

Effect on the Growth and Development of Chickens When Cottonseed is Substituted for Soybean in Their Diets

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Introduction & Objectives

An inexpensive source of animal protein for internal consumption would be most welcome in Uzbekistan. Toward that end, we are seeking new sources of plant protein that can safely be used as a feed for broiler chickens. The Food and Agriculture Organization of the UN estimates that Uzbekistan produced more than 2,250,000 metric tons of cottonseed in 2009. This cottonseed cannot be fed to non-ruminant animals such as chickens because it contains the animal toxin gossypol. Gossypol occurs as two enantiomers referred to as (+)- and (-)-gossypol. Most of the toxicity of gossypol resides in (-)-gossypol. We are currently developing cotton plants that contain a high percentage of the less toxic (+)-gossypol in the seed. To assess the potential usefulness of this new high (+)-gossypol seed we have begun a series of chicken feeding experiments using commercially available cold pressed cottonseed meal. The commercial cottonseed used in this study contained 1.57% total gossypol and the (+)- to (-)-gossypol ratio was 63.2:36.8. We now report the results of these early experiments.

Results & Discussion

Birds were fed diets containing 23.2% cottonseed meal (CSM), or 15% CSM and a control with no cottonseed. Differences in the physiological health among experimental groups were not visually evident. Thus, chickens in all groups were active, willingly ate feed, and developed normally. However, birds receiving the 23.2% CSM Diet exhibited some digestional distress as evidenced by abnormal excrement, and the differences in body weight between this group and the control were evident after 4 weeks, while after 8 weeks they weighed 10% less than those on the Control Diet. Conversely, even after eight weeks the body weights of the birds receiving the 15% CSM Diet were not statistically different than those on the Control Diet (Figure 1).

Examination of the internal organs and tissues of the euthanized animals receiving the 22.3% CSM Diet showed an increased deposition of fatty tissue in the ventricular muscle, myocardium, abdomen and other organs; these fatty deposits were apparently largely due to the cellular content of the birds. Effusion in the myocardium and abdominal cavity was also observed in a majority of chickens on the 22.3% CSM Diet. This was also observed in some birds receiving the 15% CSM Diet. In addition, broilers receiving the 22.3% CSM Diet showed inflammation mucous in the small and large intestines. These changes were characteristic for chickens 6-8 weeks of age.

Experimental

One-day-old chickens (60) were fed either a standard diet (Control Diet), or diets in which 15% or 23.2% of the soybean meal was replaced with commercial cottonseed meal (15% CSM Diet, and 22.3% CSM Diet, respectfully) for eight weeks. Birds were weighed at the end of each week. At the end of 1, 3, 5, 7 and 8 weeks, 12 birds were euthanized and samples of liver, breast and gizzard were freeze dried and submitted for gossypol analysis. Results of the gossypol analysis are reported elsewhere in these Proceedings (Golubenko, et al.).

The broilers were euthanized after 1, 3, 5, 7 and 8 weeks and their internal organs were visually examined. In addition, their liver, breast muscle, and gizzard were frozen, and submitted for gossypol analysis.

Conclusions

The analysis from these initial studies indicates that broilers fed a diet containing perhaps as much as 15% cottonseed meal could be profitably utilized in Uzbekistan, especially if it contained a high percentage of the less toxic (+)-gossypol. However, a separate Poster presented in the 2010 Beltwide Cotton Conference Proceedings (Golubinko et al.) reports the results of preliminary studies on the gossypol content of tissue taken from chickens fed cottonseed in this study. They found gossypol was present in tissues from these chickens. Thus, a question remains concerning the suitability of human consumption of chicken meat that contains trace amounts of the toxin, gossypol. Additional studies are indicated to determine how quickly gossypol is eliminated from various chicken tissues.

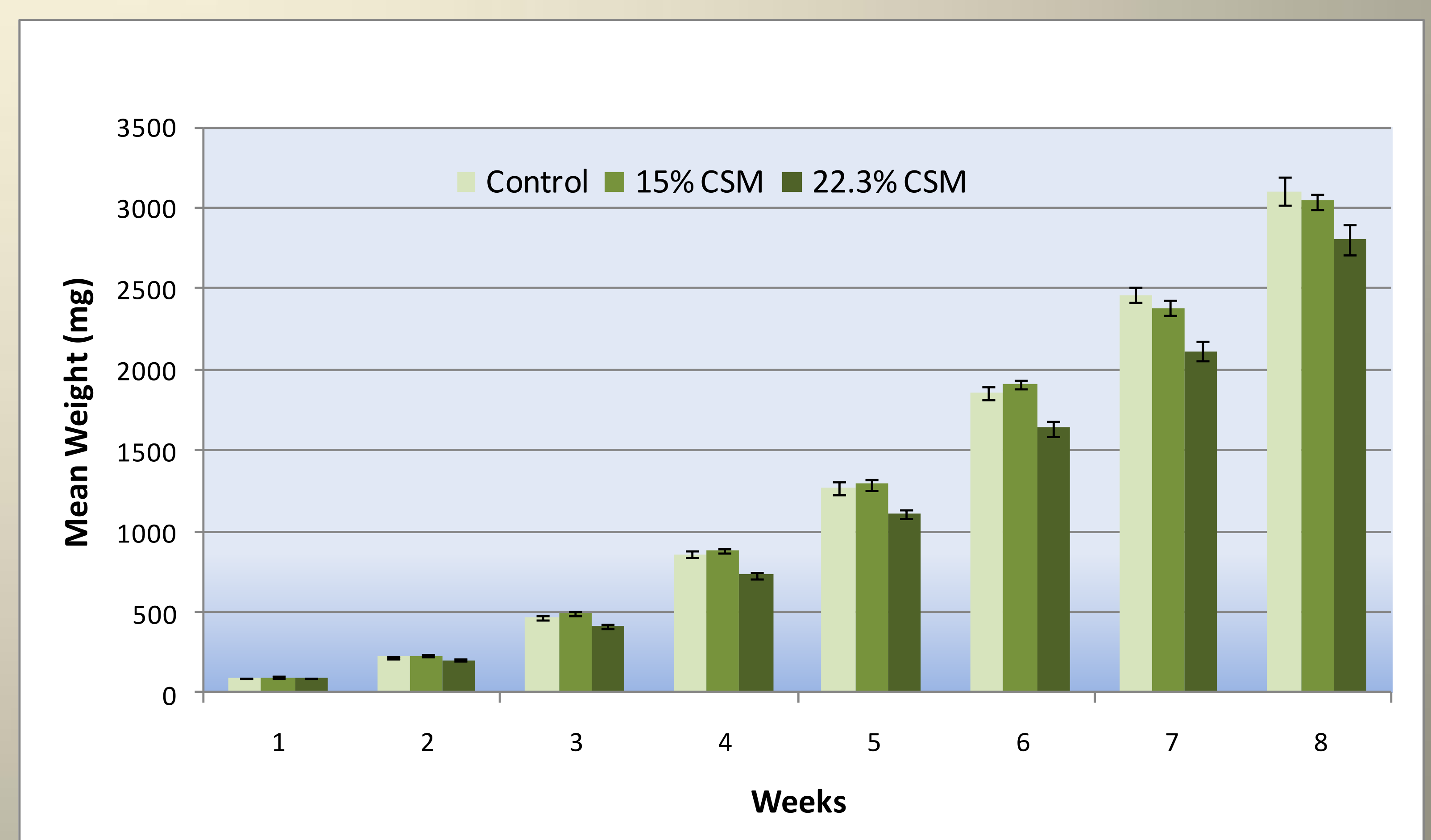


Figure 1. Mean body weight of broilers fed a control diet, and diets containing 15% and 22.3% cottonseed meal in place of soybean meal.