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FOOD SAFETY WITH EMPHASIZING THE EFFECTS OF DIETARY PROBIOTIC AND ORGANIC ACID SUPPLEMENTATION TO DIETS ON BROILER PERFOMANCE

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ABSTRACT

Animal production in the world has undergone a transformation over the last 50 years from a system mainly comprised of independent animal producers to one mainly comprised of concentrated animal feeding operations. The major production animal species, beef cattle, swine, chickens, and turkeys, are produced under a variety of conditions that may have significance in regard to the presence or absence of potential food borne pathogens.

Poultry products are universally popular and in recent years the consumption of poultry meat has risen dramatically. To ensure the continued growth and competitiveness of this industry, it is essential that poultry meat quality and safety are maintained during production and processing.

Dietary certain feed additives are products, which are incorporated into animal food to create favourable conditions in the animal's intestine for the digestion of feed. Growth promoters have been used extensively in animal feeds and water all over world especially in the poultry and pig industries. Antibiotics improve the production results of meat – production chicks, and utilization of energy particular is improved. However the use of growth-promoting antibiotics is being placed under more and more pressure, as consumers increasingly fear that their usage in feed rations of productive livestocks leads to the formation of resistance against bacteria, which are pathogenic to humans. Some probiotic micro organisms and organic acid are an alternative to antibiotic to be used exclusively as a growth stimulant and for improvement of the feed conversion rate in farm animals.

The basic principles of probiotic feed are utilizing naturally occurring antagonist bacteria, which are non-pathogenic for both chickens and humans, inhibiting the growth of dangerous pathogenic bacteria. These so called antagonist bacteria act as a natural. Cost effective and humane way to protect chickens and possibly other animals by improving the overall health of the chicken and eliciting infection fighting probiotic compounds. By producing acids (such as acetic acid and lactic acid) and other compounds which inhibit the growth of "bed". Bacteria which produce toxins, lactic acid and other useful bacteria have demonstrated probiotic effects. Studies with broiler chicks were indicated a positive response to dietary supplementation of probiotic.

KEY WORDS:

food safety, standards, poultry, probiotics, broiler

1. INTRODUCTION

Evidence from the first earliest historical writings that governing authorities were already then concerned with codifying rules to protect consumers from dishonest practices in the sale of food. Assyrian tablets described the method to be used in determining the correct weights and measures for foodgrains, and Egyptian scrolls prescribed the labeling to be applied to certain foods. In ancient Athens, beer and wines were inspected for purity and soundness, and the Romans had a well organized state food control system to protect consumers from fraud or bed produce. In Europe during the Middle Ages, individual countries passed laws concerning the quality and safety of eggs, sausages, cheese, beer, wine and bread. Some of these ancient statues still exist today (1).

The second half of the nineteenth century saw the first general food law adopted and basic food control systems put in place to monitor compliance. During the same period, food chemistry came to be recognized as a reputable discipline and the determination of the "purity of a food was primarily based on the chemical parameters of the simple food composition. When harmful industrial chemicals were used to disguise the true color or nature of food, the concept of "adulteration" was extended to include the use of hazardous chemicals in food. Science had begun providing tools with which to dishonest practices in the sale of food and to distinguish between safe and unsafe edible products (2).

Food regulation in different countries is often conflicting and contradictory. Legislation governing preservation, nomenclature and acceptable food standards often varies widely from country to country. New legislation not based on scientific knowledge is often introduced, and little account may be taken of nutritional principles in formulating regulations.

2. CODEX ALIMENTARIUS: GLOBAL STANDARDS

Since 1963, an international food code has been placed to ensure food safety world-wide. Codex Alimentarius, jointly administered by FAO (Food and agriculture Organization) and WHO (World Health Organization), sets standards for pesticide and veterinary drug residues, additives, food imports, inspections and food sampling methods, among other issues. It serves as the basis for many national food standards. The Codex Alimentarius came into being in response to a widely recognized need. It was the product of a long evolutionary process involving a wide cross-section of a global community. Many people representing many interests and disciplines were involved in the process, and it is not unreasonable to suppose that, as long as the need perceived by those people remains, so the Codex Alimentarius remain.

Codex has established such well-known safeguards as the "Best if used before" food label and definitions for low-fat and light food. Evolving constantly, it is now meeting the new challenges of organic farming and biotechnology. For example, a Codex task force is currently drawing up recommendations on labeling standards for genetically modified ingredients (3)

Codex considers independent scientific advice from such bodies as the Joint FAO/ WHO Expert Committee on Food Additives, the Joint FAO/WHO Meeting on Pesticide Residues and the Joint FAO/WHO Meeting on Pesticide Residues and the Joint FAO/WHO Consultation on Biotechnology and Food safety.

The Codex Alimentarius contains more than 200 standards in the prescribed format for individual foods or groups of foods. In addition, it includes the *General Standard for the Labeling of Prepackaged Foods, the Codex General Guideliness on Claims* and the *Codex Guidelines on Nutritional Labelling,* all of which are aimed at ensuring honest practices in the sale of food while also providing guidance to consumers' health and they are valued widely for this purpose.

Instruments such as principles and codes have been developed or the express purpose of protecting the health of consumers against food-borne hazards. For example, general principles have been developed for the use of food additives, food import and export inspection and certification and addition of essential nutrients to food.

The Codex Alimentarius contains wide-ranging *guidelines* for the protection of consumers, including such diverse subjects as the Establishment and Application of Microbiological Criteria for Foods and Levels for Radionuclide in Foods Following Accidental Nuclear Contamination for Use in International Trade.

It also contains *codes of practice,* most of which are codes of hygienic practice providing guidance on the production of food that is safe and suitable for consumption-in other words, their purpose is to protect the health of consumers. The *Recommended International Code of Practice- General Principles of Food Hygiene* applies to all foods. It is particularly important in protecting consumers because it lays a firm foundation for food safety and follows the food chain from primary production through to final consumption, highlighting the key hygiene controls required at each stage.

The Codex Alimentarius also contains the *Recommended International Code of Practice for Control of the Use of Veterinary Drugs*, which has the express aim of preventing the use of drugs that create a hazard to human health (2).

There are also a number of so-called *codes of technological practice*, which are intended to ensure that the processing, transport and storage of foods produced to Codex standards are such that consumers receive end products that are wholesome and of the expected quality.

The Hazard Analysis Control Point (HACCP) system, which monitors critical steps in the food chain, has had a major impact on reducing contamination during food processing. Introduced in the food industry in the United States in the 1970s, HACCP has been recommended by Codex Alimentarius since the mid-1990s. It is now required by regulators in many countries such as those of the European Community, and the United States. HACCP does not rely on end-of-the-line product inspection.

Instead, it identifies exactly were problem may occur and the food handler takes appropriate precautions to prevent contamination.

New challenges for regulators are genetically modified (GM) food and organic farming. GM foods can harm consumers if the modification transfers allergens from one organism to another. For example, someone allergic to peanuts might react to a completely different food into which the peanut-allergen has been transferred. Regulations should require that food labeling specify any GM ingredients that transmit commonly known allergens

Organic farming expanded by 25 percent a year in Europe in the 1990s and is making steady inroads throughout the world. While it reduces chemical residues, the absence of preservatives results in a theoretically higher risk of microbial contaminations. In practice, organic produce is at least as safe as conventional foodstuffs, but there have been outbreaks of poisoning, and even deaths, from pastereurized fruit juice. As organic farming spreads into regions with varying regiment of food standards, Codex Alimentarius will be needed more than ever to ensure food safety. Guidelines already cover production, processing, labeling and marketing of organic foods (3).

In helping to establish and strengthen food control systems, FAO and WHO have emphasized the importance of consumers' input and, in some developing countries, have assisted with the establishment of national consumers' organizations.

When assisting with the establishment of National Codex Committees, the two organizations have consistently recommended the inclusion of consumers' representatives and advocated the necessity of receiving their input concerning national activities within the country. In doing this, FAO as recognized the limitations of its authority and prerogatives and sovereignty of national governments in deciding in the extent to which consumers might and can involved.

The main problem for poorer countries is the cost of meeting the standards. FAO has proposed a food safety and quality fund to provide grants to the least-developed countries to strengthen their systems.

3. Hazard associated with poultry meat

Animal production in the world has undergone a transformation over the last 50 years from a system mainly compressed of independent animal producers to one mainly comprised of concentrated animal feeding operations. The major production animal species, beef cattle, swine, chickens and turkeys, are produced under a variety of conditions that may have significance in regard to the presence or absence of potential food borne pathogens.

Poultry products are universally popular and in recent years the consumption of poultry meat has risen dramatically. To ensure the continued growth and competitiveness of this industry, it is essential that poultry meat quality and safety are maintained during production and processing.

The development of a PPP Standard for Poultry Meat will need to focus on hazards that significantly contribute a public health risk and include biological, chemical and physical agents.

3.1. BIOLOGICAL HAZARDS

Poultry, like all animals, may carry a wide range of microorganisms, some of which are human pathogens. It is widely recognized that the organism of greatest public health concern to the consumer of poultry meat products are Salmonella spp, and Campylobacter spp. These two organisms are the leading cause of intestinal infections in developed countries and have been isolated from raw poultry and implicated in food-borne illness.

SALMONELLA

Many studies have been undertaken to determine the incidence and prevalence of Salmonella in poultry and poultry meat products. Salmonella is commonly isolated across the whole poultry production chain, from the farm through to the retail level (4). The principles source of Salmonella on the dressed poultry carcass is faeces. Extensive faecal cross-contamination occurs during shed depopulation, transport and slaughter of the birds, and results in contamination of equipment and carcasses during processing.

The WHO/FAO has recently published a quantitative risk assessment that estimates the risk of salmonellosis from the consumption of poultry. The assessment includes modeling of parameters that impact on Salmonella on broiler caracasses during distribution and storage, preparation, cooking and consumption. Using the model, the change in the risk of illness following the implementation of Salmonella control measures could be estimated.

CAMPYLOBACTER

The principal reservoir of pathogenic *Campylobacter* spp. is the gastrointestinal tract of wild and domesticated mammals and birds. *Campylobacter* species commonly associated with human illness are *C. jejuni* and *C. coli* (8). These organisms are distinguished from other *Campylobacter* spp. primarily by their high optimum growth temperature ($>42^0$) and therefore termed thermophilic *Campylobacter* (5).

International studies have shown that C. jejuni is frequently isolated from poultry and poultry products at all stages of production.

WHO/FAO is currently a quantitative risk assessment for *Campylobacter* spp. In broiler chickens which attempts to model the levels of *Campylobacter* in the broilers across the whole poultry production process including home preparation and cross contamination.

OTHER PATHOGENS

Other microorganisms that are public health significance and potentially found on poultry meat products include *Listeria monocytogenes, Clostridium perfrigenes* and *Staphylococus aureus.*

3.2. CHEMICAL HAZARDS

There are a number of chemicals that may be introduced into the food chain during poultry meat production. Chemicals may be added deliberately during primary production and/or processing (e.g. antimicrobial agents), or in intentionally via environmental exposure (e.g. heavy metals, polychlorinated biphenyls).

ANTIBIOTICS

Antibiotics, a type of antimicrobial, are commonly defined chemical substances capable of destroying or preventing the growth of bacteria. Like humans, animals need antibiotics to fight off bacterial infection. Use tends is higher in the intensive rearing industries, mainly the pig and poultry industries. Antibiotic use in animal falls into three areas:

- for medical or therapeutic use-when the individual animal or groups of animals are ill and show symptoms of disease. Most antibiotics are used for this purpose.
- For preventative or prophylactic use-as a safeguard when there is a high probability that animals will catch diseases, including when diseases is already appearing in group of animals. For example, a common disease in chickens is necrotic enteritis, a gut disease. When kept together in the chicken sheds or barns this disease spreads quickly, so antibiotics may be given in their feed to prevent it spreading.
- For growth promotion-in intensive rearing situations, healthy food animals can very low doses for long periods to increase the rate and efficiency of growth of the animal (6, 11).

HORMONAL GROWTH PROMOTANTS

Hormones are natural substances produced in the body to stimulate cells or tissues into action. They can also be synthetically produced in the laboratory. The hormones used to artificially stimulate meat production in livestock are known as hormonal growth promotants or HGPs'. HGPs' is a natural substance used as a quality enhancer to boost growth in food animals. In the USA they are considered safe and used extensively, but in the EU they are banned (7).

3.3. PHYSICAL HAZARDS

The physical hazards associated with poultry meat products are intrinsic hazards (e.g. bones and bone fragments in fillets, feathers) and extrinsic hazards (e.g. metal inclusions, plastic, glass and other material that is foreign to the nature of the food).

Extrinsic physical hazards are potentially introduced at all stages along the poultry processing chain. Sources for such contaminants include badly maintained facilities and equipment, improper production procedures, packaging materials and poor employee practices. The various physical hazards may cause traumatic injury to the mouth, tongue, teeth, gums, throat, stomach and intestines, as well as presenting a choking hazard. Depending on the nature of the hazard and the poultry meat product, the products may be recalled from sale.

THE EFFECTS OF DIETARY PROBIOTIC AND ORGANIC ACID SUPPLEMENTATION TO DIETS ON BROILER PERFORMANCE

Dietary certain feed additives are products, which are incorporated into animal food to create favorable conditions in the animal's intestine for the digestion of feed. Growth promoters have been used extensively in animal feeds and water all over the world especially in the poultry and pig industries. Antibiotics improve the production results of meat –production chicks, and utilization of energy particular is improved. However the use of growth-promoting antibiotics is being placed under more and more pressure as consumers increasingly fear that their usage in feed rations of productive live stock leads to the formation of resistance against bacteria which are pathogenic to humans (9). Concerns over the emergence of the antibiotic-resistant "super bugs" and it links with the use of antibiotics for prophylactic purpose in the feed industry have led to a partial or total ban of antibiotic use in feed in a number of European countries. Many countries are following the European example, either regulating the use of antibiotics in feed or setting up programs to reduce the overall use of antibiotics. The problem, however, is much more complicated than just a simple withdrawal of these growth promotants overnight because it will not only affect feed efficiency, but also increase mortality and morbidity of animals. Currently, many parts of the world are experimenting alternative feed additives that may be used to alleviate the problems associated with the withdrawal of antibiotics from feed. Many counties are maintaing good production and health of the animals by using alternatives such as organic acid, probiotics, prebiotics and feed enzymes (10).

The ban of antibiotic growth promotants in Sweden since 1986 has been a great test case for the rest of the world. With the aid of a number of alternatives including organic acids, prebiotics (mainly oligosaccharide products), probiotics and feed enzymes, not only has the general health status of the poultry in Sweden been maintained, but also the growth rate and feed efficiency improved markedly (12).

ENZYMES

Important effects of supplementary enzymes include improved digestibility of nutrients, reduced small intestinal fermentation and increased caecal fermentation . The increased microbial activity in the caeca is a likely result of poorly absorbed products of enzymatic degradation entering the caeca, where they stimulate bacterial fermentation. This aspect of enzyme activity may resemble the mode of action prebiotics (12).

ORGANIC ACIDS

Organic acids are used widely in Europe to inhibit pathogens like *Salmonella* in both raw materials and finished feed. Organic acids in there undissociated forms are able to pass through the cell membrane of bacteria. Once inside the cell, the acid dissociates to produce H^+ ions which lower the pH of the cell causing the organism to use of its energy in trying to restore the normal balance, whereas the $RCOO^-$ anions produced from the acid can disrupt DHA and protein synthesis, putting the organism under stress so that it is unable to replicate or replicate rapidly.

Inclusion of dietary acids could reduce the number of lactic acid-producing bacteria in the crop, and hence the amount of naturally produced organic acids. The effects of organic acids are included in the feed or drinking water (13).

PREBIOTICS

Another method which may be used to manipulate the gut ecosystem is the supplementation of the diet with small fragments of carbohydrates. Such carbohydrates can selectively stimulate the growth and activity of bifidobacteria and lactobacilli in the gut and thereby benefit health. These carbohydrates are also known as prebiotics in the feed and food industries. The net effect on host health and well being is rather similar to that of probiotics. The commercially available prebiotic products are mainly oligosaccharides of galactose, fructose or mannose. For example, soy bean contains 3-5 % naturally occurring galacto-oligosaccarides and the angustifolius lupin contains up to 9 % of oligosaccharides. There is evidence that most of these prebiotics exert their beneficial effects on the host by selectively feeding the good bacteria at the expense of the harmful ones. It is claimed that the mannan oligosaccharides from yeast cell wall work by providing the specific binding sites (D-mannose) to enteric pathogens, thus reducing their chances to attach to the intestinal tract (10). Since mannan oligosaharides are not digested by the endogenous enzymes of the bird, they pass through the gut with pathogens attached. There is also " cleaning up" effect, i.e. they detach pathogens already to the gut (14).

PROBIOTICS

Probiotics are organisms and substances, which help to improve the environment of the intestinal tract. It may be defined as living microorganism which, given to animals, assist in the establishment of an intestinal population which is beneficial to the animal and antagonistic to harmful microbes (9).By producing acids (such as acetic acid and lactic acid) and another compounds which inhibit the growth of "bed" bacteria which produce toxins, lactic acid and other useful bacteria have demonstrated probiotic effects (15).

The beneficial effects of a balanced gut micro flora include inhibition of pathogens, modulation of the immune system, synthesis of vitamins, mucosal permeability, colonization resistance, production of metabolitic fuel for enterocytes and contribution to digestion. There have been numerous studies in humans and animals on the ability of probiotics to change the types and numbers of the gut micro flora (15,16). Cavazzononi et al (1998) reported that a *Bacillus coagulans*-based probiotic products enhanced the growth rate of broilers and Jin et al. (1998) also reported a significant improvement in FCR and weight gain of broilers over a 42 day trial period with a lactobacillus based probiotic supplement. The research on influence of VEBAC probiotic addition in drinking water on the growth of Avian 24 K chicken also indicated a positive effect on performances of broilers (17). According this report average live weights of Avian 24 K chicken in age of 42 days was for 10.8 % higher in group treated with 3g /100 l probiotic VEBAC, compared to the second group without probiotic in drinking water. Softic at al. (2003)(18) also reported the positive effects of probiotic which contained yeast, lactose and C vitamine on sternum length, body length and diameter of the leg.

The effectiveness of probiotics in poultry depends on the hygiene standard of the operation and the general health of the flock.

4. CONCLUSION

Many public health advocates say the use of antibiotics in poultry causes disease germs to become resistant not only to those drugs but also to the closely related drugs used to treat human diseases. The theory is that stronger, more drug-resistant strains of bacteria grow when competing organisms are killed off. Strong resistance to a drug may cause it and others in its chemical class to become ineffective for treating some diseases. The world will follow the European lead, either by government regulation or voluntarily, to reduce or discontinue the use of antibiotics for prophylactic purpose in animal feed. There are a number of alternatives including enzymes, prebiotics, probiotics and organic acids that can be used strategically. Combined with good hygiene management of the animal house, these alternatives have proven to be effective in maintaining production and controlling common diseases in pig and poultry operations in Europe.

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