# An Alternative Dietary Approach to Prevent Enteric Disorders in Poultry Production

With the ever increasing need for animal protein sources for human consumption, the poultry industry always coped up to meet the needs at an affordable manner. The conditions in developing countries for the production of either broiler or table egg may not be entirely free of unseen losses. The following article will review briefly about such losses by gut disorders and the approaches to avoid the same.

Broiler production in major countries is estimated to total 74,237,000 metric tons in 2009, 3.5% more than the 71,733,000 tons expected this year, according to data from USDA's Foreign Agricultural Service (FAS).


Global egg production doubled between 1990 and 2005. By then, some 64 million tons of eggs were produced worldwide. Today there are approximately 4.93 billion egg-laying hens in the world, each capable of producing up to 300 eggs per year. By 2015, world egg production is expected to reach 72 million tons, according to the U.N. Food and Agriculture Organization (FAO).

At this point of time we should be highly thankful for superior genetic selection; the commercial poultry, both layer as well as broiler has undergone dramatic improvements in growth, feed efficiency and production. But at the same time due to its faster growth and high production efficiency, the modern poultry is highly vulnerable to acquire enteric pathogens as early as well. Gut health challenges are significant and most important issue for current poultry production. This may include viruses such as

enterovirus, reovirus, rotavirus and other unnamed viruses, no need to mention the bacterial challenges (*E. coli, Salmonella* and *Clostridium*) and protozoal issues (Coccidia). More over with ever increasing feed cost, even one point lost in feed conversion or 0.01 % production drop will be a big economic challenge in long run for the commercial poultry producers in India even through the world. Some of us may be focusing much on very immediate returns on investment and failing to focus on long run profitability. Gut health issues can result in loss of feed conversion, uniformity, weight, rate of gain, exposure to common enteric pathogens, additional investment on treatment costs and higher condemnation rates. Therefore, early prevention of gut enteric challenges can result in significant savings.

As per recent estimates the approximate loss from a single bird due most common enteric disorders like Necrotic enteritis, Colibacillosis and Coccidiosis either clinically or sub-clinically are all put together is Rupees 5.00-7.00. At most times it is not less than Rupees 2.50 – 3.00 by either one or two causes. The causative agents like Enterococcus, Streptococcus and Staphylococcus are gaining access to entry even before the chicks receive their first drop of water at the farm. These causative organisms are ubiquitous in nature that is found in soil, dust, faeces, feed, poultry litter, and in intestinal contents (Ficken, M. D et al, 1997).

Although, small numbers of *Clostridium perfringens, E. coli* and other secondary bacterial pathogens are also commonly found in the intestinal tract of healthy broilers, but normally they may not cause clinical disease. Under normal conditions the beneficial bacteria (“good bacteria”) in the intestinal tract keep them under control i.e. small in number. However, when conditions change in the intestinal tract due to any sort of stress, the pathogens number will increase, toxins are produced and the clinical disease appears. While anything that causes intestinal irritation can lead to severe productive loss, like stress; sudden dietary changes; intestinal disease (worm infestation, coccidiosis); immune suppression etc., (Vijay. D et al, 2007).

**Fig: Watery droppings due sub-clinical infections**

In commercial farming operations, the sub-clinical course of disease may be most economically important form because it has been shown to impair feed conversion ratio and growth pattern in broilers (Stutz, H. W. et al, 1984) as well as production efficiency and growth pattern in layers. Like Salmonellosis, Colibacillosis infection plays a significant cost factor in poultry production not only in commercial operations but also in breeders through vertical transmission.

The sub-clinical infections like colibacillosis, necrotic enteritis is commonly seen in 2 to 5 weeks old broiler chickens raised on litter is accounts for USD 3000 – 4000 per lakh birds. Even in caged birds such as growers and layers the spread of these types of pathogens are very common and it results in 0.5-1.50% production loss throughout the life cycle (Vijay. D et al, 2007).

**Prevention:**

Till date, for the prevention of losses from sub-clinical and clinical enteric disorders, the methods used by way of providing antibacterial feed additives, also referred to as antibiotic growth promoters, such as Virginiamycin, Lincomycin, Tylosin, Neomycin and Penicillin (Ficken, M. D. et al, 1997 and Stutz, H. W. et al, 1984). In recent years with the increase in export of eggs as well as frozen and ready to eat form of chicken preparations and the restrictions on the use of regular antibiotic feed supplements which hitherto are most successfully used to control the incidence of clinical and subclinical Necrotic Enteritis.

In consequence to this the occurrence of Necrotic Enteritis, Colibacillosis and some other non-specific enteritis has become epidemic in most part of the country in commercial flocks especially in broilers (25 to 40%). Keeping these things in mind, new strategies to be identified and adopted for the prevention and control of these unobserved losses.

As discussed earlier it has been documented that disturbances in the intestinal microflora leads to elevated levels of *C. perfringens and Colibacilli* (Fukata, T. et al, 1991). And it has been found that the pathogenic effects of these organisms could be reduced by feeding chicks as well as growers (which as more susceptible) and layers with optimally concentrated probiotic. Few other researchers also observed that the use of continuous competitive exclusion (CE) cultures of chicken intestinal flora (viable colonies) could reduce the incidence of clinical mortality and caecal colonization and prevent subclinical negative effects on body weight and feed efficiency in broiler chickens as well as production performance of layers (Elwinger, K., et al. 1992 and Hofacre, C. L., et al 1998).

**Development of Bacterial Colonies in chicken Intestine:**

The results of a recent study indicated that in young chicks the major species present in the small intestines and caeca was *Lactobacilli,* with a *Bifidobacteria* population becoming more dominant in the caeca at older age. *Clostridium* was detected in some segments of the small intestine in young chicks. In older chickens, *Salmonella, Campylobacter,* and *E. coli* species were found in the caeca.

During the first 2 to 4 days of post-hatch, Streptococci and Enterobacteria colonize the small intestine and caecum. After the first week, Lactobacillus predominate in the small intestine, and the caecum is colonized mainly by anaerobes (Bacteroides) and facultative anaerobes (*Escherichia coli*).

The study further reports about how the bacteria colonize in gut at different periods of chicken life.

In chicken caeca at 4 days, the relative proportion of *Lactobacilli* was about 25% of the total examined bacteria and *Bifidobacterium* was not detected. Relatively high proportions of *Salmonella* were detected (40%) and *Campylobacter* was present in minor amounts (2%). Almost one-third of the bacteria in the caeca at this age consisted of *E. coli* and *Clostridium* species.

At the age of 14 days, the relative proportion of *Lactobacilli* and *Bifidobacterium* increased and reached 40% of the total bacteria. In contrast, the relative proportion of

*Salmonella* was reduced by approximately 10%. *Campylobacter* was present only in trace amounts and proportions of *E. coli* and *Clostridium* changed little.

At 25 days of age, almost one-half of the bacteria in the caeca were *Lactobacilli* and *Bifidobacterium* species. Furthermore, the relative proportion of *Salmonella* had decreased by approximately 50% compared with that at 4 days. Proportions of *Campylobacter* remained small, whereas proportions of *E. coli* and *Clostridium* remained approximately 30%.

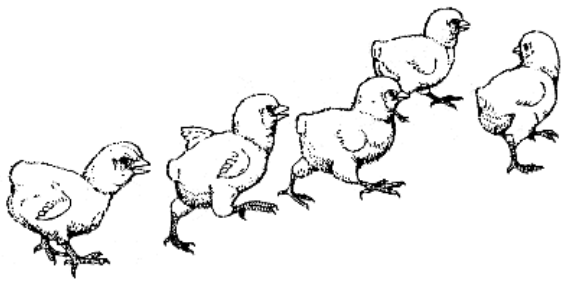
**How much Probiotic to Supplement?**

Supplementation of probiotic cultures should enable the beneficial colony in the gut to dominate the clostridial and other gut pathogens in terms of colonies. In normal conditions the chicken intestine hosts both beneficial and pathogenic or non-pathogenic strains of unwanted microflora also, with the ideal ratio being approximately 85% or more of friendly and 15% or less of unfriendly microflora. Unfortunately, in many cases, this ratio gets disturbed due to several stress factors. Many degenerative stress factors are also linked to bacterial imbalances.

**Total bacterial population in the intestine**

| Part | pH | Bacterial Density | Common Organisms |
|---|---|---|---|
| Crop, Gizzard & Duodenum | 3.0 – 6.0 | $10^3$ to $10^5$ cfu/g | Acid tolerant Lactobacilli |
| Small Intestine | 6.5 – 7.5 | $10^8$ to $10^9$ cfu/g | Lactobacilli, Clostridia, Streptococcus and Enterococcus |
| Large Intestine | 7.0 – 7.5 | $10^{10}$ to $10^{12}$ cfu/g | Lactobacilli, Bacteroides, Clostridia, Fusibacteria, Coliforms and faecal Streptococci. |

**For optimum gut micro flora balance, the friendly bacteria such as gram positive *Lactobacilli* and *Bifidobacteria* should dominate more than 85% of total bacteria**



## Optimum Concentration through Feed

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|---|---|
| **Ideal density of probiotics organisms in the intestinal levels** | **$10^{12}$ to $10^{14}$ CFU per gram of intestinal contents** |

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| **A probiotic dose required in feed** | **$10^{6}$ to $10^{7}$ CFU per gram of feed or $10^{12}$ to $10^{14}$ CFU per ton of feed** |

## Optimum Concentration through Water

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|---|---|
| **Ideal density of probiotic organisms in drinking water** | **$10^{7}$ to $10^{8}$ CFU per ml of drinking water** |

### Probiotics for Hour-Old Chicks:

Newly hatched chicks have sterile gut and it will take few hours to few days to initialize and establish the optimal gut flora required. Immediately after hatch the chicks are to be transported to poultry farms which are located at different far away places from the hatchery. Reports from various researchers, it is found that Streptococcus and Enterococcus will only take about 24 hours for their multiplication, which are undesirable. But, for Lactobacilli and Bacillus, it will take 24-48 hours for the initiation of

development and will take 21 days for the complete establishment in the gut, half of the life cycle in case of broilers. Providing beneficial bacterial colonies immediately after reaching the farm or even from the hatchery will enhance the performance of the birds. This is how, the first 24 hours of chick management is essential for its future performance, which is similar to that first week's body weight that determines the body weight at the end of crop period. This indicates continuous provision of such type of beneficial colonies not only improves the performance of bird and profitability but also slowly reduces the pathogenic baterial population from the gut as well as environment.

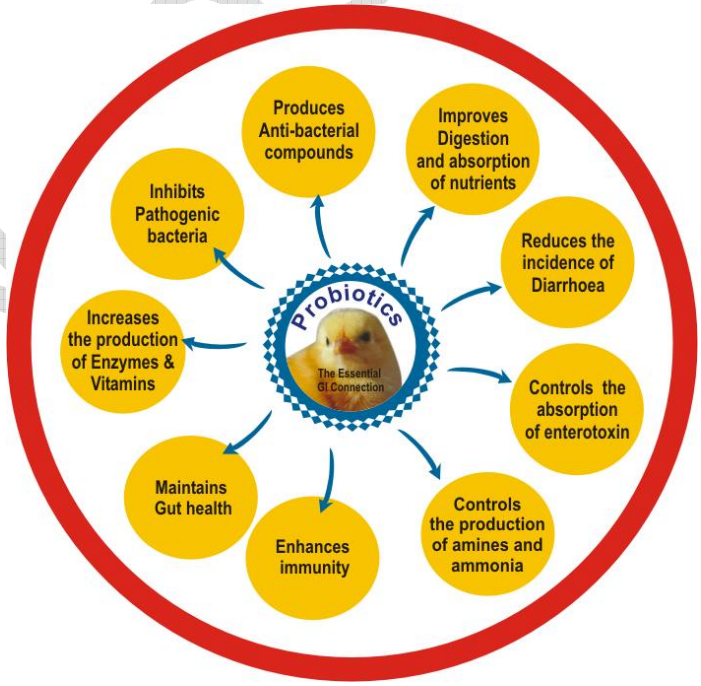
## Initial establishment of gut population

| | |
|---|---|
| **A probiotic dose at hatchery** | **$10^8$ to $10^{10}$ CFU per chick as a coarse aerial spray** |

## Probiotics for Adult Birds:

This is as simple concept to maintain the beneficial colony population more than 85% in the total gut population. This helps to avoid unnecessary losses from sub-clinical issues and frequent outbreaks of enteric disorders and subsequent medicinal expenses.

## Major Roles of Probiotics:



## Conclusion:

For the past four decades, antibiotics have been supplemented to animal and poultry feed to improve growth performance, efficiency and protect animals from adverse effects of pathogenic enteric microorganisms. The use of in-feed antibiotics has been practiced as one of the main strategies for controlling *Clostridia, Salmonella* and *E.coli* associated problems in poultry. But usage of non-therapeutic antibiotics in poultry feed are fast disappearing worldwide due to fear of development of antibiotic resistant microbes. Strategies to control these types of pathogenic micro-organisms in addition to antibiotic growth promoters have centered upon dietary and management practices. Supplementation of ideal concentration of beneficial bacterial colonies will enable the bird to perform to its potential by eliminating undesirable bacteria.

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