



Role of Aloe Vera as A Natural Feed Additive in Broiler Production[#]

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ABSTRACT

Phytopathogenic feed additives have replaced the use of antibiotic growth promoters (AGP) in the diet of poultry particularly broiler chickens. Researchers are moving towards the use of natural products such as herbs, spices, plants and plant products, which possess influential effects on growth performance parameters, immune response and treatment of various diseases. Aloe vera is a well-known medicinal plant and is being used for commercial and therapeutic purposes such as antimicrobials, antitumor, anti-inflammatory, immunomodulator, wound healing, antioxidant and antiprotozoal agents. From a few last decades, the use of Aloe vera has been increased as a natural additive to broiler diet. Based on the review of literature, Aloe vera can improve immune response, growth performance in the broiler, as well as an excellent alternative of AGPs and anticoccidial drugs. It can be used for broiler diet in the form of gel, powder, ethanolic extract and aqueous extract. This review provides information about the use of Aloe vera in broiler production with reference to the effects on growth performance, immune system, intestinal microflora and coccidioides in broiler chickens.

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Introduction

Immunity is the capability of a host to combat the invading pathogens and hamper them from proliferating and colonizing. The immune system of poultry is classified into a specific and non-specific system. These systems protect the birds from diseases and depend upon vaccines and antibiotics to retain flock's health. Antibiotics are used in poultry feed as AGPs to control the pathogens and diseases to enhance the production level of birds (Miles et al. 2006). Since AGPs have proved to be the causative agent of antimicrobial resistance in pathogens, The European Community banned AGPs in 2006. Scientists are searching for alternatives, which would be safe, cheap and easy to use. The prebiotics, probiotics and different herbal products are found to be quite promising among the replacements. Amongst herbal products, Aloe vera (AV) has gained much interest as it has more reliability and

tolerability by consumers (Loh et al., 2010; Salim et al., 2013; Pourhossein et al., 2015; Akram et al., 2019b). Aloe vera is one of the best alternatives to AGPs which belongs to the Liliaceae family. Extensively; it is used as a medicinal plant. Aloe vera has many benefits with 75 biologically active compounds, including anthraquinones and acemannan that gives anti-inflammatory, anti-oxidative, immuno-stimulant effect, anti-viral, antibacterial, anti-neoplastic and gastrointestinal properties that fulfil the demand of consumer. (Ahlawat and Khatkar, 2011; Radha and Laxmipriya, 2015, Akram et al., 2019b). Most of the major components of AV have been summarized in Table 1. It can either be mixed with water or given in the powdered form to poultry. Aloe vera includes proteins, polysaccharide, arthroquinones and naphthalenones. Among them, arthroquinones are the chief

active compound. Arthroquinones are found in bitter yellow exudate having aloin A, aloin B, aloe-emodin, aloe-nin, chrysophanol & aloesaponol I, II, III, IV (Reynolds, 1985). Among polysaccharides, glucose and mannose are the most usual ones (Paulsen et al., 1978). Other components in AV include lectin, cellulase, catalase and superoxide dismutase (Suzuki et al., 1979; Sabeh et al., 1996).

Aloe vera increases the digestion process and helps to fight against bacteria and viruses when it is offered to the birds in the water. And also it damages the cancerous cells and foreign materials. Furthermore, antibody titers against Newcastle and coccidiosis are also increased (Akram et al., 2019b). The microflora present in the gut has a significant effect on the growth and overall performance of birds. Aloe vera helps microflora to grow properly.

Use of AGPs should be significantly reduced as they are the main reason of increasing antimicrobial resistance. Keeping a balance between human health and food quality is highly preferred with judicial use of chemical feed additives. The main objective of this paper is to review the effects of AV as a natural feed additive. This review provides a brief and basic understanding of the application of AV on poultry production.

Effects of Aloe Vera on Growth Performance Parameters

Economical achievement of good body weight and better feed conversion rate (FCR) are the preferred goals in broiler farming. Prebiotics, probiotics, some herbs and natural ingredients are highly favoured as compared to antibiotics. A study took place that resulted in better growth performance by combining AV with AGPs such as virginiamycin instead of feeding AV gel alone. Virginiamycin is an AGP that can be replaced with 1% AV leaf powder. There was no significant weight gain when AV powder alone was fed with an amount of 0.1 and 0.2% while when AV was offered with water, a prominent weight gain was observed (Olupona et al., 2010). Likewise, weight gain was increased when AV gel supplemented with water at an amount of 1.8ml/litter (Hassan et al., 2012). Furthermore, combining dry and fresh AV gel had overall positive effect on FCR (Sinurat et al., 2002). Using AV powder with an amount of 0.3, 0.5 or 0.8 showed no positive response whereas using 1.5, 2 and 2.5% of AV gel showed notable difference in FCR (Darabighane et al., 2011). Akram et al. (2019b) examined the effects of Av at three different PH on the broiler chickens. They observed that AV extract with PH 3 significantly increased the feed intake at 21 and 35 days of age and feed conversion ratio at 21 days of age. The highest weight gain was also obtained at 35 days of age.

Effects of Aloe Vera on Immune Response

In poultry, a significant factor to enhance consistency, growth performance and long life is the reinforcement of immune system against diseases which can be obtained by improving immune response against pathogens. Medicinal herbaceous plant and mushrooms containing polysaccharide which cause the improvement of the immune system have been showed by previous studies

(Guo et al., 2004). Various studies have shown that the macromolecular polysaccharides and glycoproteins of AV are the major reason of its immunomodulatory activity. AV has good anti-bacterial properties which help in promoting beneficial bacteria in the intestine and improve the immune response of birds. The improvement of immune system caused by AV is probably due to presence of acemannan in its structure (Karaca et al., 1995; Zhang and Tizard, 1996; Djeraba and Quere, 2000; Harlev et al., 2012; Akram et al., 2019b). The acemannan's immunoregulatory programme is connected to the stimulation of macrophages. They activate the immune cells, boost the release of interferon IFN-c, cytokines, interlukin 6, TNF and NO and expression of surface antigens (Zhang and Tizard, 1996). The activation of macrophages by this acemannan of AV is mainly due to presence of a β (1-4)-linked acetylated mannan which has mannose in it and can attach to the receptors of mannose in macrophages (Karaca et al., 1995). Suppression of immune system caused by UV rays and risk of skin cancer is possibly reduced by the extract of AV gel which has the ability to modulate DNA-damage activated signal transduction pathways (Strickland 2001).

The acemannan of AV causes the reinforcement of macrophage activity has been shown in chickens through various experiments (Djeraba and Quere, 2000; Karaca et al., 1995). Addition of AV gel to broiler diets (at 1.5%, 2%, and 2.5%) increased the antibody titter against Newcastle disease virus (NDV) on days 24 and 38 (Darabighane et al., 2012). Similarly, Valle-Paraso (2005) observed same effects against NDV on day 37 and 52 when broiler supplemented with 2% AV gel (mixed with drinking water). Alemi et al., (2012) reported increase in antibody titter against NDV by adding (0.5%, 0.75%, and 1%) AV gel powder in broiler feeds. Furthermore, Jiang et al., (2005) reported that the addition of the acemannan (0.1% and 0.05%), polysaccharide (0.1%), and AV gel (0.1%) in broiler feeds have showed a great enhancement in antibody titer. The reduction of losses and clinical signs of NDV infections have been reported by Waihenya et al., (2002) due to usage of Aloe secundiflora in broilers. Investigators have studied antibody titter against sheep red blood cells (SRBC) alongside the AV effects on antibody titter against NDV. For example, as compared to the control group, the broilers which have been treated with AV gel showed an increase in antibody titter against SRBC reported by Darabighane et al. (2012). As compared to control group it is reported that the oral administration of ethanol and aqueous extracts of AV pulp for three successive days to broilers at 300 mg/kg body weight/day have increased the titter of antibodies against SRBC (Akhtar et al., 2012). In addition, 35 day-old broilers treated with 0.5% and 1% mixture of AV leaf powder in feed and 15 and 30 ml/l addition of aqueous extract of AV in drinking water showed an increase in total immunoglobulin which have been reported in a study on antibody titter against SRBC (Besharati et al., 2012). Mahdavi et al. (2012) reported that addition of 0.75 and 1% AV gel in birds diet increased the antibody titter against SRBC as compared to control groups which supplemented with 0.5% AV. In addition, intermittent application of AV gel at 1% showed a great reinforcement in antibody titter (Shokraneh et al., 2012). As a result of adding AV gel to broiler feeds an increase in total white blood cell count of broilers have been reported

(Darabighane et al. 2011; Valle-Paraso et al., 2005). Valle-Paraso et al. (2005) reported that the calculation of blood parameters at day 37 and 52 of broilers that received 2% AV gel mixed with drinking water showed an increase in total count of WBCs and lymphocytes. Similarly, 1% AV gel powder group showed the highest haemoglobin, RBCs, and WBC count as compared to control group (Mahdavi et al., 2012). In addition, Sun et al., (2011) reported that the birds received the polysaccharides contained in AV had good immune response against *B. avium* inactivated vaccine. Akram et al., (2019b) reported that AV extract with PH 3 and 7 significantly ($P<0.05$) improved the serum antibody titers against IDBV (Infectious bursal disease and Newcastle disease vaccine respectively).

Effects of Aloe Vera on Coccidiosis

In poultry farming, coccidiosis is one of the commonest and priciest illnesses which lead to harmful influences on growth performance. Anticoccidial drugs are an outstanding method to switch coccidiosis off. Nevertheless, high dealing charges and sensitive confrontation beside these drugs have moved considerations in the direction of herbs for monitoring the disease. Among one of those herbal remedies, AV is a good choice. AV has antibacterial and anti-protozoal properties that highly help in controlling the diseases. Anti-coccidial drugs can cause resistance in the pathogens, which is a negative effect and is an alarming situation for the world. *Eimeria* is a species that infects broiler and AV proved to be an immunostimulant against it (Akhtar et al., 2011). These protozoal pathogens have their life cycle within the range of one and two weeks (Akram et al., 2019a). Humoral and cellular immune response was boosted by the use of AV in poultry diets. It was reported that obvious reduction in oocyte count of coccidia occurred due to increase in contacts of AV and *Aloe spicata* on reticence of avian coccidia oocysts sporulation (Mwale et al., 2006). Likewise, addition of AV powder in diet at the rate of 0.1%, 0.3%, and 0.5% reduced the faecal oocyte shedding as compared to control group (Yim et al., 2011). Furthermore, broilers which are orally presented with ethanol and aqueous extracts of AV pulp for 3 successive days at dose rate of 300 mg/kg body showed suggestively lower faecal oocyst shedding rate (Akhtar et al., 2012). Moreover, in contrast to the rheostat group and the group that fed with ethanol extract of AV pulp, the broilers that fed with aqueous extract of AV pulp had the lowermost mean mark injury in caeca and intestine. In addition, the broilers which received mix feed with 2.5% AV gel had the smallest faecal oocyst shedding (Darabighane et al., 2011). Anticoccidial actions of AV are attributable to stimulate the immune system because it definitely affects immune response. It increases weight gain and reduces number of faecal eggs caused by anticoccidial effects of AV in production of antibody against coccidiosis reported by Akhtar et al. (2012). Yim et al. (2011) stated that AV can provide more encouraging effect related to antibody reaction by cellular mediated reaction. Akram et al. (2019b) also reported that AV extract of PH3 decreased the faecal shedding of coccidial oocysts as compared to un-supplemented group.

Effects of Aloe Vera on Intestinal Microflora

It is important to create equilibrium and have stable amount of microflora in intestine. This can be resulted in the better growth performance and immune response of birds. An increased amount of *Lactobacilli* and decreased amount of *E.coli* was seen after using AV gel (1.5, 2, 2.5%) in the feeders of broilers (Darabighane et al., 2012). *Lactobacilli* compete infectious agent for nutrients and for gripping the intestinal area. *Lactobacilli* are favourable as after fermentation of acetic acid, lactic acid is formed that helps in inhibiting the growth of micro-organisms in gastro-intestinal tract. Broilers that were given 0.75% or 1% of AV gel with drinking water tend to have more *Lactobacilli* as compared to the control group fed with 0.5% of AV. *Lactobacilli* was remarkably increased when broilers were fed with diet carrying 4.5 mg flavophospholipol/kg of diet. AV gel when combined with acemannan and polysaccharide also had positive effect on the increased amount of *Lactobacilli* and *Bifidobacteria* as well as lessened the amount of *E.coli* (Jiang et al. (2005)). Furthermore all the herbal products and polysaccharide have AV extracts that help reducing *E.coli* and cause an increase in the amount of *Bifidobacteria* and *Lactobacillus* (Dai et al. (2007)). The mode of action of AV is not known that how it work upon intestinal microflora but still only the positive effect is only determined.

Conclusion

Aloe vera belongs to the Liliaceae family. It is a highly important compound used in broilers' feed as powder or gel form. Broilers were fed with different amounts of Aloe vera in variable forms after being mixed in water. Anti-oxidant, anti-stimulatory, anti-bacterial and anti-viral are some of the major properties of AV. Major components include arthroquinones, acemannan and polysaccharides. Aloe vera is effective against many diseases & helps to increase anti-body titter against coccidiosis, Newcastle disease and SRBC. It has positive effects on the immune system, intestinal microflora and overall growth of the organism. Being an herbal product and alternative to antibiotic growth promoters AV showed relatively better results on growth performance parameters, immune response and coccidiosis in broiler chicken.

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