FINAL REPORT FOR THE PROTEIN RESEARCH FOUNDATION

A COMPARISON OF THE RESPONSE TO DIETARY PROTEIN BY COBB AND ROSS BROILER STRAINS USED IN SOUTH AFRICA

R M Gous

University of KwaZulu-Natal

February 2015

CONTENTS

Executive summary

A comparison of the response to dietary protein by the Cobb and Ross broiler strains used in South Africa

R M Gous
University of KwaZulu-Natal

This report takes the form of a four scientific papers that have been published on the research that has been conducted for the PRF over a period of about six years. Two avenues of research were used to explore differences in the response to dietary protein of the two main commercial broiler strains used in South Africa at present. In the first, a range of dietary protein levels was fed to each strain and the response in food intake and growth rate was measured. In the second, the response of the two strains in body protein gain and in the growth of the different physical parts of the body was measured to a range of dietary protein levels.

The first demonstrated that the response to dietary protein in growth and food intake of the Cobb and Ross strains differed substantially. For example, the Cobb strain increased food intake as dietary protein was reduced thereby showing a relatively slight drop in growth rate but a large decrease in food conversion efficiency (FCE). Food intake in the Ross strain, on the other hand, did not increase as protein decreased, so growth rate was severely reduced, but FCE was not as severely reduced as with the Cobb strain. In addition, mortality increased and uniformity decreased more in the Cobb than in the Ross under these conditions. Performance by the Cobb strain did not increase with dietary protein content, but the Ross strain continued to exhibit improved growth rate and FCE. These results indicate that the optimum dietary protein content for the two strains would differ as the cost of dietary protein or the revenue obtained from the sale of the broiler was changed. A paper reporting the results of this trial was published in the South African Journal of Animal Science (Berhe and Gous, 2008).

The second avenue of research aimed at determining differences in the response of broiler strains to dietary protein was to determine to what extent the yield of parts (breast, thigh, drum, wing) could be altered in response to changes in dietary protein content. Many reports claim that improvements have been made in the yield of parts (breast meat in particular) of broilers, with resultant 'high yield' strains having been developed by some breeding companies. Similarly, there are numerous claims that breast meat yield can be increased by altering dietary nutrient specifications, for example by increasing dietary protein content. In two comprehensive studies the response in body protein gain and in the growth of the different physical parts of the body was measured to a range of dietary protein levels. The responses in this case depend upon the manner in which the results of the trials are interpreted: when measured at an age or at a given body weight, wide differences are noted in the weights of these parts between both strains and sexes, whereas when plotted against the weight of body protein (i.e. allometric relationships) no differences are observed between strains or sexes. The only differences shown in these allometric plots were when low protein feeds were given, in which case the weight of each part was heavier at a given body protein weight than when higher protein feeds were given because of the additional lipid that accumulates in these tissues when low protein feeds are given. The amount of lipid that accumulates in each tissue differs, as is evident when comparing skin, breast meat and thigh meat, so the same correction cannot be applied to all tissues of commercial importance.

Essentially, the results of these allometric studies indicate that the relationships between body protein and the physical parts of the body have remained fixed in spite of the efforts by geneticists to alter these by selection. The improvement seen in breast meat yield at a given body weight is due to a reduction in the amount of body lipid that can be deposited in the carcass, brought about inadvertently by selecting for

breast meat yield. This has important consequences when feeding modern commercial broilers in that they are less tolerant of low protein feeds as they no longer have the capacity to overconsume energy as a means of overcoming a shortage of dietary protein. Two scientific papers have been published reporting the results of these trials (Danisman and Gous, 2013; 2014)

In a trial that links this project with another PRF-funded project (The effect of lighting on the efficiency of utilisation of dietary protein by Cobb and Ross broiler strains used in South Africa) the effect of feeding higher levels of dietary protein to broilers kept under different daylengths was measured in an attempt to understand the reason for the lower breast meat yield in broilers kept on short daylengths. The results were disappointing in that the higher protein feeds did not improve breast meat yield in broilers on 12-h light. Some other reason for this reduced yield on short daylengths needs to be found as every other performance parameter favours the use of 12-h lighting programmes for growing broilers. A paper on this research has recently been published (Mlaba, Ciacciariello and Gous, 2015).

Two interesting observations made whilst conducting these trials lend themselves to further research. It appears that day-old breast and wing weight is influenced by the nutritional status of the embryo, which suggests that *in-ovo* feeding of the embryo, or the nutrition applied immediately after hatching may influence the breast meat yield of broilers later in life. And secondly, to improve the accuracy of prediction of component weights as influenced by strain, sex and dietary protein content the minimum and maximum amounts of lipid that can be deposited in each of these components by different broiler strains should be measured.

The research described in this Final Report is of considerable significance in commercial broiler production.

- It demonstrates that genotypes differ in their response to dietary protein, which implies that the optimum economic levels of dietary protein used for each strain will differ under a given set of circumstances, and that these optimum levels will also differ within a strain under different circumstances. To determine the optimum level of feeding each strain its genotype needs to be accurately described and the use of a simulation model that predicts voluntary food intake is essential.
- Differences in yield of parts, which are evident between genotypes when measured at an age or at a given weight, increase the complexity of determining the optimum economic level of protein feeding between genotypes, but because the allometric relationships between the parts and body protein remain the same over all genotypes and sexes, predicting the effect of feeding different protein levels to these strains is straightforward.
- Where broiler producers are not concerned with selling further-processed products, a 12-h lighting program provides the optimum conditions for commercial broiler production, under which circumstances dietary protein is most efficiently utilised. However, where breast meat yield is of importance, the lower breast meat yield on a 12-h light schedule cannot be rectified by feeding higher levels of dietary protein. Some other explanation for this decrease in yield needs to be found.

R M Gous
February 2015