

## Plenary 4: Gut Physiology: Gut Function and Nutrition

### Energy metabolism in broiler chickens is influenced by digesta transit time and gut microflora

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**Background** – Feed is the largest single cost factor (60%) in production of chicken meat, with energy being a major contributor to feed cost. Modern breeds of chickens have the genetic potential to convert less than 1.7 kg cereal grain to 1 kg lean chicken meat. The economy of the Australian chicken meat industry is characterised by small profit margins and rapid throughput. Annual production exceeds 800,000 tonne of chicken meat and utilises approximately two million tonne feed.

**Digesta transit time** – Modern breeds of broilers have a prodigious capacity to eat (1), a relatively short retention time for ingested food (2), and greater absorptive capacity compared with egg laying hens (2). Among broilers, a selection line with slower transit time retained more energy and protein than another line with faster transit time (3). A recent study examining natural variation in transit time showed that apparent metabolisable energy (AME) and whole tract transit time were positively correlated and that this relationship was unaffected by gender (4). On the other hand, non-starch polysaccharides (NSP) in wheat, barley and triticale can form a viscous gel in the gut which impedes digesta flow, has detrimental effects on digestion and absorption of nutrients, and can lead to proliferation of bacteria in the small intestine (5).

**Gut microflora** – The gut of the newly hatched chicken is free of organisms (6). Shortly after hatching, chickens are exposed to ubiquitous microorganisms in the hatchery and on arrival on the farm. These organisms proliferate as they compete for various niches in the microenvironment of the gut (7). The profile of the gut microflora is also likely to change with the age of the chicken in response to ingestion of various types and amounts of substrates such as complex carbohydrates in the diet. In turn, deconjugation of bile salts by gut organisms can reduce lipid absorption (8). Further, the gut microflora influence quantity and composition of mucus secreted by goblet cells (9,10), and subsequent mucus degradation (9). Finally, microbial fermentation can lead to relatively large losses of energy and nutrients through expiration of hydrogen and methane in breath (11,12) in addition to faecal losses of volatile fatty acids. Recently, increased AME in chickens was linked with composition of microbial communities (13) in chickens fed different diets. Many species contributed to the differences between microbial communities. This finding (13) emphasises the complexity of the interplay between bacterial species, and the host with its microbial community, and the impact it can have on nutrient requirements and growth performance (14).

**Conclusion** – Gut microflora compete for energy and other nutrients thus slowing the rate of growth and reducing feed efficiency. In addition, microbial proliferation can have detrimental effects on health and welfare of chickens through inflammation of the gut, invasion of tissue by pathogens, and tissue repair once infection subsides.

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