

IMMUNOGENIC INGREDIENTS: EVOLUTION OF A CONCEPT

Nick Dale
Poultry Science Department
University of Georgia
Athens, GA 30602

Nutritionists fully appreciate the existence of a wide variety of deleterious substances which may be present in poultry feeds. Among these, several of the best known are tannins in sorghum and gossypol in cottonseed meal. These occur naturally and serve a function in the respective plants. Anti-nutritional factors such as the tripsin inhibitor in soy compromise bird performance but can be destroyed by heating. Other classes of deleterious compounds are the mycotoxins, which are resistant to heat, and peroxides which can develop in fats.

In recent years, studies have confirmed the existence of other problematic substances which may be present in feeds, these being the immunogenic factors in certain ingredients. Although it would not be technically accurate to classify these as allergenic, due to the nature of the animal's response the effect is quite similar. That is, an immunogenic factor would be one which, while not being deleterious in its own right, causes an immune reaction in the animal. If the substance does not in and of itself present a threat to the animal's health and performance, this immune response is unnecessary and counter-productive.

In poultry and swine feeds, the immunogenic substance which has been most studied are the β -mannans which occur naturally in ingredients such as soy (1) and palm kernel meal. Originally it was thought the principal negative impact of β -mannans was to reduce the digestibility of nutrients in the feed, and to a certain extent this is true. However, in recent years it has been demonstrated that the destruction of β -mannans (through the use of the β -mannanase enzyme) principally benefits the health of the animal. Several studies have demonstrated a reduction in levels of acute phase proteins in the plasma of birds consuming diets formulated with soybean meal but supplemented with the β -mannanase enzyme (2,3). As acute phase proteins (specifically, AGP in birds) are excellent indicators of the activity of the innate

immune system, it is concluded that the β -mannans in soy are in fact immunogenic. While an immune response is of obvious value in the presence of a pathogen, it is counter-productive in the absence of a legitimate challenge. Klasing (4) has described the negative effects of the innate immune response on productivity. The anorexia, inflammation, fever, muscle catabolism, and production of cytokines and acute phase proteins are clearly incompatible with maximum productivity. Hence, the destruction of immunogenic factors in the feed such as β -mannans enables the animal to focus resources on productivity and direct them to defend the body against legitimate threats such as pathogens. This was in fact demonstrated by Jackson, *et al.* (5) who observed improved performance of chicks infected with *Eimeria* sp. and *C. perfringens* when a corn-soy diet was supplemented with β -mannanase.

Observations in this laboratory have confirmed a great variation in plasma levels of acute phase proteins between individual chicks. Upon eliminating the immunogenic threat, the more sensitive chicks appear to have achieved a greater growth rate, thus improving flock uniformity. Reports in the literature (6) and at this laboratory have observed an increase in the size of eggs early in the laying cycle when feeds were supplemented with β -mannanase. This is taken to confirm a positive productive response to the elimination of the immunogenic factor.

While the principle impact of reducing the immunogenic factors in the feed may be to improve bird health (and thus productivity), the indirect effect on nutrition cannot be ignored. Klasing (4) has indicated that an acute phase response may divert up to 10% of ingested nutrients away from productive processes. In the case of energy, consideration must be given not only to metabolizable energy but also to net energy. Thus, assays structured to measure the absorption of energy containing substrates would not take into account the efficacy of post-absorptive utilization. If fewer calories are diverted to support an unnecessary acute phase response, this energy will be more readily utilized for productive, as opposed to maintenance, functions. This effect will not be detected in metabolizable energy assays, which are restricted to measuring absorption and not productive efficiency.

At present, the β -mannans in soybean meal have received by far the most attention as immunogenic factors in feed. The possible presence of similar factors in other feed ingredients needs to be investigated. The numerous novel ingredients becoming available to the feed industry may well contain factors stimulating an immunogenic response.

References

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