



Review

Whole grain feeding: Methodologies and effects on performance, digestive tract development and nutrient utilisation of poultry



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ABSTRACT

There is growing interest world-wide on the feeding of whole grains to broilers a means of lowering feed costs and because of the reported positive effects on digestive function. When finely ground, pelleted diets are fed, enlargement of proventriculus and atrophy of gizzard are observed and there is mounting evidence that these adverse effects can be effectively overcome by whole grain feeding. Whole grain feeding is also attractive as it meets the consumer demand for natural feeding in animal production systems. In addition, there is evidence that whole grain feeding may positively influence gut microflora ecology and incidence of coccidiosis. These beneficial effects have been attributed largely to the influence of whole grain feeding on the development and functionality of the gizzard. However, published data on the effects of whole grain feeding on performance of broilers are contradictory due to a number of confounding factors, including differences in experimental methodology, inclusion level of whole grain, type and quality of grain, age of birds, and feeding regime. Most published data are based on whole wheat and data on other grains are scarce. In view of absence of a comprehensive review on this important aspect in poultry nutrition, available literature on the influence of whole grain feeding on the performance, digestive tract development, intestinal microflora and nutrient utilisation are reviewed. The main factors responsible for the variable responses reported with whole grain feeding are also highlighted.

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Abbreviations: AGP, antibiotic growth promoters; AME, apparent metabolisable energy; FCF, free choice feeding; MF, mixed feeding; SF, sequential feeding; PRP, pre-pelleting; PP, post-pelleting.

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1. Introduction

Feed cost accounts for up to 65% of the production cost of chicken meat and eggs, and therefore attracts attention as a major opportunity to lower the product cost and increase profits. One type of feeding programme that has found favour, through reduction of handling and processing costs of the feeds, has been the feeding of whole grains with a balanced concentrate, typically a crumble or pellet. Some technologies lend themselves to commercial adoption without extensive science supporting the mechanisms involved or even the best methods of application. The feeding of whole grains, usually whole wheat, is one such technology. Most published data are based on whole wheat and data on other grains are scarce despite maize being the most commonly used cereal grain in poultry diets worldwide. In broilers, whole wheat feeding is common commercial practice in Europe (particularly Scandinavia, United Kingdom and the Netherlands), Australasia and Canada under a variety of forms. In some parts of the world, whole wheat feeding is also used as part of a strategy for broiler breeders and table egg layers.

The primary aim of whole grain feeding is to lower feed costs by eliminating the grinding step. Furthermore, this also meets consumer demands for a natural feeding system and improved animal welfare (Gabriel et al., 2008). Whole grain feeding is thought to encourage colonisation of commensal bacteria and discourage proliferation of harmful bacteria that cause diseases or compete for nutrients in the distal intestinal tract. It has also been reported to have beneficial effects on prevention of coccidiosis (Cumming, 1989). Whole grain feeding obtains its benefits from a combination of two physiological actions - the physical and functional benefits of a larger, stronger gizzard and the better matching of daily requirements through self-selection by the bird.

Published literature on the effects of whole grain feeding on performance and nutrient utilisation of broilers, however, have been contradictory, with some reports showing beneficial effects, while others failing to show any advantages and some showing poorer performance. These results are difficult to interpret as researchers have rarely employed similar methodology which would allow for direct comparisons of data. The discrepancy among published reports is due to a number of confounding factors, including differences in feeding strategies, inclusion level of whole grain, length of feeding, age of birds, training and, type and quality of grain. Despite growing interest in whole wheat feeding and its commercialisation, the potential usefulness and challenges in this approach has not been extensively reviewed. To the authors' knowledge, the only relevant published paper is a short overview by Rose (1996), almost two decades ago. The aim of the current work is to compare the different methods of whole grain feeding and to review available data on the influence of whole wheat feeding on the performance, digestive tract development and nutrient utilisation of poultry. Factors that may be responsible for the variable responses reported in the literature are also discussed.

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