



Final report summary

The response of broilers to insoluble fibre and
exogenous enzymes in low protein diets



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Abstract

This project investigated whether adding fibre sources and/or protease to low protein broiler diets can mitigate the poorer performance and gut health outcomes associated with such diets.

The study showed that reducing dietary crude protein by 20 g/kg or less negatively affects the growth performance of broilers and increases abdominal fat pad, even when diets are supplemented with crystalline amino acids (AA) to meet the minimum required digestible AA content.

However, the supplementation of sugarcane bagasse at 20 g/kg in both normal and low crude protein (CP) diets decreased feed conversion ratio (FCR) and increased weight gain and relative gizzard weight of birds. Thus, the performance loss in broilers associated with a 20 g/kg reduction in dietary CP can be fully restored for FCR and partly restored for body weight.

Furthermore, the study showed that including exogenous protease in low protein diets improves performance in broilers.

Background

A current focus of the Australian poultry industry is on developing a low CP feeding program for broilers. Low protein diets can reduce the industry's dependence on imported soybean meal, as more crystalline AA will be used in feed to meet the AA requirement of birds. However, as dietary CP is reduced, growth performance is often impaired, body fat and fat pad weight increase, and gut health is negatively affected. These effects are more pronounced in broilers fed a wheat-based diet compared to a corn-based diet, and this brings a further challenge as broiler diets in Australia are predominantly based on wheat.

The performance loss in broilers associated with feeding a low CP diet cannot be fully recovered by supplementing essential AA. To restore this performance loss, the use of the specific non-essential AA, whole grains and enzymes has been explored, but with limited success. Thus, there are still challenges associated with feeding broilers a low CP wheat-based diet, and more measures need to be investigated before the industry can effectively use a low CP diet.

Research has shown that adding sugarcane bagasse and other fibre sources to diets improves performance. However, whether they improve performance when incorporated in a reduced protein diet remains unclear. This project investigated the effects of insoluble fibre and/or protease as a nutritional strategy to improve the growth performance and gut health of broilers.

Objectives

This project aimed to examine whether the growth performance and gut health outcomes of broilers fed a low CP diet can be enhanced through the supplementation of different sources of insoluble fibre and protease in feed. The outcomes of this project will lead to the more effective use of protein in broiler diets, which could potentially reduce the cost of feed, enhance gut health, minimise the incidence of wet litter and mitigate the nitrogen excretion from birds that results from undigested protein.

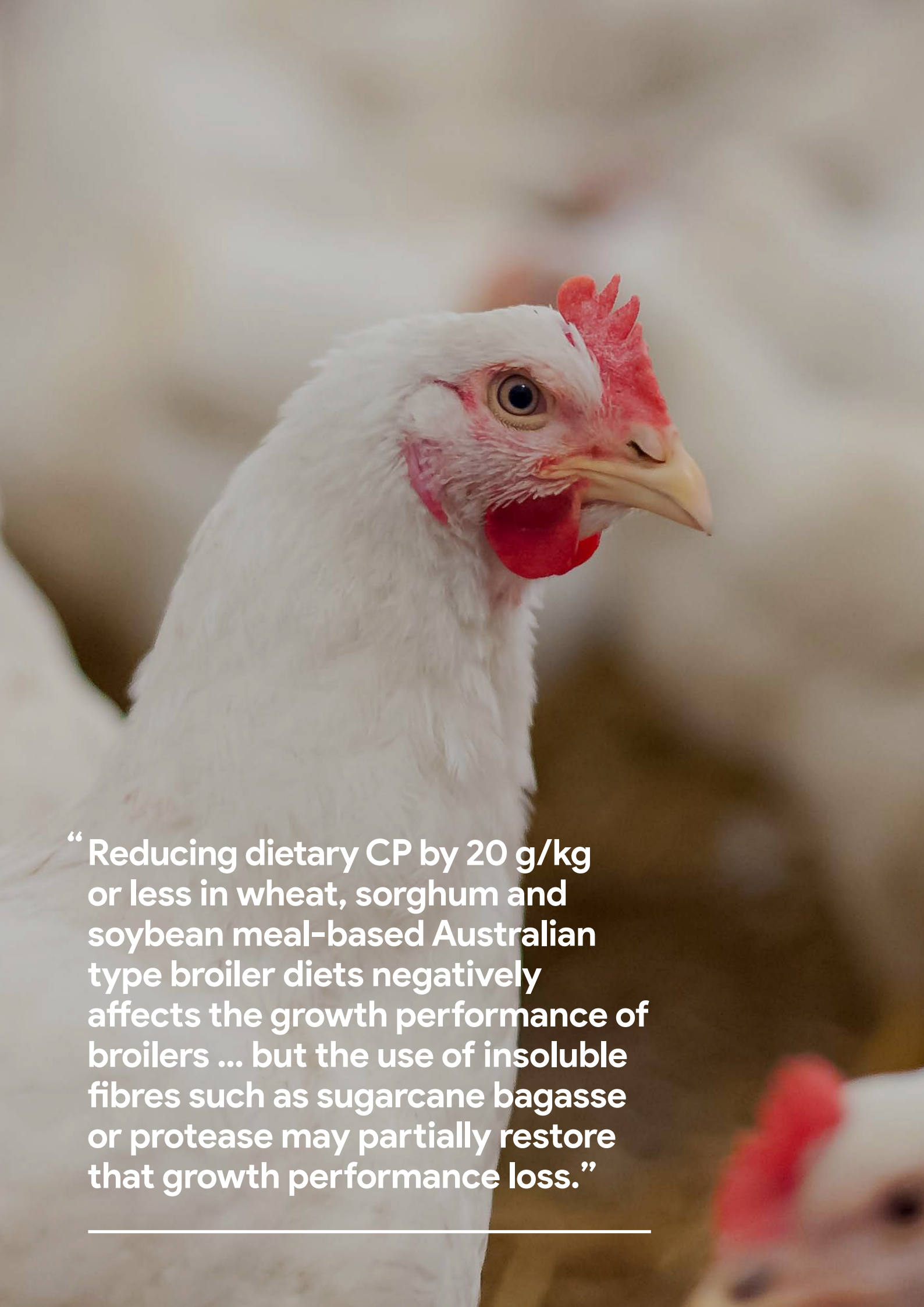
Research

Three experiments were conducted to investigate the roles of insoluble fibre and exogenous protease in low protein diets fed to broilers. In each experiment, 672 day-old Ross 308 male parent-line broiler chicks were used. On arrival, chicks were randomly assigned to 48 floor pens of equal size in an environment-controlled facility.

The treatment grower and finisher diets were offered as 3 mm pellets from day 10 to 24 and day 24 to 35 respectively. The diets were based on wheat, sorghum and soybean meal, and were formulated to meet the Ross 308 nutrient specifications. The low protein diets were supplemented with crystal AA to meet the minimum requirements.

The parameters measured include growth performance, carcass yield, water intake, nutrient digestibility, gut microflora, gene expression of digestive enzymes, tight junction proteins and nutrient transporters. Feed intake, weight gain and mortality-adjusted FCR were determined in all the experimental phases. Water intake was measured at two time points in each experiment.

The first experiment employed a 2 × 2 × 2 factorial arrangement of treatments, with normal or reduced protein, sugarcane bagasse at 0 or 20 g/kg, and protease at 0 or 0.2 g/kg. The second experiment had six treatments: a normal protein diet, a low protein diet, and low CP diets formulated with either sugarcane bagasse, lignocellulose, oat hulls or soy hulls. The third experiment had six treatments: a normal protein diet, a normal protein diet with 30 g/kg soy hulls, and four low protein diets progressively lowered in dietary protein by 10 g/kg with 30 g/kg soy hulls.



“Reducing dietary CP by 20 g/kg or less in wheat, sorghum and soybean meal-based Australian type broiler diets negatively affects the growth performance of broilers ... but the use of insoluble fibres such as sugarcane bagasse or protease may partially restore that growth performance loss.”

Outcomes/key findings

The study found that reducing dietary CP by 20 g/kg or less in wheat, sorghum and soybean meal-based Australian type broiler diets negatively affects the growth performance of broilers and increases abdominal fat pad, even when diets are supplemented with crystalline AA to meet the minimum required digestible AA content.

The use of insoluble fibres such as sugarcane bagasse or protease may partially restore the growth performance loss associated with feeding a low CP diet. Insoluble fibres in low CP diets had no impact on water intake and water-to-feed intake ratio, indicating that litter quality will not be negatively affected by the inclusions of insoluble fibres at a relatively low level.

The source of the insoluble fibre is important as fibres differ in composition and particle size distribution. Among those studied in this project, sugarcane bagasse showed benefit, soy hulls showed variable results, but oat hulls and lignocellulose did not show a beneficial effect when added to the reduced protein diet.

Implications and recommendations

Poultry nutritionists, researchers, stock feed manufacturers and poultry producers will benefit from the outcomes of this study. It is recommended that nutritionists and stock feed manufacturers add certain types of insoluble fibre, such as sugarcane bagasse, to broiler diets. This will help to stimulate gizzard function, cap dietary starch-to-CP ratio, modulate starch-CP digestive dynamics and allow better AA uptake relative to glucose in the small intestine to improve FCR of birds.

Further research is warranted to examine the effect of different inclusion levels and particle size distribution of fibres on the performance of broilers fed low CP diets, and the effect of soy hulls in low CP diets.

Publications

Sharma, N. K., Kheravii, S. K., Gurney, K., Choct, M. and Wu, S.-B. (2021). Response of broilers to dietary inclusions of different insoluble fibre sources in a reduced crude protein diet. *Proceedings of the Australian Poultry Science Symposium*, 32:134

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Sharma, N. K., Dawson, B., Johnson, C. M. and Wu, S.-B. (2021). Water intake in broilers as affected by insoluble fibres and exogenous protease in a reduced crude protein diet, *Proceedings of the Australian Poultry Science Symposium*, 32:178.

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