

Key factors in the development of optimal gut function

The efficient conversion of feed into its basic components for optimal nutrient absorption is vital for broiler breeder production and welfare. Gut health, an intricate and complex area combining nutrition, microbiology, immunology and physiology, has a key role to play.

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When gut health is compromised, digestion and nutrient absorption are affected, which can have a detrimental effect on feed conversion leading to economic loss and an increased susceptibility to disease. In addition, recent changes in legislation on the use of antimicrobials, differing feed requirements and more efficient birds highlight the need for a better understanding of gut function and gut health.

This article aims to explore the area of gut health and outline key factors that are important in the development and maintenance of optimal gut function.

An overview of the gut and how it works

The intestinal tract of a bird is a specialised tube that starts at the beak and ends in the cloaca. The primary function of the gut is the conversion and digestion of food into its basic components for absorption and utilisation by the bird.

The gut is separated into five distinct regions (Fig. 1); the crop, proventriculus, gizzard, small intestine (duodenum, jejunum, and ileum), and large intestine (caeca, colon and rectum).

Each of these regions has a specific role in the digestion process and subsequent absorption of nutrients. The feed enters the crop where it is stored for a short period of time and partially fermented by the resident bacteria. The feed then enters the proventriculus where it is mixed with acid and pepsin (an enzyme which breaks down protein) and then on to the gizzard.

The gizzard acts like a grinding mill to

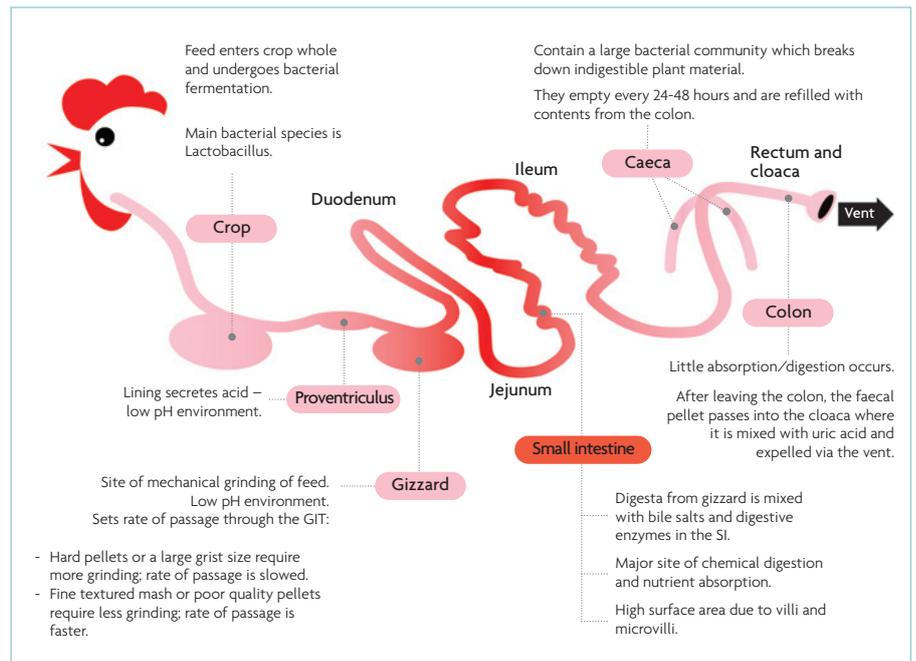


Fig. 1. The gastrointestinal tract of a chicken.

break the feed into smaller particles; once the feed particles are small enough, they are then released into the small intestine. Whilst the gizzard grinds the feed is mixed with the acid and enzymes secreted by the proventriculus.

This process allows for the precipitation and breakdown of whole proteins into smaller peptides which can then be digested in the small intestine into amino acids for absorption. Within the small intestine the carbohydrates and fats are also broken down so that they can be absorbed and used by the birds.

During the normal digestion process, by the time the digesta reaches the last part of the ileum all the proteins, fats and carbohydrates should have been absorbed leaving behind the non-digestible components of the feed (for example, cellulose, non-starch polysaccharides etc).

This material has two fates; it is either passed out in the faeces or taken up by the caeca where bacteria ferment these materials to form organic acids, short chain fatty acids and vitamins which the bird can absorb for extra nutrients.

Gut inhabitants

The gastrointestinal tract (GIT) contains a diverse community of bacteria, fungi, protozoa, and viruses (collectively known as the gut microbiota).

It has been estimated that the GIT of a broiler chicken is colonised by an estimated 600-800 species of bacteria, the abundance and diversity of which varies along the length of the GIT.

The development of the adult gut microbiota predominantly begins on hatching; bacteria are picked up from the environment, the feed, and the people handling the chicks post-hatch.

Each of these three areas can therefore affect gut microbiota development. The first bacteria entering the gut can be considered as the pioneering bacteria as they will rapidly multiply and colonise the GIT.

It can take 3-4 weeks for the microbiota of the gut to develop fully; optimal brooding conditions along with good feed and water quality will ensure stability of the gut is reached sooner.

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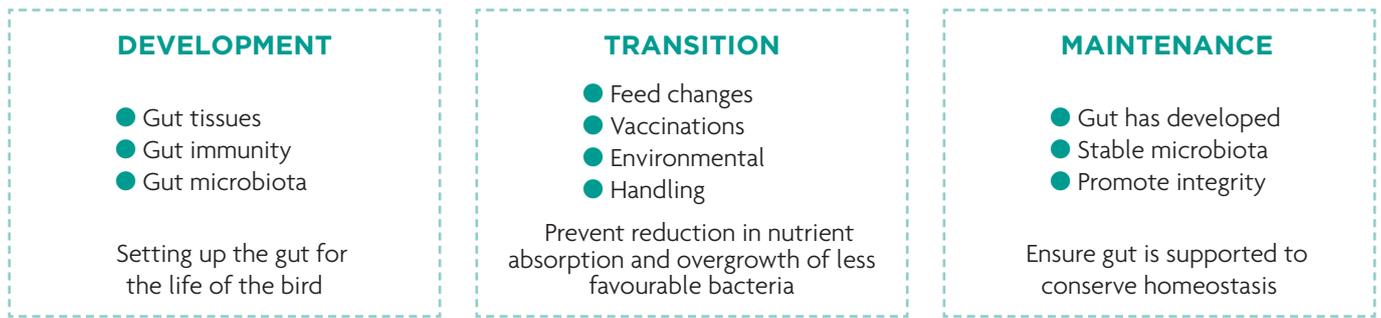


Fig. 2. Understanding the needs of the gut at different points in the bird's life and the main goals of gut health support at these times.

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Role of the intestinal microbiota

The microbiota in the gut have an extremely important role in the health and well-being of the host.

The bacterial community of the intestinal microbiota form a protective barrier which lines the gut, preventing the growth of less favourable/pathogenic bacteria such as salmonella, campylobacter and Clostridium perfringens.

In addition, animals that lack a gut microbiota have been shown to be more susceptible to disease and have poorly developed immune tissue. Intestinal microbiota can also influence the growth rate of the host by producing extra nutrients through the fermentation of plant fibres that the birds can not digest themselves.

Maintaining the balance of gut health

Maintaining good gut health is critical for maintaining the growth, health, and welfare of the bird.

If digestion and nutrient absorption is compromised an imbalance or overgrowth of the gut microbiota can occur which in turn will affect bird health and performance.

The balance of the microbiota in the gut can be significantly affected by bird management, feed quality and also the environment.

● Diet:

The most influential factor on the composition of the gut microbiota. Raw materials, nutrient density and feed form all influence the balance of the gut microbiota.

● Water quality:

Water quality and line management are essential for long term gut health and bird performance, and failure to monitor and promote water quality on farm can reduce gut health.

● Brooding conditions:

During the first week of life the gut undergoes rapid maturation and the provision of optimal brooding conditions is therefore essential for ensuring optimal development of the gut tissues, immune system and microbiota. Early access to feed and water is essential.

● Biosecurity:

If clean-out and disinfection procedures and subsequent on farm biosecurity are inappropriate, the birds may be exposed to pathogens which may have a negative influence on gut health and development.

● Risk periods:

There are times during poultry production when the bird will be challenged, for example during feed change-overs or vaccination. During these periods, the gut microbiota can fluctuate and in some cases, if management is sub-optimal, dysbacteriosis can occur.

● Environmental conditions:

Temperature and ventilation. Achieving optimal environmental conditions will promote good gut health.

● Mycotoxins:

Mycotoxins and infections will also impact gut health.

Gut health additives

There are many products available to support gut health. Varying in their mode of action and impact on the gut, choosing the right product can be difficult.

Consequently, when deciding what product to use it is essential that the cause of the gut health issue is known. Any product administered should offer a solution to the needs of the gut at significant points in the chicken's life (Fig. 2).

Conclusions

Maintaining the balance of good gut health is a key aspect of getting the best growth and FCR out of any food-producing animal. Many researchers have attempted to understand gut microbiota, gut function, and gut immunity. It is increasingly evident that the gut remains a highly complex area.

Regional variations in poultry production, management styles, climate, disease challenge, and feed raw materials add further complexity to maintaining good gut health but what is clear is that developing and maintaining gut health through good bird management practices is key to maintaining bird health, welfare, and performance. ■