As the main meat produced in India, poultry has enjoyed a long research-orientated approach that is reflected in its present status as an organised industry representing about 1.38% of the country GDP. The total size of Indian poultry production is estimated at 4,000 million USD and it employs 1.6 million people. The estimated annual poultry in India is:

- Commercial broilers: 1400 million
- Commercial layer: 135 million
- Breeders layers: 1.2 million
- Breeders broilers: 9.0 million

The growth of the poultry industry averages 5% - 6% in layers and 10% - 12% in the broiler segment. The industry is evolving and consolidating its position in Indian economy.

The importance of nutrition

With the continuous genetic improvement of broilers, layers and breeders, productivity has improved to a great extent in India in the last 15 years. Along with the genetic development, the nutritional requirements of the birds also have undergone tremendous changes.

By Dr P Linge, manager institutional business, Venky’s India Limited

With the continuous genetic improvement of broilers, layers and breeders, productivity has improved to a great extent in India in the last 15 years. Along with the genetic development, the nutritional requirements of the birds also have undergone tremendous changes.

Venkateshwara Hatcheries (VH) Group is the most versatile and integrated group in India, which was established in 1971 founded by the late Padmashree Dr BV Rao who is considered as a father of modern Indian poultry industry. With its main business being day-old chicks supported by vaccine manufacture, poultry health products and R&D on poultry diseases, VH Group is also a leader in poultry feed production and poultry equipment manufacturing. With the launch of BV Feed supplement manufacturing company, the VH Group focuses on the manufacture and application of vitamin premixes, probiotics and prebiotics in the feed to improve efficacy of feed.

Probiotics are pure cultures of one or more living microorganisms given in feed that proliferates in the host GI tract. They ensure that the bird maintains a beneficial microbial population in the GI tract.

By Dr P Linge, manager institutional business, Venky’s India Limited
try industry for safe and natural alternatives, through its BV Feed Supplements branch, to improve feed efficiency.

While these alternatives can answer producers and consumer needs, we mustn’t forget that they are part of a global solution. They are not exclusive and can be combined for optimum animal production in terms of safety and performance, but they will only be efficient if basic management practices are followed, especially in terms of nutrition and hygiene.

The digestive microflora

When considering poultry breeding, the intestine is the prime organ responsible for growth and efficiency of the bird. Any intestinal dysfunction or inefficiency will result in a reduction in the birds’ growth efficiency. To better understand the actual role of the intestine in the digestion and utilization of nutrients we must understand the role of the gastrointestinal (GI) tract microbial flora, which plays many important roles in the development of growing or developing birds, such as:

- Digestion and fermentation of dietary compounds (vitamins, amino acids etc).
- Anatomy and physiology of the GI tract.
- Development and functions of the Gut Associated Lymphoid Tissue.

The GI tract of birds is host to a vast number of microbial species, which are responsible for induction of changes in its microhabitat. This has a direct impact on the overall health and productivity of the bird. Changes in the microhabitat of the GI tract can be induced by modification (qualitative or quantitative) of the diet, by addition of live beneficial bacteria (probiotics), or by selectively stimulating the development of certain strains already present in the gut (prebiotics).

The beneficial microflora of the GI tract should follow some criteria for the bird to attain optimal performances. The stability of the microflora in the GI tract to resist changes in the diet composition, pathogen challenge, or environmental changes is of great importance. In developing birds, a biochemically and physiologically diverse population of microorganisms that can readily adapt to changes is necessary. The microflora should be able to provide protection against colonisation of pathogen bacteria. Lower incidence of pathogens will also limit the development of sub-clinical infections. Another important characteristic of the microflora is its ability to aid and facilitate tissue development in the gut and development of the immune system, especially in young birds. Finally, beneficial microflora should have the ability to destroy toxins that are either produced by pathogens or enter the gut through feed.

Probiotics and performance

The three major diseases caused by pathogen bacteria in poultry are: Colibacillosis, Salmonellosis and Clostridial infections. The economical losses associated with such bacterial infections correspond to high mortality, loss of weight, poor feed conversion, down-grading of carcasses (e.g. Colibacillosis), lowering fertility and hatchability (e.g. Salmonellosis), severe drop in egg production (e.g. TB), human health problems.

Undoubtedly antibiotics are of great benefit to poultry industry for controlling a targeted pathogen and when prescribed by a veterinarian. Nevertheless, they can represent several disadvantages. Sub-therapeutic levels, when used as growth promoters or misused are suspect of fostering resistant populations of bacteria, rendering subsequent use of the antibiotic for therapy difficult; and negative effect on the host lactic acid bacteria.

Therapeutic levels of antibiotics affect indigenous gut flora (intestinal upsets), persist even after their cessation, and result in the appearance of residues in the organs and tissues of treated birds.

Raising poultry without antibiotics may result in poor performance and enteritis which are economic and welfare problems. An alternative feed additive looked at to replace antibiotics is probiotics.

Probiotics are pure cultures of one or more living microorganisms given in feed that proliferate in the host’s GI tract. They ensure the bird maintains a beneficial microbial population in the GI tract. Products falling under the generic title of “probiotics” are subject to strict regulations. A probiotic must satisfy the nutritional needs of animals or improve animal production. Alongside efficacy, the product must satisfy independent evaluation for identity, safety and stability. The presence of a large probiotic population in the gut can be achieved in two ways:

1. By using a strain that colonises the intestine and is self-replicating. This can be achieved by:
   a) selecting a strain that grows faster than its rate of removal by peristalsis
   b) by using a strain which adheres to gut lining and remains behind after the food moves on.

2. By continuous feeding of large numbers of live microorganisms which do not necessarily colonise the intestine but which survive the adverse condition of stomach and remain viable in small intestine and lower gut where they can metabolise and exert probiotic effect.

Probiotics in use in India

Probiotics currently on the market or under investigations in India contain Lactobacilli: Streptococcus, Pediococcus, Bifidobacterium, Saccharomyces, or Bacillus. These have been used both alone
The lactic acid bacteria *Pediococcus acidilactici* and the yeast *Saccharomyces boulardii* strains have shown promising scientific proven effects (Figure 1): protecting the animal’s digestive tract. This effect reinforces the microbial ecosystem, treating diarrhoea in humans. Its mode of use is very well documented. Its shield effect reinforces the microbial ecosystem, protecting the animal’s digestive tract. This shield effect is the result of three scientifically proven effects (Figure 1): 1. Inhibition of damage caused by *Clostridium*, by producing a protease which destroys toxins, 2. Reinforcement of intestinal mucosal integrity, by stimulating enzymatic activities, improving epithelial cell integrity, increasing immune response and better utilisation of the diet, 3. Positive balance of the digestive microflora by agglutinating pathogenic bacteria as *Salmonella* and expelling the complex through the faeces. This probiotic is subject to a patent due to its power of limiting Salmonella development in poultry. *Saccharomyces boulardii* is now incorporated in breeder diets as a regular component of Salmonella prevention programmes.

### Lactic acid bacteria

Another important probiotic successfully used in India is the lactic acid bacteria *Pediococcus acidilactici* (Bactocell®), Lallemand, France), which improves the digestibility of feed in fattening animals such as broilers. It enhances overall levels of lactic acid bacteria within the digestive tract and has a beneficial barrier effect against pathogens. A series of scientific research projects demonstrated that addition of the probiotic resulted in a significant improvement in birds’ zootechnical performance including: body weight, weight gain, total feed consumption, and final feed conversion rate (Figure 2).

### Selenium enriched yeast

Mineral sources of selenium such as sodium selenite and sodium selenate are used to supplement rations of farm animals, despite their low digestibility. Recently, organic forms of selenium have been produced industrially to provide selenium in the form of selenomethionine and other selenoproteins. Selenomethionine is the methionine amino acid in which the sulphur element has been replaced by selenium. This type of reaction occurs in nature when plants are incorporating selenium from the soil. However, on a large-scale systems, yeast (*Saccharomyces cerevisiae*) is used to produce selenium-enriched yeast by replacing sulphur with selenium in the culture medium in order to synthesise selenoproteins.

The main advantages of organic selenium (selenomethionine) are related to:  
- *Bioavailability*: this organic form of selenium is biologically active and will be used like methionine as an amino acid analogue during protein synthesis. Therefore, the selenium will be stored in tissues (muscles, milk, …) rather than excreted and re-used in specific physiological conditions,  
- *Retention in body tissues*,  
- *Reduced toxicity*,  
- *No pro-oxidative properties*,  
- *Similar to natural form of selenium*. This implies major positive health and nutrition effects not only for animals but also for humans, who also benefit from Se rich food products. The benefits of organic Se yeast in poultry include:  
- Increased egg selenium content enhances antioxidative profile, beneficial to the chick, improved egg quality and human nutritional value,  
- Improved hatchability,  
- Stronger antioxidant defences in the newly hatched chick: improved chick viability,  
- Stronger antioxidant defences in the yolk: improved egg freshness.

### Conclusions

Natural and biological ingredients such as probiotics and yeast derivatives are some of the solutions that can contribute to better management of animal production, and in particular poultry, in the context of antibiotic withdrawal. Each of them being part of a global solution, they do not exclude each other, on the contrary, they can be used in synergy to fulfill producers and consumers expectations. These solutions will only be efficient if they are part of an integrated system, if production basic management practices are followed, in particular in terms of nutrition and hygiene. In India, Venky’s experience of implementing these solutions on a highly competitive market in full development has shown the economic viability of these microbial-based products. 

---

*Figure 3 - In vitro agglutination of pathogen by mannanoligosaccharides*