thermal homeostasis, increased levels of reactive oxygen species (ROS) occur. As a consequence, the body enters a stage of oxidative stress, and starts producing and releasing heat shock proteins (HSP) to try and protect itself from the deleterious cellular effects of ROS. In fact, higher concentrations of HSP70 were found in broilers and laying hens exposed to heat stress**.** (Felver-Gant and J.N. Mack *et al.,* 2012)

2.4 Aloe Vera

Aloe vera, a cactus-like plant has been used for traditional medical purposes for thousands of years. Aloe leaves can be separated into two basic products: the latex, a bitter yellow liquid beneath the epidermis of the leaf and the gel, a colorless and tasteless

substance in the inner part of the leaf. Both of them have many biologically active components, mainly anthraquinones and polysaccharides (the most active is acemannan), which may act alone or in synergy. Scientific studies provide support for the application of aloe vera in cosmetic-moisturizers, toothpastes etc, and food as flavoring compounds or preservative of fresh products and in medicine of humans or animals. Aloe vera seems to treat a variety of conditions because of its wound healing, anti-inflammatory, immunity, antidiabetic, antioxidant, laxative, antibacterial, antifungal, antiviral and antitumor effects on human and animal. Besides these applications it can be also included in the animal's diet to utilize their benefits to the maximum extent.

2.5 Medicinal species

Aloe vera, A. barbadensis (Barbados aloe), A. vulgaris, A.arborescens, A. ferox (Cape aloe), A. perryi (Socotrine or Zanzibar aloe). There are over 300 species of aloe, most of which are native to South Africa, Madagascar and Arabia. (Ghazanfar SA. *et al.*)

Special quality of plant

- Aloe vera can survive for more than 7 years without water and taking the water it needs for survival and grow the surface of its leaves.
- Repel attacking insects, rodents, snakes and dear by means of the bitter aloin (the yellow colored part of the sap) just beneath the rind.

2.6 Aloe vera contains following components

2.6.1 Vitamins and Antioxidant

Aloe vera is rich in vitamins and minerals. 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. The vitamins A, C, and E are responsible for the aloe's antioxidant activity while vitamin B

and choline are involved in amino acid metabolism and vitamin B12 is required for the production and development of blood cells.

Several methods are available to alleviate the negative effects of high environmental temperature on the performance of poultry. Since it is expensive to cool animal buildings, such methods are mostly focused on the dietary manipulation. In this respect, vitamin C, vitamin E, and vitamin A are used in the poultry diet because of their anti-stress effects and also because their synthesis is reduced during the heat stress (Sykes, 1978; Hornig, 1984; Sahin,1999; and Naziroglu *et al*.,2000).

Nutritional manipulations, such as the addition of antioxidants, enzyme mixtures and some herbs are reported to be beneficial in alleviating some of the heat stress related to physiological responses and improving thermo tolerance. Vitamin C and E supplementations are reported to be beneficial in alleviating some of the heat stress related to physiological responses and improving thermo tolerance through their antioxidant effects in poultry production. (Jones, 1996; Sahin and Kucuk, 2001 *et al.,* 2006).

Heat stress stimulates the release of corticosterone from the adrenal gland, initiates lipid peroxidation in the cell membrane and leads to the generation of free radicals (Etches *et al.*, 1995). Spurlock and Savage (1993) stated that high ambient temperature increased the free radicals and other reactive oxygen species (ROS) in the body fluids and tissues and added that the accumulation of ROS due to over-production or a decreased antioxidant defense, leads to damage of biological macromolecules and disruption of normal cell metabolism and physiology. The only effective means found to limit the release of corticosteron to the really necessary amount is via vitamin C. however, vitamin C is consumed during stress and birds are in a vitamin C deficient status. Therefore supplementation of poultry diets during stress periods with vitamin C is not only useful but also necessary (Cafantaris *et al.*, 1990).

Others studies showed the strong antioxidant characteristics of vitamin E and vitamin C which have been well-known to play important roles in generating a suitable environment for the removal of free radicals (Azzi, Stocker, 2000; and Padayatty *et al.*, 2003).

Vitamin C (Ascorbic acid), one of the most studied additives when attempting to cope with heat stress, appears to alter the endocrine aspects of physiological stress so that the immune suppressive effects are minimized; the presence of vitamin C inhibits 21-hydroxylase and 11-βeta hydroxylase, which are key enzymes in the biosynthetic pathway of corticosterone (Brake *et al.*, 1989). A reduction in plasma corticosterone tends to improve the growth performance of heat stressed birds (Hussein, *et al.*, 1996). Stress conditions may increase metabolic need for vitamin C beyond the normal synthetic ability of the bird, since ascorbic acid ameliorate the steroid-mediated immuno- suppression (Pardue and Thaxton *et al.*, 1986), decreased body temperature (Shoukry *et al*., 2001), increased feed intake (McKee. and Harrison, *et al.*, 1995), decreased mortality and increased body weight gains (Pardue *et al.*, 1985). Mohamed (1997) noted that, ascorbic acid supplementation (at 0, 100, 200 or 300 mg/kg diet) improved body weights of male chicks (4 weeks of age) exposed to hot environment temperature of 36ºC, especially when pellet diet was used. Homidan (2000) found that, Hybro broiler chicks reared in hot climate (25ºC) during 5 to 7 weeks of age reflected a negative effect on productive performance this effect was prevented by using 250 mg Vit C/liter drinking water, which, improved body weight and feed conversion.

Ascorbic acid supplementation improved plasma protein, calcium and phosphorus concentration, while plasma glucose, cholesterol concentration and plasma GOT and GPT activities were significantly lowered lipids.

Regarding vitamin E, It is mainly found in the hydrocarbon part of membrane lipid bilayer towards the membrane interface and in close proximity to oxidase enzymes which initiate the production of free radicals (Putnam and Comben, 1987; McDowell, 1989; Packer *et al.,* 1991). Vitamin E, therefore, protects cells and tissues from oxidative damage induced

by free radicals (Gallo-Torres, *et al.,* 1980). Vitamin E is known to be a lipid component of biological membranes and is considered a major chain-breaking antioxidant (Halli-well and Gutteridge *et al.,* 1989).

Vitamin E is used in the poultry diet because of the fact that vitamin E level is reduced during heat stress (Sahin *et al.*, 2001, 2002). One of the most important properties of vitamin E is its antioxidant function (Maini *et al.*,2007) reported that broilers fed diets supplemented with vitamin E (200 mg/kg), as antioxidants improved significantly live weight gain and feed conversion ratio during summer season.

2.6.2 Anthraquinones

It provides 12 anthraquinones, which are phenolic compounds traditionally known as laxatives. It increases intestinal water content stimulates mucous secretion and increases intestinal peristalsis. Aloin and emodin act as analgesics, anti-bacterial and anti-viral.

2.6.3 Minerals

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, with vitamins and other trace elements.

2.6.4 Enzymes

Ruan and Niu *et al.,* (2001) studied the influence of hot stress on the activities of intestine digestive enzymes of broilers. They found that heat stress decreased significantly the activities of total protein hydrolase, lipase and amylase in intestine. They indicated that the daily gain had a significantly positive relationship to the activities of digestive enzymes in intestine demonstrated that the decrease of digestive enzymes was an important

reason of bad performance caused by hot stress. The heat stress affects drastically the enzyme-kinetics (Yang and Wang *et al.,* 2006), and consequently the rate of the metabolic pathways (Schlesinger *et al*., 1997). Wen *et al.,* (2009) reported that heat stress negatively influences the performance of broilers mainly by reducing the feed intake and depressing the digestion and absorption function. They indicated that performance of broilers could be increased by improving their digestion and absorption function during heat stress.

Many studies indicated that exogenous enzyme in feed additive can complement to endogenous enzymes in the digestive system during heat stress. Kidd *et al.,* (2001) conducted an experiment to evaluate post pellet enzyme application to broilers corn and as a pain killer). Soybean meal diets at different environmental temperatures (warm versus thermo neutral). The primary active enzyme in the product tested was α-galactosidase, which may improve energy digestibility of soybean meal. Broilers fed diets supplemented with enzyme preparations primarily containing α-galactosidase had improved feed conversion at both environmental temperatures. Attia *et al*., (2006) studied the response of broilers raised at a constant high temperature to a multi-enzyme or phytase supplementation.

Aside from vitamins and minerals, aloe vera is rich with enzymes (help the breakdown of food sugars and fats), hormones (aid in healing and anti-inflammatory activities), sugars (i.e. glucose and fructose that provide anti-inflammatory activity), anthraquinones or phenolic compounds (aid absorption from gastro-intestinal tract and have antimicrobial and pain killing effects), lignin (increases the blood circulation), saponins (provide cleansing and antiseptic activity), sterols (antiseptic and analgesic), amino acids (basic building blocks of proteins in the production of muscle tissue) and salicylic acid.

2.6.5 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.

Cosmetic values of aloe vera in human beings

- Aloe vera stimulates the production of collagen and elastin that prevents aging of the skin.
- Aloe vera is used in soaps, shampoos, creams and lotions for beauty purposes.
- Aloe vera gel lightens the dark spots on the face and reduces the intensity of pigmentation.
- When applied topically, the gel acts as best moisturizer removes dead skin cells and rejuvenates the skin.
- Also it conditions the damaged hair. All you need to do is mix aloe vera gel and lemon juice. Apply this mixture on your hair after shampooing it. Leave this for 4-5 minutes and then rinse thoroughly with water.
- It hastens the skin repair and hydrates your skin resulting in healthy and glowing skin.
- People with oily skin can prevent formation of pimples and acne by using this gel
- Scarring and scratch marks are some of the signs of aging which can be prevented by the antioxidants present in this plant. The gel of the plant should be rubbed on the scalp for 30 minutes and rinsed well thereafter, in order to naturally treat dry hair and dandruff.

CHAPTER III

MATERIALS AND METHODS

3.1 Experimental birds

The farm recognized as small-scale broiler farm keeping 400-500 broilers per batch. Either it diets or water was fed from 11 days to 35 days of age. They were kept on the floor in isolated cages (plastic net) and fed commercial ration and water ad labium. The experiment was done in the summer season.

Figure 1. Name of the Poultry Farm

3.2 Experimental design

The experimental day old chicks (250) were divided into 5 groups. Each group consisting of 50 chicks was designated as group To, T_1, T_2, T_3 and T_4.The chicks were divided into five treatments with five replicates (10 chicks for each replicate) on a completely randomized design (CRD). The control group (To) was treated with plain water along with required diet.

For the next four treatments T_1, T_2, T_3 and T_4 were provided with 5ml, 10ml, 15ml and 20 ml per liter aloe *vera* gel respectively. Either diets or water was fed from 11 days to 35 days of age. Nutritional needs of broilers in different experimental periods: data on the starter (days 01 to 16), finisher (days 17 to 35) were extracted from tables provided for farming Cobb 500 chicks.

All broilers were reared in flooring an open sided house under similar environment. Each group was bedded with rice husk. Temperature, humidity, light and ventilation were the same for all treatments. Feed and water were available to broilers in all treatments. Vaccination was not administered for evaluating the mortality rate of broilers.

3.3 To complete the research work following steps were followed

3.3.1 Collection and preparation of aloe vera gel

Aloe vera (*Aloe barbadensis*) leaves were selected to determine the influence of aloe gel on growth performance and controlling stress condition of broilers. Mature and disease free aloe vera *(Aloe barbadensis*), leaves were collected from Carmichael college campus (Dhui Soinic store), Rangpur, Bangladesh.

3.3.2 Preparation of 10% Aloe vera Gel

Aloe gel infusion was prepared accordingly to the method (Durrani *et. al.* 2005). Fresh aloe leaves were collected from Dhui Soinic store, Rangpur 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 leaf in a glass bottle and one liter of boiled water at room temperature was poured on it. It was taken in blinder machine for five minutes making a homogeneous solution. The PH of aloe vera gel was 4.49. 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.

Figure 2. Preparation of aloe vera gel

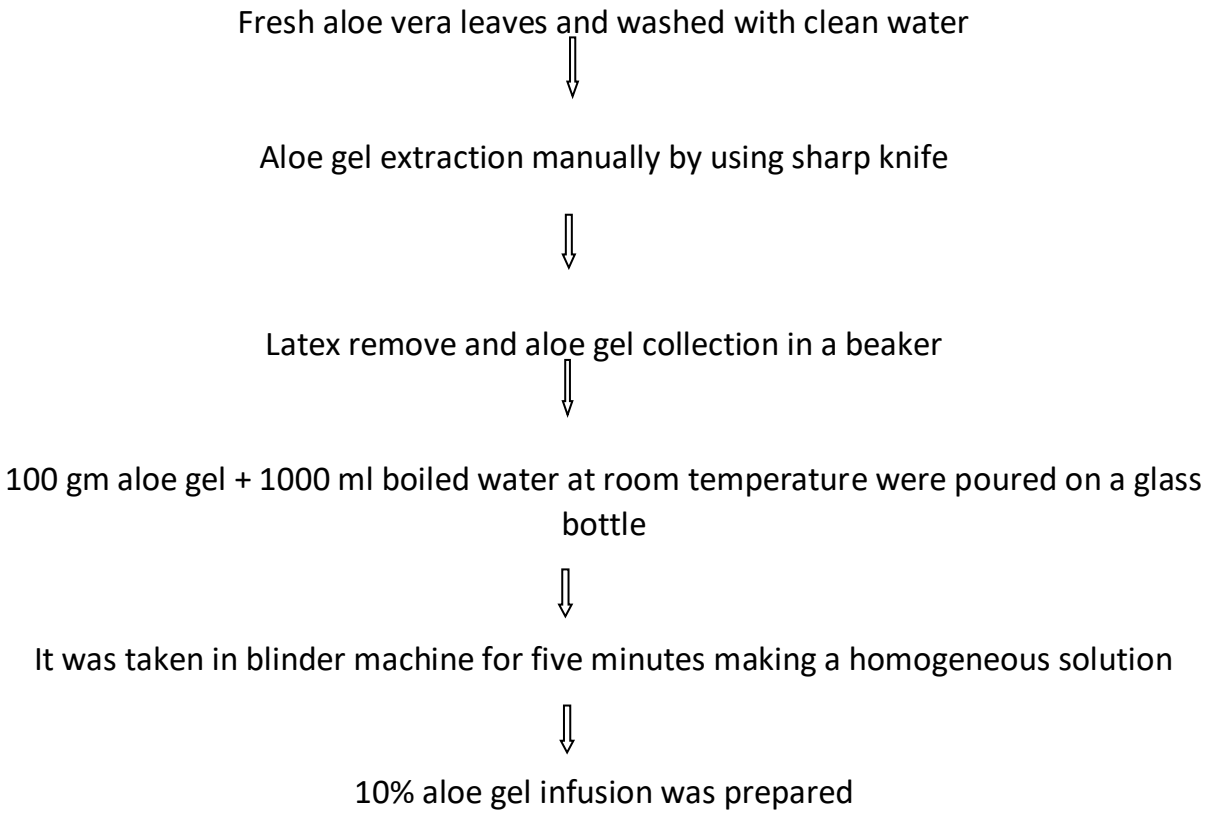

Figure 3. Preparation of 10% aloe vera gel

Table 1. Nutritional manipulations of Freeze Dried Aloe vera Concentrate (Nutritional Analysis 1 liter gel)

1.Lipids	30 milligrams/dl
2.Inorganics: Minerals	
Calcium (Ca)	35.7 milligrams/dl
Chloride (Cl)	56 milliEquivalents/L
Chromium (Cr)	122 micrograms/L
Copper (Cu)	59 micrograms/L
Fluorine (F)	529 micrograms/L
Iodine (I)	0.0 milligrams/L
Iron (Fe)	123 micrograms/dl
Magnesium (Mg)	107 milligrams/L
Manganese (Mn)	37 micrograms/L
Molybdenum (Mo)	76 micrograms/L
Phosphorus (Po)	7.4 milligrams/dl
Potassium (K)	32 milliEquivalents/L
Selenium (Se)	18 micrograms/L
Sodium (Na)	63 milliEquivalents/L
Zinc (Za)	820 micrograms/L
3. Enzymes:	
Dehydrogenases	0 International Units/L
Phosphatases	1 International Units/L
Phosphokinases	1 International Units/L
Transaminases	4 International Units/L
4.Vitamins:	
Fat soluble:	

Vitamin A	10 micrograms/dl
Vitamin E	0.1 milligrams/dl
Water soluble:	
Vitamin B-1 -- Thiamin	3 nanograms/ml
Vitamin B-2 -- Riboflavin	33 nanograms/ml
Vitamin B-3 -- Niacin	0.297 micrograms/ml
Vitamin B-5 -- Pantothenic Acid	402 nanograms/ml
Vitamin B-6 -- Pyridoxine	0.03 micrograms/ml
Vitamin B-12 -- Cyanocobalamin	50 picograms/ml
Folic Acid	1.4 nanograms/ml
Vitamin C -- Ascorbic Acid	0.05 milligrams/dl
5.Osmolarity	309 MilliOsmoles/Kg

(Source.http://www.desertharvest.com/physicians/t-chemical-constituents-nutrients.html).

3.3.3 Collection and management of broilers

Day old broiler chickens (250 in number) were brought in the experimental shed from Aman Poultry Limit. The strain of chick was Cobb 500. At first the shed for rearing broiler chickens (experimental shed at Shondha Poultry Farm) was properly prepared by following ways.

3.3.4 Cleaning and disinfecting

When the batch of broilers grown in a house sold, the area was thoroughly cleaned, dusted and disinfected, and left vacant for a considerable length of time (down time) before the next batch of broiler chicks are received in the area. This ensures proper growth of broilers, by reducing the accumulated load of disease- producing organisms in

that area. The weld-mesh, bottom of the roof, etc., was dusted and cleaned to remove cobwebs. Water under high pressure was sprayed on the floor and fixtures to remove dried droppings. The entire area must then was sprayed with any reputable disinfectant (when quaternary ammonium compounds are used, metal containers must not be used for the solutions).

3.3.5 Housing

The house of indoor system was made with a concrete floor and windows were building with wire net and bamboo 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.

3.3.6 Litter management

Broilers are usually reared on deep litter only. So, the materials commonly used as litter are paddy husks. The choice of litter material depends mostly on cost and local availability of the material. A total litter height was 4 cm. The litter was kept as dry as possible. After two weeks, caked material was broken up and exposed to facilitate drying. Removing the drinkers and feeders while raking the litter, to avoid spillage. Moisture levels in litter material were increased every day because of the water in bird droppings.

3.3.7 Lighting and brooding management

During this study, the birds received a lighting regimen of 24 h lights (16hrs day light+ 8 hrs Solar light). To provide warmth for brooding, artificial lighting (Harkin light) was given up to two weeks. Brooding temperature was initially set to 33±1°C and was gradually reduced over 3 wks to acclaim chicks to outdoor temperatures. However, it was summer; continuous night lighting except for a one-hour break was recommended.

3.3.8 Feeding

Feed and water were provided ad libitum. Total cage number was 25, drinker and feeder were placed two in each cage. Starter diets were provided from 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 feeds 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, 11:00 AM and 4:00 PM o'clock in the afternoon. Ad libitum of water was supplied available at all times in water trough. All other management practices such as hygiene and sanitation was followed strictly.

Figure 4. Feeding the experimental birds

3.3.9 Temperature recording

A thermometer scale was placed in middle point of the farm for recording the daily temperature and humidity in the air. The maximum and minimum temperature and humidity were taken in 2 times in a day. Finally average record was calculated.

3.3.10 Slaughtering

At the end of growth period (35 day of age), 5 birds were randomly taken from each treatment to carry out the slaughter test to determine the carcass traits. Before slaughtering, the birds were starved for 12 hours, then weighed, slaughtered and allowed to bleed freely for about 5 minutes. Absolute weight of carcass, heart, gizzard, liver, and abdominal fat were proportioned to the live body weight upon slaughtering.

Figure 5. After slaughtering different parts of carcass were weighted

3.4 Data Collection

Records were collected from 11 days to 35 days in 20th July to mid 14th August in 2014. Birds of each treatment was randomly selected and weighed on a schedule basis for body weight gains. Electronic weighing scale was used for sample group weighing to determine the body weights. Feed intake was estimated by calculating the number of feed bags supplied on the schedule basis according to the manual of nutrient requirement for poultry Bureau of Indian Standard (Bureau of Indian Standard, 1992). Feed intake, body weight gains, mortality, feed conversion efficiency, temperature and humidity data were taken from 11 days to 35 days of age in each treatment group of broilers. Chicks' weight and feed consumption were recorded for each experimental unit as schedule time intervals. After 34days, two birds from each replicate was selected, slaughtered (12h after feed withdraw). The carcass, stomach, abdominal fat, breast meat (including pectoralis major and pectoralis minor muscles) and leg meat (including thigh and drumstick meat) were weighed. Percent of eviscerated carcass was calculated as the ratio between the eviscerated carcass and live body weight after fasting broilers and feed were weighed at 11, 17, 24 and 35 days of age for determination live weight and feed efficiency. Livability was recorded as a percentage of live birds. Broilers chicks of control and treatment groups were weighed. The weight of broiler chickens was taken weekly. The average of these weights was calculated and recorded. Mean live weight gain of each group of chicken at 11, 17, 24 and 35 days of age (weekly basis) were recorded. Antibiotics and Vaccination was not administered to evaluate the livability of broiler chickens by aloe extract feeding practiced.

Figure 6. Body weight taken by digital balance

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 *et al.* (1981).

Table 2. Ingredients and chemical composition of the basal diets

Ingredients (%)	Starter (0-16 days)	Grower (17-35days)
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
		1.49

Dicalcium phosphate Vit. and min. premix1 Salt DL-methionine	1.94 0.50 0.30 0.21	0.50 0.30 0.02
Total (100%)	100.00	100.00

Calculated analysis		
ME (kcal/kg) CP (%) Calcium (%) Phosphorus (%) Sodium (%) Arginine %) Methionine + Cystine (%) Lysine (%) Tryptophan (%)	2900 21.44 1.05 0.51 0.16 1.41 0.91 1.20 0.31	3100 19.37 1.00 0.50 0.14 1.23 0.69 1.10 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, 40μg; 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.

CHAPTER IV

RESULTS AND DISCUSSION

This experiment was conducted to study the efficacy of aloe vera (Aloe barbedensis) leaves gel as a growth promoter in broiler production in hot humid climatic condition in Rangpur region.

Heat stress was the major problem in poultry farming during summer season in Rangpur. Being a sub-tropical country the temperature was reached over 30-33°C during summer and was not suitable for poultry farming. Hot humid weather conditions and poor management practices were increased the mortality in flocks, reduce the growth and make poultry production to uneconomical level in such area. Therefore concluded that herbal (aloe vera) extract has effects as alternative growth promoter and also reducing stressful condition of broilers farm. Herbs can stimulate appetite and endogenous secretions which in turn improve performance. Several studies have shown antimicrobial properties of herb extract (Coman,1999 and Hammer *et al.*, 2004) which can improve intestinal micro flora population an enhance health of broilers digestive system through reduction in number of diseases making bacteria.

So this experiment was conducted to study the efficacy of aloe vera gel as a growth promoter and protecting heat stress in broiler production. The experimental units were kept on a floor litter system in separate cages (plastic net and bamboo). A weight amount of the ration was offered to the birds twice a day and the left over feed was collected to the calculating feed consumption of the birds. Fresh and clean water with aloe vera extract was made available at all the complete randomized design and data about per replicate body weight, weekly feed consumptions (Feed intake),water intake, Feed Efficiency, offal's weight and dressing percentage, and mortality rate were recorded during the experimental period (11-35 days of age).

Table 3. Mean body weight gain, feed, and water intake, feed conversion, mortality rate from broilers given aloe gel in drinking water

Treatments	To	T1	T2	T3	T4	**Level of Significance**
1. Initial live wt. /chick (gram)	$340.5^{a} \pm 11.54$	$345.1^{a} \pm 5.7$	$343.1^{a} \pm 11.54$	$342.4^{a} \pm 11.54$	$340.0^{a} \pm 5.77$	**NS**
2. Final Live wt. (gram)/chick	$1691.0^{e} \pm 17.3$	$1757.0^{d} \pm 23.09$	$1934.0^{b} \pm 11.54$	$2057.0^{a} \pm 5.77$	$1855.0^{c} \pm 11.54$	*
3. Total live wt. Gain Per chick (gm)	$1351^{a} \pm 15.27$	$1412^{c} \pm 17.32$	$1591^{d} \pm 20$	$1714^{b} \pm 10$	$1515^{ab} \pm 10$	*
4. Water intake (ml)/chick	$5726^{b} \pm 15.01$	$5732^{b} \pm 11.54$	$5798^{a} \pm 17.32$	$5825^{a} \pm 14.43$	$5810^{a} \pm 11.54$	*
5. Feed intake (gram)/chick	$2307^{a} \pm 28.86$	$2335^{a} \pm 20.20$	$2376^{a} \pm 13.8$	$2394^{a} \pm 32.33$	$2380^{a} \pm 17.3$	**NS**
6. Feed conversion ratio	$1.708^{a} \pm 0.11$	$1.65^{a} \pm 0.05$	$1.49^{ab} \pm 0.05$	$1.39^{b} \pm 0.11$	$1.57^{ab} \pm .04$	*
7. Mortality (%)	4 ± 0.57	0.00 ± 00	0.00 ± 00	0.00 ± 00	0.00 ± 00	*

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

4.1 Effect of aloe vera gel supplementation on broiler production

4.1.1 Body weight gain of broilers

The live body weight of broilers fed on 15 ml/L aloe vera aqueous gel in drinking water showed significantly higher body weight gain ($P<0.05$) was observed in T3 group than control group of the broilers provided the clean water (Table-3).The broilers of T_3 gained 1714g whereas the treatment groups of T_1, T2, T_4 gained 1412 g, 1591g and 1514 g respectively. The body weight was increasing up to 15ml/L of aloe gel and then decreased slightly provided with 5 ml/L of aloe vera aqueous extract in drinking water.

Similarly Changkang *et al.* (2007) found similar results. They were supplemented that 600 mg of *aloe* vera gel with water increased body weight gain in third and sixth weeks. T_3, providing with 15 ml/L aloe vera gel, revealed significantly ($P<0.05$) higher body weight gain as compared to other groups. Similar findings have been reported by Jiang *et al*. (2005), Jamrose and Kamel (2002), Wheeler *et al.* (1994), Guo *et al.,*(2004), Mehmet *et al.* (2005), Chand *et al.* (2005) and Durrani *et al*. (2007).

Swaim *et al. (*1992) found that broilers took 10 ml of aqueous extract aloe gel per liter of drinking water showed better performance due to diversified antimicrobial activities of aloe gel. Broilers are prone to various environmental stressors that negatively affect bird's immunity (Quinteiro-Filho *et al.,* 2010) 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*., 2002) can alleviate the negative influence of environmental stressors and can improve immune function to combat different types of diseases resulting increased growth performance.

Table 4. Live body weight gain of broiler (weekly)

Treatment	Intial body wt (gram) ± SE mean	Second week body wt (gram) ± SE mean	Third week body wt (gram) ± SE mean	Fourth week body wt (gram) ± SE mean	Finally body wt (gram) ± SE mean
T0	$340.5^{a} \pm 2.8$	$611.7^{b} \pm 5.2$	$984.7^{d} \pm 11.5$	$1367.0^{d} \pm 23.0$	$1691.0^{e} \pm 9.6$
T1	$345.2^{a} \pm 2.3$	$627.1^{bc} \pm 2.3$	$1100.0^{c} \pm 6.6$	$1524.0^{c} \pm 16.0$	$1757.0^{d} \pm 21.18$
T2	$343.1^{a} \pm 5.06$	$642.1^{b} \pm 1.80$	$1189.0^{b} \pm 6.33$	$1655.0^{b} \pm 18.3$	$1934.0^{b} \pm 13.3$
T3	$342.4^{a} \pm 2.9$	$689.1^{a} \pm 10.0$	$1265.0^{c} \pm 21.0$	$1750.0^{a} \pm 14.9$	$2058.0^{a} \pm 20.3$
T4	$340.5^{a} \pm 2.8$	$639.9^{b} \pm 6.0$	$1092.0^{c} \pm 5.6$	$1623.0^{b} \pm 19.1$	$1855.0^{c} \pm 12.6$

N.B: LSD means Least Significant Differences and SE means standard error.

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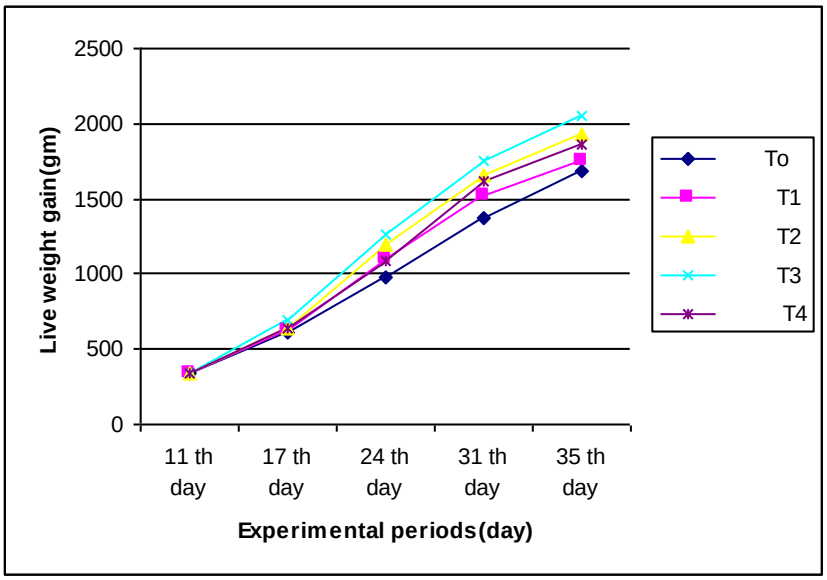

Figure 7. Effect of aloe vera gel supplementation on live weight gain of broilers

Legend: T3 treatment group showed higher body weight gain than other treatment groups especially control groupT0

Since the main polysaccharide contained in aloe *vera* gel is acemannan, the enhanced body 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 micro flora. 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.

4.1.2 Feed intake

Average weekly feed intake was individually calculated by the difference between weekly offered feed and the weekly residual in g/replicate. Feed intake of the broilers during experimental period of in all treatment groups were not significantly differs from one group to another. But T_3 group containing 15 ml/L aloe vera gel water took by the broilers showed total higher feed intake 2394/gm than To control group 2307/gm, this stimulation might be photogenic substance that may stimulate appetite and endogenous secretion which in turn improved

performance. 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. Daily and cumulative feed intake was determined by offering known amount of feed and measuring feed refusal:

Feed intake = Feed offered – Feed refused.

4.1.3 Water intake

Significant differences were observed in all treatment groups. Herbs can stimulate appetite and endogenous secretions which in turn improve performance. From the table-1, we observed that group mean water intake was 5726/ml, 5732/ml, 5798/ml, 5825/ml, and 5810/ml respectively in different treatment groups. Because aloe vera gel contain different types of mineral such as calcium, chromium, copper, iron, magnesium, manganese, potassium, phosphorous, sodium, zinc etc. Similarly Mehmet *et al.* (2005) reported higher water intake. But Ismail *et al.* (2004) and Chand *et al.* (2005) reported different findings. Water intake was recorded at the end of experiment.

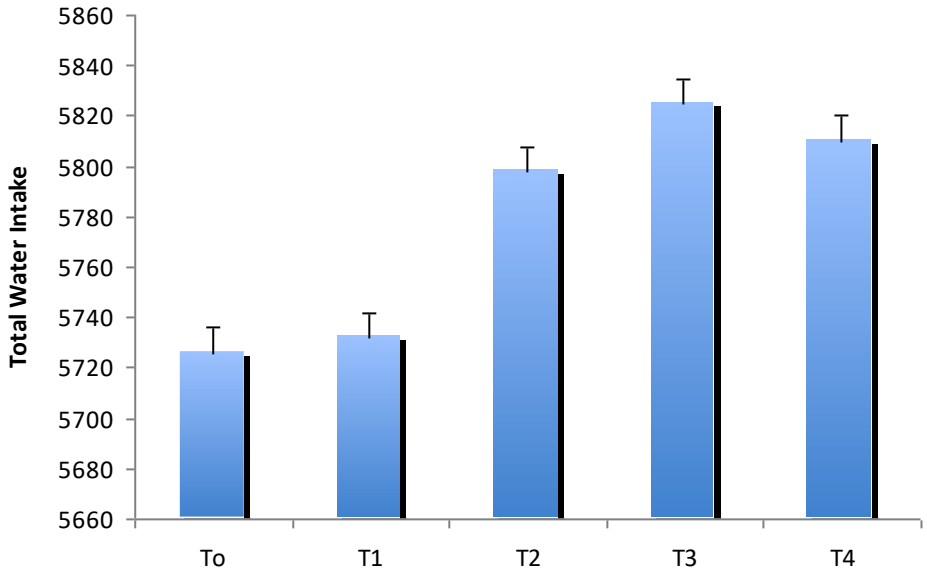

Figure 8. Water intake of broiler

(Legend: T3 treatment group showed higher water intake than other group especially control groupT0)

4.1.4 Feed Conversion Ratio

At the experimental period, the broilers of T_3 @ 15 ml/L aloe gel converted feed to meat most efficiently. The feed conversion ratio of T_0 was significantly ($P<0.05$) lower than the treatment groups (From the table-1). The feed conversion ratio of the broilers fed 15 ml/L and 20 ml/L aloe vera aqueous gel in drinking water were significantly ($P<0.05$) higher than the broilers given 5 ml/L and 10 ml/L aloe vera aqueous extract in drinking water . The FCR were increased with increased the level of aloe vera aqueous extract in drinking water up to 15 ml/L aloe gel showed slightly decreased FCR 1.39 which is better for production. 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 conversion ratio. Guo *et al.* (2004) found higher feed effiency in broilers treated with Chinese herbs on the days 21 through 28. This can result in higher feed efficiency for herbal medicine used as growth promoters. A poorer feed conversion may be obtained possibly attribute to poorer utilization of ingested energy. Feed conversion ratio was measured by the following formula-

$$\text{Feed Conversion Ratio} = \frac{\text{Total feed intake}}{\text{Total feed intake}}$$

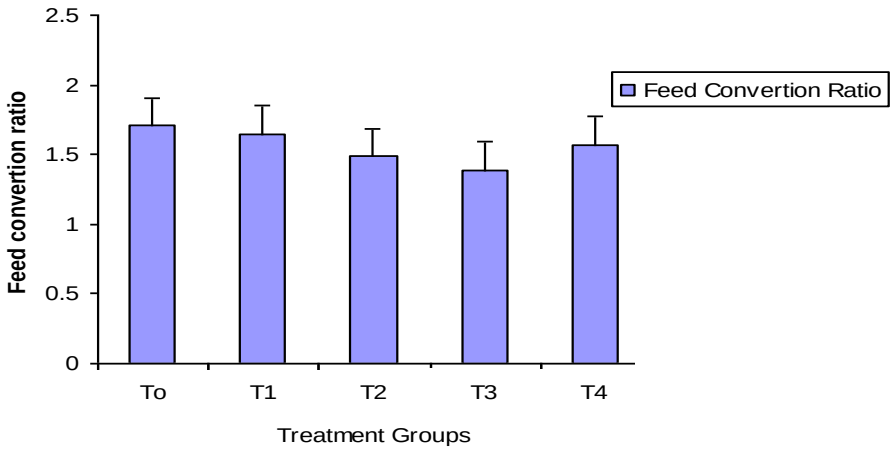

Figure 9. Feed Conversion Ratio

(Legend: T3 treatment group showed slightly decreased than other groups where production was high)

4.1.5 Temperature and Humidity

The experiment was done in the summer season. Temperature and relative humidity were recorded at every 3 hours interval. The maximum, minimum, and mean of temperature were 31.73 ºC, 27.47 ºC and 28.14 ºC. While the maximum, minimum, and mean of relative humidity were 87%, 69% and 78% throughout the experimental period (Table 5).

Body temperature of birds were decreased in different treatment groups than control group. On the other hand control group containing no aloe vera gel as a result four birds was death due to heat stroke. Due to over intake of feed and excess heat one bird from T4 group was death.

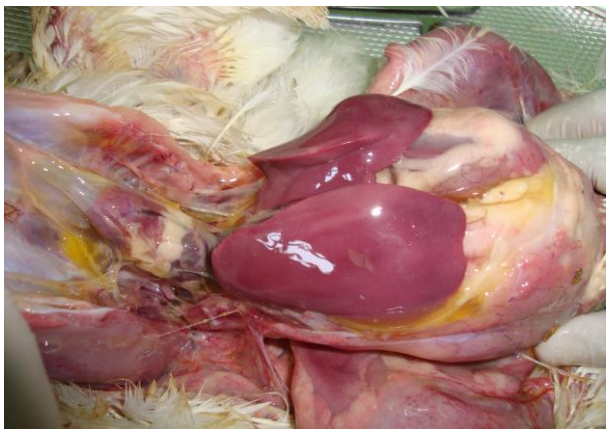

Figure 10. Post mortem examination of chicken showing edema due to heat stroke death

It was supported by Atta (2002) who noted that, body temperature, respiration rate, blood pH and corticosteron were reduced when Arbor Acres broiler chicks, which exposed to 1 hr heat stress at 38±1ºC for three consecutive days, given drinking water supplemented with ascorbic acid (at 500 mg / litter). Kalamah *et al*. (2002) also found that, ascorbic acid supplementation 250 mg/kg diet improved body weight, feed conversion and mortality also reduced body temperatures and respiration rate of Norfa chickens exposed to hot environment temperature (37,

41 and 45ºC). Results of Kucku*et al.* (2003) indicated that the effects of vitamin C and vitamin E are additive in preventing stress.

Table. 5 Appendix data for daily temperature and humidity during experimental time

Date	Air Temperature		(°C)	Humidity		(%)	Date	Air Temperature		(°C)	Humidity		(%)
	Max.	Min.	Mean	Max.	Min.	Mean		Max.	Min.	Mean	Max.	Min.	Mean
21.07.14	32.7	27.4	30.5	82	74	78	03.08.14	32.7	28.30	30.5	90	68	79
22.07.14	31.4	27	29.2	88	75	81.5	04.08.14	29.8	27.2	28.5	92	67	80
23.07.14	33.7	26.0	29.8	92	76	84	05.08.14	28.6	24	26.3	87	65	76
24.07.14	32.1	28.5	30.3	88	71	79.5	06.08.14	33.1	28.7	30.9	88	61	74.5
25.07.14	30.5	25.0	27.7	83	62	72.5	07.08.14	32.5	28.2	30.32	82	77	79.5
26.07.14	32.8	29.5	30.7	89	64	76.5	08.08.14	29.6	24.2	26.9	87	72	79.5
27.07.14	31.2	27.2	29.2	87	68	77.5	09.08.14	30	28	27	84	73	78.5
28.07.14	32.6	28.5	30.1	85	68	76.5	10.08.14	31.1	29.2	30.15	82	71	76.5
29.07.14	31.1	28	28	82	62	72	11.08.14	32.2	29	30.65	85	78	81.5

30.07.14	32	27	29.5	80	60	70	12.08.14	33.2	28	30.14	89	75	82
31.07.14	30.9	29.5	29.7	85	64	74.5	13.08.14	32.4	24.5	28.45	88	64	76
01.08.14	30.9	29.5	29.7	85	64	74.5	14.08.14	33	26	29.5	92	72	82
02.08.14	33.2	28.5	30.8	82	67	75.5							
Average :25 days								31.73	27.47	28.14	87%	69%	78%

Table 6. Mean weight of offal's of broilers given aloe gel in drinking water

Treatments	Breast Muscle(g)	Thigh weight (g)	Abdominal fat (g)	Liver weight (g)	Heart weight (g)	Gizzard weight (g)	Dressing (%)
T_0	261.2± 5.7	66.5± 3.46	21.6^{b}± 2.3	42.5± 1.15	9.7 ± 1.1	23.5± 1.73	71^{e}± 2.3
T_1	256± 11.5	71.4± 5.19	30.7^{c}± 2.8	44.8± 2.8	11± 1.154	24.± 1.154	75^{c}± 6.4
T_2	284± 5.7	70.6± 5.77	29.20^{b} ± 2.3	45.3 ± 2.8	11.6 ± 0.57	26.5± 3.46	74^{b}± 2.3
T_3	287.5 ± 5.7	74.5± 2.3	31.8^{ab}± 1.15	43.4± 1.73	10.2± 1.1	25.8± 1.73	75^{b}± 4.0
T_4	249.5± 5.7	68.5± 2.30	27.2^{d} ± 1.15	42.3± 2.8	10.8 ± 1.7	25.5± 2.3	73^{c}± 1.73
Level of Significant	***NS***	***NS***	*****	***NS***	***NS***	***NS***	*****

NS Means in row with different superscripts were significantly different at P<0.05

NS= statistically not significant, *= statistically significant

4.2 Mean weight of offal's of broilers given aloe extract in drinking water

Carcass weights were measured by digital weight balance after removal of feather, head, legs and abdominal contents, gizzard, liver, heart, and abdominal fat dissected and recorded. The weights of breast and thigh muscle were recorded and were calculated as the percentage of fasted live body weight.

4.2.1 Dressing %

On 35 days of age, final body weight of broiler chickens were measured, 2 birds from each replicate were randomly selected, tagged, and fasted for 8h (no limitation of water access). Dressing % was measured by following way.

$$\text{Dressing } \% = \frac{\text{Dress weight of bird}}{\text{Live weight of bird}} \times 100$$

Significantly, the group heavier dressing percentage was observed in T_3 (75%) group than other treatment groups T_0 (71%), T_1 (75%), T_2 (74%) and T_4 (73%) respectively (Table 6).

4.2.2 Thigh muscle weight (g)

Thigh weight of the broilers was not affected by giving aloe extract in drinking water (Table. 6)

4.2.3 Abdominal fat (g)

Abdominal fat deposition were recorded T_0 (21 g), T_1 (30 g), T_2 (29 g), T_3 (31 g) and T_4 (27 g) respectively from (Table 6). Pelicano (2004) and Demir *et al.* (2003) reported that the inclusion of medicinal plants in diet had no effect on abdominal fat which was disagreement with observations of the present study. In presence of medicinal plants, the bill acid secretions reduce, their digesta concentrations severely decrease, hepatic-intestinal circulation impress, and lipids emulsification

strike. It results in the decrease of lipids absorption. 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 juice(0.25 and 1.0 g/kg) in broiler diet from 1-day old to 5 weeks of age showed no significant effect on abdominal fat levels.

4.2.4 Liver, Gizzard and Heart weight (gm)

Liver, Gizzard weight Heart weight of the broilers was not affected by giving aloe extract in drinking water (Table 6.). Similar results were found for gizzard, liver, and heart weight (Table 6.). Findings of the present study were in agreement with Ismail (2004) and Hernandez *et al. (*2004) reported similar findings whereas, Failey *et al.* (1985) associated an increase in the relative weight of Gizzard for the broilers given antimicrobial agents in their diets.

CHAPTER V

SUMMARY AND CONCLUSION

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 and offal weight (breast muscle, abdominal fat, dressing %).

Keeping one group as normal control and rest groups were subjected to treatment with aloe vera gel. The body weights were measured in all groups by digital weight machine. 250 day old broiler chicks were divided into five groups, To, T1, T2, T3 and T4 which were supplemented with Aloe vera gel @ 0 ml, 5ml, 10,15ml and 20 ml per liter drinking water of broiler ration, respectively. Weekly observations were recorded for live body weight, weekly gain in weight, weekly feed consumption, FCR, daily temperature-humidity, mortality and finally offal's weight parameters of birds for 11-25 days. The broilers of T_3 gained 1714g whereas the treatment groups of T_1, T2, and T4 gained 1412 g, 1591g, and 1514 g respectively. The body weight was increasing up to 15ml/L of aloe gel and then decreased slightly provided with 5 ml/L of aloe vera aqueous extract in drinking water. The experiment was done in the summer season. Temperature and relative humidity were recorded every 3 hours. The maximum, minimum, and mean of temperature were 31.73 ºC, 27.47 ºC and 28.14 ºC. While the maximum, minimum, and mean of relative humidity were 87%, 69% and 78% throughout the experimental period (Table 5). It was stressful environment for poultry production in study area.

In traditional farming, during the summer farmers have to continue taking flocks compromising with poor performance in feed intake, growth rate, live weight gain, FCR (Feed conversion ratio) in broilers along with mortality or totally close the business to avoid all these risks that could disturb the hired labour and extra money cost. Stress free environment may be made by the use of 15% aloe vera gel for broiler production in summer season in Bangladesh without medicine .Thus poultry farmer can overcome this critical summer situation.

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