Growth Promoters as Feed Additives in Poultry Production

Abolade Opeyemi Joshua
Department Of Animal Science, University Of Ibadan, Oyo State, Nigeria
EMAIL: joshuaabolade19@gmail.com

ABSTRACT

The use of feed additives also in poultry production has been beneficial to poultry industry as they help in yield improvement; this has made most farmers to abuse the correct use of it, this has initiate the need for this study, the demand for poultry and poultry products is increasing daily and this has called for need to improve and increase production through the use of feed additives in which we have the growth promoters and this can otherwise be called genetic engineering, in this study different types of growth promoters are examined such as antibiotics, enzymes, hormones, implants and beta antagonists and also there effect on the consumers, some antibiotics such as bacitracin, virginiamycin and avoparcin, control Clostridium perfringens infections, which are potentially fatal, in addition to improving feed conversion efficiency in poultry. Moreover, Rogers et al. (1997) in his investigation to discover the long term effects of monensin therapy concluded that there is no real adaptation of rumen microbes after a period of 96-146 days of monensin treatment and that most effects disappear within a few hours following monensin withdrawal. The use of pristinamycin and quinupristin as growth promoters has been banned according to Butaye et al 2000 because they are also used in human medicine and so there are fears that its continued use may compromise human therapy. Different types of enzymes have been used as growth promoters they work in breaking down food into smaller particles for better absorption. Hormones are produced in the body of the animal but they are also added to feed as growth promoters as it helps the animal to gain weight faster, furthermore, implants and beta antagonists are products containing natural and synthetic hormones and they affect the hormone status of the animal also to promote growth.

Keywords: Feed Additives, Growth promoters, Antibiotics, Enzymes, Hormones, implants and Beta Antagonists

INTRODUCTION

Feed additives are defined as feed ingredients of a nonnutritive nature that Stimulate growth or other types of performance. Improve the efficiency of feed utilization are beneficial in some manner to health or metabolism of the animal (Jensen, 1998). Animal products are routinely tested to ensure that feed additives are being used correctly. Use of feed additives has been beneficial to livestock producers under our modern methods of production. Development of intense systems of management and concentration of animals has been made possible only because additives could be used to help control various diseases and/or parasites in Broilers,
laying hens, growing-finishing pigs, fattening cattle and sheep and thereby growth is improved.

The various ways in which human food is produced are intensively discussed and questioned in modern societies; we all expect food from plants, farm animals and microorganisms to be inexpensive, healthy and of good quality. Because the costs of environmental care are becoming highly significant, consumers, and the food industry are increasingly concerned about environmental matters and low energy inputs. In addition, arguments come primarily from biological farming organizations and consumers organizations on the quality of the food we eat. In general, all of us expect our food to be as natural as possible and free of any toxic or undesired substances. In highly developed countries we do not always feel the impact of the steady growth of world population. In twenty five years from now there will be almost 9 billion inhabitants (FAOSTAT, 1998) on earth who expect to get enough food to meet their nutritional needs. Today, more than 800 million people suffer from hunger. The goal to produce sufficient food for everybody can only be achieved if the world food production increases by about 2% per year. Furthermore, the actual world cereal reserves can supply current needs for less than two months, which is the lowest reserve of the last 20 years (FAO, 1996). It is expected that world animal production will follow this trend. According to Han (1998) world production will grow 1.8 and 2.0% for pigs and chicken respectively in the next 20 years. For beef production a slight reduction of 0.4% is expected mainly in developed countries. In many parts of the world environmental pollution, available water resources, soil structure and energy availability are the primary limiting factor for increasing agricultural production. Therefore, world food production must grow without increasing the environmental pollution, available water resources, soil structure and energy availability are the primary limiting factors for increasing agricultural production. Therefore, world food production must grow without increasing the environmental waste load. This precondition demands the efferent use of all available resources of traditional and modern technologies. There is no doubt that today’s worldwide agriculture must be increased however, the consumers in highly developed countries make higher and higher demands on quality and idealistic images of food that focus attention on issues other than yield. The use of new technologies such as genetic engineering in food and animal feed production are questioned. Even synthetic amino acids, vitamins or other feed additives and growth promoters produced by modern technologies are banned in certain production systems. A general ban of antibiotic as feed additives in animal nutrition is realized since 1986 in Sweden and is generally discussed In Europe because of the increased occurrence of pathogens resistant against therapeutically antibiotics used in animals and humans. This effect is somehow brought in connection with the use of antibiotic feed additives as growth promoters in farm animals. Despite
the report of the SCAN (1996) showing no evidence that the use of avoparin has led to increased resistance against vancomycin (an antibiotic used in human medicine), avoparin was banned as growth promoter in the European Union in April 1997. After an intensive discussion of these decisions, Switzerland banned all antimicrobials feed additives as growth and performance promoter in 1999.

CONCEPT OF GROWTH PROMOTERS

Growth promoters are drugs that are used to improve an animal’s ability to efficiently use nutrients and produce more affordable meat. The meat industry uses certain growth promotants to help provide consumers with a wholesome, affordable and increasingly healthful meat supply, the use of growth promotants is backed by an overwhelming body of scientific evidence proving its safety and effectiveness. Small amounts of growth promotants enhance animal growth by increasing the efficiency with which feed is converted to muscle. An animal given growth enhancers gains weight more rapidly and produces a leaner product. By reaching market weight sooner, the cost of meat production goes down; which can mean lower prices to consumers. The use of growth promotants in meat production has several benefits throughout the supply chain. Consumers want leaner meat and they want it at a price they can afford. Growth promotants are one tool that helps meat producers satisfy that demand by helping animals make the most of the nutrients found in the food they eat and convert it to more lean muscle. These sustainable technologies allow producers to reduce the natural resources needed to produce meat. For example, since 1977 U.S. cattle farmers are producing 31 percent more beef with fewer animals, feed, water and land. This increased efficiency has significant environmental benefits and reduces prices for consumers as well.

REGULATORY CONTROL OF GROWTH PROMOTERS

The safety of growth promoting products used in meat production is assured through several layers of requirements that are enforced by multiple government agencies. First, growth promotants are subject to a comprehensive, multi-step scientific review process conducted by scientists at the Food and Drug Administration’s Center for Veterinary Medicine (CVM) to ensure animal health and human food safety. More than 500 different studies have been conducted on growth promoting products and submitted as part of this stringent approval process. If approved, these products are then re-evaluated by FDA annually and only remain in the marketplace if they are continually proven safe. In addition, meat packing and processing plants are required to address any potential chemical concerns, such as growth promotant residues, as part of their facility’s government-mandated Hazard Analysis and Critical Control Point plan. Under the Federal Meat Inspection Act, the U.S. Department of Agriculture’s Food Safety and Inspection Service (FSIS) tests for residues of growth promoting products at
harvest that exceed FDA-established safe levels. FSIS has conducted testing since 1967 and in 2011, the most current year data, reported zero residue violations for growth promotants in cattle and pigs.

THE CHARACTERISTICS REQUIRED FOR A GROWTH PROMOTER

The characteristics include:

1. They must not be absorbed from the intestines or found in the edible tissues.
2. They must be non-toxic to both animals and people.
3. Performance must be improved with economic benefit.
4. There must be no adverse effects in relation to other antibiotics.
5. They must have no therapeutic value in human medicine.
6. They must not alter the normal bacteria in the gut, or allow one organism to predominate over another, for example salmonella.
7. They must not pollute the environment and must be quickly biodegradable.
8. They must not increase medicine resistance or be involved in the transfer of medicine resistance between one bacterial species and another.

TYPES OF GROWTH PROMOTERS

1. Antibiotic growth promoter
2. Enzymes as growth promoter
3. Implants and beta agonists as growth promoters
4. Hormone growth promoter

MEAT QUALITY

Meat quality of animals fed with growth promoter should be tested to see if it affect the appearance of meat, if the meat have a different appearance to the normal, post mortem examination should be carried out to detect the reason for the change in quality or appearance which may be due to overdose or the fact that the usage of the growth promoter is not stopped at the due time. Meat quality is defined by the compositional quality and palatability factors such as visual appearance, smell, firmness, juiciness, tenderness and flavor.

VISUAL APPEARANCE

The visual identification of quality meat is based on colour, marbling and water holding capacity. Marbling is small streaks of fat that are found within the muscle and can be seen in the meat cut. Marbling has a beneficial effect on juiciness and flavour of meat. Meat should have a normal colour that is uniform throughout the entire cut. Beef, lamb, and pork should also have marbling throughout the meat.

SMELL

Another quality factor is smell. The product should have a normal smell. This will be different for each of the species (i.e. beef, pork, chicken), but should vary only slightly within the species. Any rancid or strange smelling meat should be avoided.

FIRMNESS
Meat should appear firm rather than soft. When handling the retail package, it should be firm, but not tough. It should give under pressure, but not actually be soft.

**JUICINESS**

Juiciness depends on the amount of water retained in a cooked meat product. Juiciness increases flavour, helps soften meat - making it easier to chew, and stimulates saliva production in the mouth. Water retention and lipid content determine juiciness. Marbling and fat around edges helps hold in water. Water losses are from evaporation and drip losses. Meat aging can increase water retention and therefore increases juiciness.

**TENDERNESS**

Tenderness has been linked to several factors, such as the animal's age, sex or the muscle location. One important way to tenderize meat is by aging. Carcasses are aged by holding them at refrigeration temperatures for extended periods of time after slaughter and initial chilling.

**FLAVOR**

Flavor and aroma are intertwined to create the sensation the consumer has during eating. These perceptions rely on the smell through the nose and on the sensations of salty, sweet, sour and bitter on the tongue. Meat flavor is affected by type of species, diet, cooking method and method of preservation (e.g. smoked or cured).

**RIBEYE AREA**

Rib-eye is cut from the roast that sits at the top of the rib primal. The rib-eye is a boneless cut. When the bone is attached it is called the rib steak. The area of the ribeye is determined by measuring the size (in inches, using a dot-grid) of the ribeye muscle at the 12th rib.

**CURRENT USE OF ANTIBIOTICS AS GROWTH PROMOTERS**

The use of antibiotics as animal growth promoters differs dramatically in the world. Sweden now makes no use of antibiotics for growth promotion purposes; the USA uses a wide range of antibiotics, including some considered to be "medically important". The following information is taken from the Report of the Joint Expert Advisory Committee on Antibiotic Resistance (JETACAR, 1999) on the use of antibiotics in food producing animals. Pigs are exposed to the greatest range of growth promoters. In the USA, for example, pigs are exposed to _lactam antibiotics, including penicillins, lincosamides and macrolides, including erythromycin and tetracyclines. All these groups have members that are used to treat infections in humans. Pigs in the USA are exposed to a range of other compounds intended for growth promotion. These include bacitracin, flavophospholipol, pleuromutilins, quinoxalines, virginiamycin and arsenical compounds. In the USA, compounds used as growth promoters for cattle include flavophospholipol and...
virginiamycin, both also used as growth promoters in poultry. Cattle are also exposed to ionophores such as monensin to promote growth. Poultry are given arsenical compounds. The Animal Health Institute of America (AHI, 1998) has estimated that, without the use of growth promoting antibiotics, the USA would require an additional 452 million chickens, 23 million more cattle and 12 million more pigs to reach the levels of production attained by the current practices.

In Australia a range of growth promoters are employed. Pig farmers use arsenical compounds, flavophospholipol, the macrolides kitasamycin and tylosin, the quinolxaline olaquindox, and also virginiamycin, a streptogramin. Poultry producers use arsenical compounds, flavophospholipol, bacitracin and virginiamycin. Australian cattle farmers employ a range of ionophores, namely lasalocid, monensin, narasin and salinomycin. They also employ flavophospholipol and the macrolide olaquindox. The glycopeptide avoparcin is still used in pig and poultry farming and in rearing cattle in Australia.

The use of growth promoters in the European Community is more limited. The oligosaccharide avilamycin is used in pig and poultry farming, ionophores, namely monensin and salinomycin are used for cattle and pigs and flavophospholipol is used with a range of livestock, including cattle, pigs, poultry and rabbits. In pig production, feed conversion efficiency is improved, along with daily growth rates, by approximately 2.5 per cent. Mortality rates, associated with scouring and proliferative enteritis, are 10-15 per cent lower than in countries, such as Sweden, who do not use antimicrobial growth promoters. In poultry, growth promoters, such as bacitracin, virginiamycin and avoparcin, control Clostridium perfringens infections, which are potentially fatal, in addition to improving feed conversion efficiency. It is estimated that this translated into an improvement of 1.5 per cent, with added economic benefits from the reduction of C. perfringens infections (JETACAR, 1999). The cattle industry in the USA is, perhaps, the most dependent on growth promoters as cattle have energy requirements that are high and that cannot be met easily without the use of growth promoters. High energy rations increase muscle growth and fat deposition in beef cattle, and help to improve milk productivity in dairy cattle. Unfortunately, the use of such rations is associated with side-effects, such as bloat and lactic acidosis, which can be debilitating or even fatal. These conditions are not a problem in Europe, where cattle diets contain more forage.

In poultry, growth promoters, such as bacitracin, virginiamycin and avoparcin, control Clostridium perfringens infections, which are potentially fatal, in addition to improving feed conversion efficiency. It does not belong to a class of medically important antibiotics and is not associated with any major resistance problems. In an investigation to discover the long-term effects of monensin therapy, Rogers et al. (1997) concluded that there is no real adaptation of rumen microbes after a period
of 96-146 days of monensin treatment and that most effects disappear within a few hours following monensin withdrawal. In this sense, monensin is probably one of the safest and most effective antibiotic growth-promoters with regard to human and animal health and associated bacterial resistance problems. Virginiamycin is used for similar purposes, such as the prevention of acid lactosis in cattle and poultry, but use of this compound has led to the selection of bacteria that are resistant to its effects. It is related to pristinamycin and quinupristin, both of which are used in human medicine and so there are fears that its continued use may compromise human therapy. Its use as a growth promoter has now been banned in the EU (Butaye et al., 2000).

CONSUMER’S HEALTH AND THE CONSEQUENCES OF USING ANTIBIOTIC GROWTH PROMOTERS

Human health can either be affected directly through residues of an antibiotic in meat, which may cause side-effects, or indirectly, through the selection of antibiotic resistance determinants that may spread to a human pathogen. A drug that illustrates both potential problems is chloramphenicol. Gassner & Wuethrich (1994) have demonstrated the presence of chloramphenicol metabolites in meat products and have concluded that a link with the presence of these antibiotic residues in meat and the occurrence of aplastic anaemia in humans cannot be ruled out. Banned for growth promotion use in America over a decade ago and in the Europe since 1994, chloramphenicol remains a drug used in treating typhoid fever. Over-use in animal husbandry is believed to have led to an increase in resistance to the drug in bacteria of the genus Salmonella, including Salmonella typhi, the causative bacterium of typhoid. It should be noted that the link between the use of antibiotic growth-promoters and increasing resistance remains unproven and that typhoid rates of infection and cure have not changed significantly since the introduction of the ban in 1994. There were 153 cases of typhoid fever in England and Wales in 1999, compared with 227 in 1994 and 132 in 1991 (Public Health Laboratory Service, On-Line). An alternative explanation for the increase in resistance to chloramphenicol is its availability as an over-the-counter drug in developing nations. It is cheap and relatively easy to produce. In general, the effect of antibiotic residues in meat is insignificant when compared with the issue of selection and amplification of antibiotic resistant strains of bacteria. Antibiotic resistance determinants selected in this manner may have various routes by which they may compromise the therapeutic use of antibiotics. Selection may occur in microbes that are pathogenic for humans. Alternatively, resistance may be selected in zoonotic bacteria that subsequently cause human disease. On another level, the resistance determinant may be selected in a bacterium that is a member of the commensal flora of the animal being fed a growth promoter. If such a resistance determinant is mobilisable, it may subsequently transfer to human or animal pathogens. The consequences of selection of
Resistance can range from prolonged illness and side effects, due to the use of alternative, and possibly more toxic, drugs, to death, following complete treatment failure. Modern medicine has furnished us with a wealth of antibiotics but, as the MRSA example discussed above illustrated, alternatives are starting to run out. The four types of bacteria most commonly associated with resistance due to use are Salmonella, Campylobacter, Escherichia coli and the enterococci; these bacteria are likely to be transmitted frequently from animals to humans.

**EFFECT OF ANTIBIOTIC GROWTH PROMOTER ON MEAT QUALITY**

Animals fed antibiotic have daily growth rate, inappropriate withdrawal period of antibiotics or administration of overdose of the drug to the animal greatly affect the meat quality, there will be residue in meat which causes shrinkage and toughening of the meat when cooked with less fat and increased protein content, and the organoleptic properties of the meat will be affected.

**ENZYMES AS GROWTH PROMOTER**

Enzymes are biological catalysts, which brings about biochemical reactions without themselves undergoing any change. Enzymes are protein in nature and composed of amino acid arranged in a sequence. Enzyme activity is dependent on the substrate in a random manner or at a very specific site on the substrate. Enzymes are not living organism but they are the products of living organism such as bacteria, yeast, fungi and plant tissue.

Commercial enzymes used as feed supplements do not contain a single enzyme but rather they are preparations of a variety of enzymes. A large numbers of multienzyme preparations have been launched by different commercial organizations. Some of the most common preparations available in the market are Novozyme Sp-243 containing beta glucanase, cellulose, pectinase and amylase; Selfeed containing protease, amylase, cellulase, lipase and pectinase; Nutrizyme containing cellulase, B-glucosidase, hemicelluloses, pectinase, protease and amylase. Poultry do not produce enzymes like cellulase, hemicelluloses and B-glucanase which are required for the digestion of cell wall component of plant material. About 85-90% of poultry feed consists of plant materials which contain large amount of dietary fibers. The most promising results with enzymes are in diets with wheat or barley as the main grain, because they both have non-starch polysaccharides (NSP) in the cell walls and the anti-nutritional activity can to some extent be eliminated by enzymes. The beneficial effect of enzymes in barley, oat, wheat and rye in diets is based on the hydrolysis of the viscous non-starch polysaccharides. By carefully selecting the enzyme from the wide range of enzymes commercially available, improvement in the performance can be obtained in the poultry. An increased use of feed enzymes is expected not only from the aspect of economic gain but also from the environmental point of view as enzymes enhances nutrient utilization, thereby...
reducing the manure output and reducing nutrient excretion particularly excess phosphorus, nitrogen, copper and zinc. Enzymes are routinely added to animal feeds and work by helping to break down certain components of the feed, such as; glucans, proteins and phytates, that the animal may have problems digesting. They are produced as fermentation products from fungi and bacteria and seem to only have a positive effect on the animal. Some ethicists, however, have argued that adding enzymes to animals merely shows that we think of them as "factory beasts". Apart from ethical objections, in-feed enzymes are very effective at maximizing feed conversion efficiency and have few drawbacks. As a result, current research is focused on improving the quality of existing enzymes; whilst broadening the range of feed ingredients that they may be used to digest. The Scientific Committee for Animal Nutrition (2001) concluded that conditions of use evaluated so far are acceptable as regards to consumers, users and animals.

**EFFECT OF ENZYMES AS GROWTH PROMOTER ON MEAT QUALITY**

Enzymes as growth promoter have positive effect on meat quality, addition of enzyme to animal feed makes the nutrient readily available for the animal and thereby the organoleptic properties of the meat are not compromised.

**IMPLANTS AND BETA AGONISTS AS GROWTH PROMOTERS**

Growth promoters, such as implants and beta agonists, are available for use in cattle. Implants have been available for cattle producers since 1975, but beta agonists for beef cattle became commercially available in 2004. Implants are products containing natural and synthetic hormones and affect the hormone status of the animal to promote growth. Implants are placed in the ear of the cattle and require no withdrawal time prior to slaughter. Beta agonists are compounds where the effects occur at the cellular level and do not affect the hormone status of the animal (not a steroid). Additionally, beta agonists are medicated feed additives and withdrawal times can vary among

**EFFECT OF IMPLANTS AND BETA AGONISTS ON MEAT QUALITY**

Intramuscular fat, marbling and juiciness are reduced as this growth promoter’s work on shuffling muscle instead of fat. These growth promoters primarily change partitioning of energy from feed and shuttle more to muscle instead of fat deposition, thereby increasing weight gain, and total red meat yield when used

**HORMONE AS GROWTH PROMOTER**

Hormones are chemicals that are produced naturally in the bodies of all animals, including humans. They are chemical messages released into the blood by hormone-producing organs that travel to and affect different parts of the body. Hormones may be produced in small amounts, but they control important body functions such as growth, development and reproduction. Certain hormones can make young animals
gain weight faster. They help reduce the waiting time and the amount of feed eaten by an animal before slaughter in meat industries. In dairy cows, hormones can be used to increase milk production. Thus, hormones can increase the profitability of the meat and dairy industries.

WHY ARE CONSUMERS CONCERNED ABOUT HORMONES IN FOODS?

According to expert scientists appointed by the European Union, the use of growth hormones in food animals poses a potential risk to consumers' health, the scientists reported that hormone residues found in meat from these animals can disrupt the consumer’s hormone balance, cause developmental problems, interfere with the reproductive system, and even lead to the development of cancer. Children and pregnant women are most susceptible to these negative health effects. Hormone residues in beef are also thought to cause the early onset of puberty in girls this puts girls at greater risk of developing breast cancer and other forms of cancer. As a result of these health risks, the European Union has banned the use of growth hormones in cattle and has prohibited the import of hormone-treated beef since 1988. Scientists are also concerned about the environmental impact of hormone residues that are found in cow manure. When manure is excreted, these hormones can contaminate surface and groundwater, thereby harming local ecosystems. Aquatic ecosystems are particularly vulnerable to the negative impacts of hormone residues; recent studies have demonstrated that exposure to hormones has a substantial effect on the reproductive capacity and egg production of fish.

EFFECT OF HORMONE GROWTH PROMOTER ON MEAT QUALITY

There is correspondence increase in carcass weight, the carcass also have low marbling, the reasons for reduced marbling are unclear but the low marbling may be due to implantation of hormonal growth promotant in life animal and or because of the increased protein deposition which efficiently dilutes the fat content within the muscle. Hormone growth promotant has no effect on dressing percentage; therefore an overall increase in carcass weight leads to an increase in weight of meat. Subcutaneous fat depth and ultimate pH are not affected by hormonal growth promotant implantation but intramuscular fat (marbling) will be decreased.

CONCLUSION

Growth promoters have been discovered to have a great impact in poultry industry as it gainfully help farmers in production of poultry and poultry products, antibiotics have been seen to have positive and negative effect, the ones with the negative effect have been marked out likewise the one with the positive one, the use of enzymes cannot be ruled out as it have no adverse effect on the consumer health as it only help in breaking down of feed particles which in turn affect the growth of the animals likewise the implants and beta antagonists, therefore the use of feed additives in poultry production is encouraged as they has pose to be a useful means of providing for the protein requirement of man without taking time for
the animals to reach consumption stage. Farmers are thereby advised to read carefully the instruction written on each type of feed additives and the appropriate dose should be administered according to the age, state and stage of the animals for better production and yield.

REFERENCES

[6] Brad Johnson, Ph.D. Professor Gordon W. Davis Regent’s Chair in Meat and Muscle Biology Department of Animal and Food Sciences Texas Tech University (806) 742-2805, ext. 224 bradley.johnson@ttu.edu
[16] Han, I.K. 1998. Role of animal agriculture for the quality of human life in the


[22] Keith Belk. Ph.D. Professor Department of Animal Science Colorado State University (970) 491-5826 Keith.Belk@colostate.edu


[31] Schiffer, Bettina, Andreas Daxenberger, Karsten Meyer, and Heinrich H.D. Meyer. The Fate of Trenbolone

