Chapter 1

Introduction

Poultry industry has showed rapid growth and recognized as one of the fastest growing component of agriculture sector. This may happen due to increased consumption of eggs and meat to fulfill all essential nutrients such as critical dietary amino acids minerals and vitamins (Dhama et al., 2014a). Nutrient uptake takes place in gut of poultry so, it has been the area of intense studies for higher production (Rinttila & Apajalahti, 2013) .After skin, majority of environmental pathogens remain in the gastro-intestinal tract (Yegani & Korver, 2008). Thus, to ensure proper health and production as well as economics, it needs to maintain sound gut health for increasing digestion and absorption of nutrients. Since the 1950 s, antibiotics have been commonly used in poultry production process (Mathew *et al*. 2007). Antibiotics have used as sub-therapeutic doses to improve growth and feed conversion efficiency and to prevent infections about 60 years (Castanon, 2007). Dahiya et al., 2006 proposed that the net effect of using antibiotic in the poultry industry was a 3–5% increase in growth and feed conversion efficiency. But according to WHO (2012), the use of antibiotic leads to development of antimicrobial resistance which is significant to human health. Various researches focused that antimicrobial resistance might be related to such type of practice (M'ikanatha et al., 2010). However, in 2006, the European Union issued a ban on the approval for antibiotics as growth promoters (Castanon, 2007). For that reasons, using antibiotics may prove economically impractical because of market limitations and export restrictions (Dibner and Richards, 2005). Thus various researches have focused on novel alternate replacements to mitigate antibiotic use in poultry industry.In this review, we focused on current strategies that are being employed on improvement of broiler performance and provides a brief description of such alternatives with their efficacy and modes of action.

Materials and Methods

Different scientific articles were reviewed to collect the information in this report which was published in different peer reviewed journals, magazines and internet resources. All the researches were collected from different data bases, such as - PubMed, Scopus and Google Scholar.Various journals showed that several alternatives have beneficial effects in broiler such as probiotics, prebiotics, synbiotics, organic acids, phytobiotics, essential oils and antimicrobial peptides (AMP), etc. Probiotics are live microorganisms whereas, prebiotics are non-digestible food ingredients that enhance the role of beneficial organism in gut and synbiotics, a mixture of probiotics and prebiotics is the best option for their synergistic effect. Organic acids reduce the pH of gut which decrease pathogenic organism load and other alternatives also have such beneficial activities in broiler performance. In this report, author accumulated the beneficial effects of such alternatives as well as their limitation by reviewing several articles.

Results and Discussion

3.1. Alternate Sources of Antibiotic

Ideal alternatives are those which have little therapeutic use in human or veterinary medicine, no cross-resistance to other antibiotics, not be mutagenic or carcinogenic, non-toxic to the birds and its human handlers, and not be involved with transferable drug resistance. According to Huyghebaert (2011), ideal alternatives should have the same beneficial effects of antibiotic growth promotor (AGP), ensure optimum performance, increase nutrient availability and have a positive impact on feed conversion and/or growth. Various alternatives for broilers include probiotics, prebiotics, synbiotics, organic acids, phytobiotics, plant extracts (essential oils) and antimicrobial peptides (AMP), etc. (Dhama et al., 2014a)

3.2. Probiotics

Probiotics are defined as “mono or mixed cultures of live micro-organisms which when administered in adequate amounts, confer a health benefit to the host” (FAO/WHO, 2001). Lee et al. (2010c) termed probiotics as direct fed microbials which now described as potential alternatives to antibiotics. Probiotics contain one or more strains of microorganisms which may be supplemented either alone or in combination in feed or water (Thomke and Elwinger, 1998). In poultry, probiotics consists of a variety of bacteria (*Bacillus, Bifidobacterium, Enterococcus, Lactobacillus, Streptococcus,* and *Lactococcus* spp.) and in some cases yeast (*Saccharomyces* spp.) (Simon et al., 2001; Griggs and Jacob, 2005). The application of several probiotics such as single strain of *Lactobacillus* sp. (*L. casei, L. fermentum, L. bulgaricus, L. reuteri*) (Nakphaichit et al., 2011), multiple strains of Lactobacillus sp. (Mookiah et al., 2014), *Bacillus sp. (B. coagulans, B. subtilis, B. licheniformis, and B. amyloliquefaciens*)(Lee et al., 2011a; Liu et al., 2012; Park and Kim, 2014), *Enterococcus faecium* (Samli et al., 2007), Clostridium butyricum (Liao et al., 2015), *Rhodopseudomonas palustris* (Xu et al., 2014) significantly increased the daily weight gains with decreased feed conversion ratio (FCR) without apparent disease . Various probiotics influce broiler performance which are described by various authors (Table 1).

Table 1: Various probiotics with their effects in broiler

Authors	years	Probiotics(strain)	Effects on broiler
Gerendai and Gippert	1988	Streptococcus faecium M-74	increased body weight, improved feed conversion ratio, and decreased mortality of the treated chickens
Kim et al.	2002	mixed probiotics containing *L. acidophilus*, *B. subtilis* and *Saccharomyces cerevisiae*	improve production of broilers and indirect immunity
Wang and Gu	2010	probiotics	improve digestion and nutrient retention by increasing digestive enzyme activity and improving the breakdown of indigestible nutrients
Lee et al.	2011a	Bacillus subtilis based diet	enhanced the general immune function of broilers by increasing serum/plasma immunoglobulin levels, antibody titers to pathogens, and immune cell numbers
Kim et al.	2012	multi-microbe probiotic	increase in villus height and crypt depth
Zhang and Kim	2014	multistrain probiotics	increased numbers of beneficial bacteria such as Lactobacillus and Bifidobacterium spp.

Multi-microbe probiotic mixtures of different beneficial bacteria and/or yeast were shown to exhibit a growth-promoting effect (Torshizi et al., 2010; Kim et al., 2012; Alimohamadi et al., 2014; Zhang and Kim, 2014). Blajman et al. (2014) to investigated that application of probiotics via water was more efficacious than through feed and there were no differences between the use of mono- or multi-strain probiotics but the effects may vary with the type of strain used.

The two most important mechanisms of probiotics are balancing the gut microflora and immune regulation by creating a hostile environment for harmful bacteria (through production of lactic acid, SCFA, and reduction in pH) and production and secretion of antibacterial substances (e.g. bacteriocins by Lactobacillus, Bacillus spp) (Schneitz, 2005; Ng et al., 2009; Brown, 2011).They (Ng et al., 2009; Wang and Gu, 2010).Lee et al(2010a, 2011a) suggested that probiotics regulate intestinal immune responses as well as increase secretory IgA production against pathogens through activation of macrophages, increase cytokine production by intraepithelial lymphocytes . However, different strains exhibit different properties so during selecting the strains or their combinations care must be taken to achieve maximum beneficial effect in vivo. In total, probiotics can be said as potential alternatives to antibiotics for increasing poultry performance.

3.3. Prebiotics

Prebiotics are certain non-digestible feed ingredients that beneficially affect the host by selectively stimulating the growth and/or activity of one or a limited number of bacteria in the in the ileum and caecum so that the health of the gut can be improved (Gibson and Roberfroid, 1995; Patterson and Burkholder, 2003). According to (FAO, 2007), prebiotics are 'non-viable feed components that confer a health benefit on the host associated with modulation of the microbiota.' A variety of short chain non-starch polysaccharides (NSP) or oligosaccharides are considered as prebiotics, including mannan-oligosaccharide (MOS), (FOS), (IOS), inulin, oligofructose, galacto-oligosaccharide, malto-oligosaccharide, lactulose, lactitol, gluco-oligosaccharide, xylo-oligosaccharide, soya-oligosaccharide, and pyrodextrins (Patterson and Burkholder, 2003). Prebiotics are synthesized from plants or synthesized by microorganisms. MOS is found in the outer cell-wall layer of yeast (*Saccharomyces cerevisiae*) and FOS is synthesized from plants (some cereal crops and onions). A great scale of research trials have focused on the effects of supplemented prebiotics in broiler (Table 2).

Table 2: Beneficial effects of various prebiotics in broiler

Author	year	Name of the prebiotics	Beneficial effects
Xu et al.	2003	fructo-oligosaccharide (0.4%)	improved growth performance and intestinal microflora.
Mohamed et al.	2008	mannan-oligosaccharide	increased body weight gain and feed conversion efficiency increased intestinal villi height.
Jozefiak et al.	2008	Lactulose	improved body weight and FCR, and increased villi height, goblet cell numbers, total short-chain fatty acid (SCFA) like propionate, acetate and butyrate concentrations.
Janardhana et al.	2009	mannan-oligosaccharide	improved immune-competence in the intestine.
Kim et al.	2011	mannan-oligosaccharide	influenced intestinal microbiota.
Mookiah et al.	2014	isomalto-oligosaccharide	Improved body weight gain and FCR.
Cho and Kim	2014	Lactulose	Increased *Lactobacillus* counts.

Microflora ferments prebiotics that produces short chain fatty acids (SCFA) which act as energy sources for intestinal epithelial cells and thus maintain the integrity of the gut lining (Ferket et al., 2005).Particularly, MOS binds to type 1 fimbriae of enteric pathogens and prevents their adhesion to intestinal epithelial cells (Spring et al., 2000). Various other prebiotics such as lignin, inulin was found to be beneficial in poultry.

In contrast to the previous results, few papers reported that prebiotic supplementation had no effect on performance (Corrigan et al., 2011; Houshmand et al., 2012). However, holo- and meta-analysis of several research trials have confirmed prebiotics in feed as alternatives to antibiotics and increased feed efficiency in poultry (Hooge, 2004; Rosen, 2007; Hooge and Connolly, 2011). Hooge, (2004) reported that adding MOS to the diets significantly improved body weight by 1.61% and reduced FCR by 1.99%, respectively .It was shown that prebiotics improved body weight by 5.41%, decreased FCR by 2.54%, and reduced mortality by 10.5% (Hooge and Connolly, 2011). Before selecting prebiotics, some characteristics should be taken into consideration which includes resistance to gastric acidic environment, intestinal/pancreatic enzyme hydrolysis, and absorption across intestinal epithelium (Ricke, 2015). An ideal prebiotic has the ability to selectively enrich beneficial microorganisms associated with health and well-being (Patterson and Burkholder, 2003; Samantha et al., 2013). Thus, the beneficial effects of prebiotics are thought to be mediated predominantly through altering the intestinal microbiota and preventing pathogen colonization either by binding directly or by competitive exclusion by promoting the growth of beneficial microbes or by stimulating them to produce bacteriocins and lactic acid (Spring et al., 2000). Prebiotics mostly act by beneficially altering luminal or systemic aspects of the host immune system. MOS acts as adjuvants, recognized by receptors of the innate immune system and helps boost the host immune responses (Ferket et al., 2005). Another way of administration of MOS is the ingestion of in ovo prebiotics in the chicken embryo which can replace antibiotic supplementation in water after hatching and the doses of prebiotics used in ovo are 10 times lower than after hatching (Bednarczyk et al. 2016).

3.4. Synbiotics

Synbiotics are the combination of probiotics and prebiotics that act synergistically which used as feed additives (Collins and Gibson, 1999; Alloui et al., 2013). Synbiotics could improve the survival of the probiotic organism by selectively promoting the growth or metabolism of beneficial bacteria in the intestinal tract (Gibson and Roberfroid, 1995). Few research trials showed the effects of synbiotics on broiler which significantly improve body weight, average daily gain, feed efficiency, and carcass yield percentage compared with controls or probiotic-fed broilers (Awad et al., 2009). Mohnl et al. (2007) showed that synbiotics improved body weight by 2.04% and decreased mortality by 0.9%.A significant increase in weight gain and a decrease in the FCR was reported when birds were supplied feed with a combination of isomaltooligosaccharide(IOS)and probiotic mixture (11 strains of Lactobacillus spp). (Mookiah et al.,2014). Fallah et al.(2013) showed that symbiotic products improved immune status in broiler chicks. Synbiotics can lead to better absorption of glucose in poultry (Awad et al., 2008) and improve broiler performance as avilamycin (an antibiotic growth promoter) (Mohnl et al., 2007). Careful selection of the combinations of various prebiotics and probiotics as synbiotics in research trials should be conducted to demonstrate their synergistic effect compared with the use of either product alone such as a combination of yeast-derived carbohydrates and probiotics (Yitbarek et al., 2015) increased body weight gain and a combination of Fructooligosaccharides and competitive exclusion flora reduced *Salmonella* colonization (Bailey et al., 1991) compared with controls. Synbiotics beneficially altered the intestinal microbial composition and increased villi height and crypt depth in the intestinal mucosa (Sohail et al., 2012). According to (Liong and Shah, 2006) an investigation, synbiotics in broiler diet regulates the concentration of the organic acids and reduce cholesterol levels. Thus, synbiotics may be used as antibiotic alternatives for improving performance and reducing pathogenic load in the intestines of poultry.

3.5. Organic acids

Organic acids are simple monocarboxylic acids (e.g., formic, acetic, propionic, and butyric acids) and /or carboxylic acids bearing hydroxyl group (e.g., lactic, malic, tartaric, and citric acids) (Dibner and Buttin, 2002), which have antibacterial nature by diffusing through lipophilic bacterial membrane and disrupt enzymatic reactions and transport system (Cherrington et al., 1991) used in the broiler feed or drinking water either individually as organic acids or their salts (sodium, potassium, or calcium) or as blends of multiple acids or their salts (Huyghebaert et al., 2011).

Table3: Beneficial effects of several Organic acids in poultry

Authors	year	Name of the organic acid	Beneficial effects
Hu and Guo	2007	Sodium Butyrate	increased body weight gain in chickens during the period from 0 to 21 days and decreased feed conversion ratio during the period from 0 to 42 days.
Nava et al.	2009	Formic and propionic acid blend (0.0525% in drinking water)	generated more homogeneous populations in the intestinal microbiota and increased the colonization of Lactobacillus spp. in ileum of chicken

Adil et al.	2010	Butyric acid	improved the digestibility poorly digestible protein sources
Samanta et al.	2010	Various organic acid blends	improved the FCR in broiler chickens
Zha and Cohen	2014	Propionic acid	inhibited mold and feed mycotoxin and reduced *Salmonella* Gallinarum count of crop and caecal contents
Banday et al.	2015	Fumaric acid	improved weight gain and feed efficiency
Mohammadagheri et al.	2016	Citric acid (2%)	improved epithelial cell proliferation and villi height of gastrointestinal tract

These researches (Table3) have shown that the beneficial effects of organic acids blend are more than a single acid. Several possible mechanism of action of organic acids in poultry production include reducing the pH of the poultry feed and upper gastrointestinal tract (crop, proventriculus, gizzard) (Samanta et al., 2008) , altering the gut microflora by reducing the numbers of pathogenic bacteria, increasing acid-tolerant beneficial species such as Lactobacilllus spp. (Nava et al. 2009), improved nutrient utilization in diets by increasing nutrient retention ,improving mineral absorption and phosphorous utilization(Nezhad et al., 2011) and reducing the contamination of litter with pathogens and diminish the risk of re-infection. Organic acids in drinking water give a protective efficacy against Campylobacter infection (Chaveerach et al., 2004) as well as E. coli infection (Izat et al., 1990) in young chicks. In spite of the demonstrated beneficial effects, further researches are needed to elucidate their mechanism of action of dietary organic acids and their effects on growth performance of broiler chickens by various combinations of acids and their concentration in feed or drinking water.

3.6. Phytobiotics

Phytobiotics also referred as phytogenics or Phytochemicals or botanicals which are plant derived compounds containing natural bioactive compounds that incorporated into animal feed to enhance productivity (Windisch et al., 2008). A wide variety of herbs(leaves and flowers) and spices (seeds, fruits, bark or root) such as thyme, garlic, ginger, green tea, black cumin, coriander ,oregano, rosemary, marjoram, yarrow and cinnamon have been used in poultry in solid, dried, and ground form or as extracts (crude or concentrated)as antibiotic alternatives (Van Der Klis and Vinyeta-Punti, 2014). Over the years, more than 80, 000 active ingredients have been identified like phenols, flavonoids, tannins, saponins, essential oils, etc. Though initially, they were neglected as waste, anti-nutritional but, now-a-days they are considered globally as an antioxidants, digestive enhancer and health promoting substances (Narimani-Rad et al., 2011). Murali et al.(2012) observed that they have anti-microbial activity across different groups of both gram positive and gram negative organisms by alteration in membrane permeability to hydrogen ions (H+).They also show anti-fungal action as these compounds are now being incorporated into cost effective as well as environmental friendly fungicide preparations (Afzal et al., 2010), anti-coccidial activity against chicken coccidian (*Eimeria* spp.)(Khalafallah et al., 2011) and antioxidant activity as these compounds are being used during stress periods (heat stress) (Wei & Shibamoto, 2007). Significantly increased body weight and improved feed efficiency were observed in broilers after supplemented with a mixture of 14 herbs (Guo et al., 2004), black cumin seeds (Khalaji et al., 2011) and dried andground Scrophularia striata and Ferulago angulata(Rostami et al., 2015) . Several research trials (El-Abasy et al., 2002, Zhao et al., 2013b) showed a significant increase in body weight gain and a lower FCR .They were found to improve the overall digestibility of the feed and feed efficiency by increasing the secretion of digestive enzymes mainly trypsin, amylase and bile from the pancreas and liver respectively (Gopi et al., 2014a) as well as increases the nutrient absorption capacity through increase in the intestinal villi length and crypt depth. They reduces the cholesterol synthesis in the liver by inhibiting the activity of hepatic 3–hydroxy–3–methylglutaryl coenzyme A (HMG–CoA) (Lee et al., 2004) which could be utilized for production of low cholesterol meat and eggs (Mohamed et al., 2012).Another active ingredient essential oils are volatile compounds include thymol, eugenol, saponins, flavonoids, carvacrol, terpenes and their precursors which exhibit antimicrobial activity against bacteria, yeast and molds (Oyen & Dung, 1999). Essential oils are derived from bulbs of onion and garlic, seeds of parsley, fruits, rhizomes, leaves of basil and tea plant, clove buds and other plant parts (Nychas & Skandamis, 2003). Antimicrobial property of thymol and carvacrol widely studied against range of bacteria such as *L. monocytogenes, S.* Typhimurium, and *Vibrio parahaemolyticus* (Tassou et al, 1995; Dhama et al., 2015a).Several research trials showed that turmeric powder enhances the circulatory anti-oxidant defence and in turn immune system (Madpouly et al., 2011), garlic (3%) as feed additive enhance growth and performance of broiler chicks (Elagib et al., 2013)and increases phagocytic activity, production of interferon, interleukin and tumor necrosis factor α (Hanieh et al., 2010),cinnamon oil(cinnamic aldehyde) exhibit antimicrobial action against a broad spectrum of bacteria such as *L. monocytogenes*, *C. jejuni*, and *S.* Enteritidis and clove essential oil (eugenol) exerts antimicrobials and antifungal activities (Smith-Palmer et al, 1998).Essential oils from oregano (Hashemipour et al., 2014), star anise (Kim et al., 2016a), coriander(Ghazanfari et al., 2015), blend of thymol and cinnamaldehyde (Amerah et al., 2011), blends of clove and cinnamaldehyde(Chalghoumi et al., 2013), different essential oils (lemon, basil, oregano, tea, etc.) (Khattak et al., 2014) were shown to improve body weight gain in broilers. A commercial blend of phytonutrients (containing carvacrol, cinnamaldehyde, and capsicum oleoresin) was approved in the EU as the first botanical feed additive which increased body weight gain and decreased FCR and mortality in broilers (Bravo and Ionescu, 2008 ,Pirgozliev et al., 2015).Dandelion (Taraxacum officinale), mustard (Brassica juncea), and safflower (Carthamus tinctorius) extracts exert antitumoral activity when used in vitro avian lymphocytes and macrophages (Lee et al., 2007, Lillehoj et al., 2011).Lee et al. (2010a) and Lee et al. (2010b) tested organic phase extracts from milk thistle (Silybum marianum), turmeric (Curcuma longa), reishi mushroom (Ganoderma lucidum), and shiitake mushroom (Lentinus edodes) for their effects on chicken innate immunity and tumor cell cytotoxicity and found that they increased the levels of gene transcripts for IL-1β, IL-6, IL-12, IL-18, and TNFSF15.Supplementation of turmeric (active principle curcumin) increases in pancreatic enzymes (trypsin, chymotrypsin, amylase and lipase) activity (Khan et al., 2012b)and ginger increases secretion of enzymes like enterokinases and other enzymes (Zhao et al., 2011)which improves the digestion and metabolism of feed(Al-Kassie et al., 2011)and possess antioxidant properties thereby reducing the free radicals produced in the cells. Herbal products of Neem, Ashwagandha, Guduchi, Noni etc. possess immunomodulatory properties (Latheef et al., 2013a; Latheef et al., 2013b; Tiwari et al., 2014a; Tiwari et al., 2014b) and herbal products of cinnamon, nishyinda and black pepper have growth promoting effects without exhibiting side effects in broilers (Chowdhury et al., 2009; Mode et al., 2009; Molla et al., 2012; Saminathan et al., 2013). Nakielski (2015) observed that eucalyptus oil (cineol and eucalyptol) relaxes air sacs with appropriate ventilation during respiratory tract infections of bird. Lillehoj et al.(2011) showed that Capsicum oleoresin stimulate a great number of gene expression associated with immunology, physiology , metabolism and immunity compared with unsupplemented controls .Cinnamon (cinnamaldehyde) stimulate chicken spleen lymphocytes in vitro (Lee et al., 2011b) with the functions of antigen presentation, humoral immunity, and inflammatory disease.

3.7.Antimicrobial peptides

Antimicrobial peptides **are** small host defense peptides present in all kingdoms of life containing 12– 100 amino acids that possess immunomodulatory and antimicrobial activity against a wide range of pathogens such as Gram-negative and Gram-positive bacteria(by targeting cell membrane), fungi, enveloped viruses, and parasites (Li et al., 2012; Kim et al., 2016b). These peptides interact with negatively charged membranes of microbials by their hydrophobic cationic residues and amphipathic structure (Wang et al., 2014).Various publications focused on their protective potential against diverse infectious pathogens rather than growth promoting activities in poultry (Fosgerau and Hoffmann, 2015). However, naturally synthesized peptides improve growth performance, absorption of nutrients and immunity by increasing intraepithelial lymphocytes or mast cell counts, and in secretory IgA levels (Liu et al.,2008).Liu-Fa & Jian-Guo (2012) identified antimicrobial peptides like colicin and cecropin, cecropin A (1-11)-D (12-37)-Asn (CADN) as growth promoter in poultry. Wen and He (2012) demonstrated that cecropin A (1-11)-D (12-37)-Asn (CADN) increased weight gain, feed intake, and intestinal villus height and decreased both jejunal and cecal aerobic bacterial counts. Harwig et al. (1994) showed that *L. monocytogenes*, *E. coli* and *Candida albicans* were inhibited by peptides isolated from chicken leukocytes.

Bacteriocins, the non-toxic ribosomally synthesized peptides secreted by various bacteria on their cell surface have antibacterial activity against closely related bacteria which initially were used as food preservatives and were believed to be produced only by specific bacterial strains (Cleveland et al., 2001) but now believed to exist in all species of bacteria and archaea (Willey and van der Donk, 2007). Bacteriocins possess a relatively narrow spectrum of antimicrobial activity compared with non-bacterial originated peptides. Svetoch & Stern (2010) observed bacteriocins effectively reduce the campylobacter colonization in poultry. Several research trials showed beneficial effects of various bacteriocins when supplemented with poultry feed (Table 4).

Table 4: Beneficial effects of various bacteriocins in poultry

Authors	Year	Bacteriocin	Bacteria	Beneficial Effects
Wooley et al.	1999	Microcin 24	Avian *Escherichia coli*	Lowered intestinal *Salmonella typhimurium* counts in chickens.
Wang et al.	2011	Albusin B	*Ruminococcus albus* 7	improved growth performance, increased intestinal absorption and Lactobacillus counts, modulated lipid metabolism, and activated systemic antioxidant defense
Józefiak et al.	2010, 2011a, 2011b, 2012	Divercin AS7	*Carnobacterium divergens* AS7	Increased digestibility and modulatory effect on intestinal microbiota.
Józefiak et al.	2013	Nisin	*Lactococcus lactis*	showed modulatory effect on the microbes of the gastrointestinal tract

Among them, FDA approves only Nisin as a food additive of poultry. In conclusion, antimicrobial peptides have considered as alternative of antibiotic though it has a number of obstacles like high production cost, resistance development.

Chapter 4

Conclusion

Since several decades, antibiotics have used in poultry industry as therapeutic agents and growth promoter but over usage has led antibiotic resistance and residues in the food and environment which can lead to public health problems. To eliminate the use of antibiotics as growth promoters, many researchers have focused on the search of potential alternatives to antibiotics such as probiotics, prebiotics, synbiotics, organic acid and plant extracts(herbal drugs)etc. which showed many potential benefits including improvement in digestion and absorption of feed ,body weight gain, decreased in FCR, immunomodulation, improvement in gut health through exclusion and inhibition of pathogens in intestinal tract, reduction n of mortality rate and improvement in safety of poultry products for human consumption. The beneficial effects of many alternatives have been well demonstrated but due to lack of consistency results vary greatly from farm to farm. Additional studies are still needed for understanding their mechanism of action, their effects on poultry health and exploring various combinations of these alternatives with specific target to enhance the production. Combinations of these alternatives may prove more beneficial than single use to achieve an effect similar to that of antibiotics. To achieve the ultimate goal of reducing antibiotic use in the poultry industry, proper combinations of various alternatives coupled with good management and husbandry practices will be used for optimum productivity in ‘Antibiotics free’ flocks.

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Biography

I am Avi Das, son of Mr. Madhusudan Das and Mrs. Bijali Das. I passed my Secondary School Certificate (SSC) from Poroikora Noyontara High School, Anwara, Chattogram in 2012 and Higher Secondary Certificate (HSC) from Anwara Govt. College, Anwara, Chattogram in 2014 from Chattogram board, Bangladesh. I enrolled for Doctor of Veterinary Medicine (DVM) degree in Chattogram Veterinary and Animal Sciences University (CVASU), Khulshi, Chattogram in 2014-2015 sessions. Now I am doing my internship program which is obligatory for awarding my degree Doctor of Veterinary Medicine (DVM), from Chattogram Veterinary and Animal Sciences University (CVASU). This study was the inauguration of me in the era of research and I have a strong intention to involve myself in these types of activities in future. I want to be a researcher as well as a veterinary practitioner in future.