The growth performance of broiler chicks fed with diets containing cottonseed meal supplemented with lysine

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SUMMARY

The aim of this study was to investigate the effects of diets containing cottonseed meal (CSM) supplemented with lysine in substitution for soybean meal (SBM) on growth performance of broilers.

A total of 300, 7-day-old broilers were randomly assigned to 3 groups. The chicks were fed with corn-soy based starter diets (control group) or fed with 20% CSM based diets supplemented with 1.5% or 3% lysine (experimental groups) during 15 days.

Higher body weights were observed in group treated by CSM-1.5% lysine than in group treated by CSM-3% lysine (p<0.01). But, no significant differences in body weight, daily body weight gains, daily feed intake, and in feed conversion ratios were found between experimental and control groups during the experimental period.

In conclusion, this study indicates that CSM with adequate supplementation of lysine could be incorporated in broiler diets without reduction of growth performance.

Keywords : cottonseed meal - lysine - growth performance - broiler.

Introduction

Soybean meal (SBM) is the most widely used protein source in the formulation of poultry diets. However, when the price of soybean meal increases, cottonseed meal (CSM) will be considered as a potential source of protein for poultry, despite low protein quality, high fiber content and toxic effects of gossypol [9,16]. Gossypol is a natural plant toxin and serves as plant defense mechanism against insect and herbivore damage. Some « glandless » varieties of cotton which have very low content of gossypol have been developed, but these varieties need a frequent use of insecticides to well growing. Gossypol is associated with depressed weight gains, increased feed intake, decreased feed efficiency, and increased mortality in chickens [14]. This toxic compound induces primarily heart damage, and deaths due to heart failure have been reported [3]. However, some feeding have also shown that chick’s performance was not significantly affected when the dietary content of free gossypol was lower than 200 mg/kg of feed [10]. It is well documented that gossypol binds to lysine and reduces the absorption of this amino acid. Therefore, lysine was added to CSM as a percentage of its protein content to improve feeding value, presumably by detoxifying gossypol [19]. Extensive feeding studies have shown that addition of ferrous sulfate to rations containing CSM reduced the adverse effects of gossypol on swine and poultry [2]. The two most important factors, which have to be considered for evaluating CSM assessment in poultry nutrition, are free gossypol amount and protein quality. A high concentration of dietary free gossypol depresses feed consumption and feed utilization [13]. FERNANDEZ et al. [6] reported that reduction in body weight was mainly due to depression of feed consumption.

The objectives of the present study were to analyze the effects of diets containing cottonseed meal supplemented with lysine on the broiler performance.

Material and methods

1. ANIMALS

Three hundred 7-days old (Ross 308) broiler chicks were randomly assigned to 12 litter pens. There were three diet groups; each group was fed to four replicate pens of 25 pouls each. The bird density was 13 birds per square meter. Food and water were supplied ad libitum. A light/dark cycle of 23:1 h and a room temperature of 22-35°C was maintained throughout the 15 days experimental period (from the 7th day to the 21st day).

RÉSUMÉ

Croissance des poulets nourris avec des tourteaux de graines de coton supplémentés en lysine. Par M.A. AZMAN et M. YILMAZ.

L’objectif de cette étude est d’explorer les effets de rations contenant des tourteaux de graines de coton (CSM) supplémentés en lysine au lieu de tourteaux de soja sur la croissance des poulets.

Au total, 300 poulets âgés de 7 jours ont été répartis au hasard en 3 groupes égaux. Les poussins ont été nourris avec un aliment de démarrage contenant mais et soja (groupe témoin) ou avec un aliment contenant 20% de tourteaux de graines de coton enrichis en lysine (1,5% ou 3%) (groupes traités) pendant 15 jours.

Les poids mesurés à la fin de l’expérimentation ont été plus élevés dans le groupe traité par CSM- lysine 1.5% que dans le groupe traité par CSM-lysine 3%. Cependant, les poids vifs finaux, les gains de poids quotidiens, les quantités distribuées d’aliments et les ratios de conversion alimentaire n’ont pas présenté de différence significative entre animaux traités et témoins.

En conclusion, cette étude indique que les tourteaux de graines de coton supplémentés de façon adéquate en lysine peuvent être incorporés dans les rations des poulets sans nuire à leur croissance.

Mots-clés : Tourteaux de graines de coton - lysine - poulet - croissance.
2. DIETS

A corn-and-SBM based broiler starter diet was fed from 7 to 21 days of age and was formulated according to NRC recommendations [12] with 21.28% crude protein (CP) and 3,178 kcal/kg Metabolic Energy (ME). The starter diets contained 57.40% corn with 29.50% soybean meal (control), and the experimental diets contained 43.80% corn, 21% soybean meal and 20% cottonseed meal supplemented lysine (L-lysine-HCl was added to obtain lysine percentages of 1.5% or 3% of protein in CSM). The experimental diets were shown in Table I.

3. CHEMICAL ANALYSIS

Feed samples were chemically analyzed for dry matter (DM), crude protein (CP), ether extract (EE) and crude ash according to AOAC [1].

4. GROWTH PERFORMANCE

Body weights (BW) and residual feed were measured on 7-day-old and 21-day-old chicks, and feed conversion ratio (FCR) was calculated (g feed/g gain).

5. STATISTICAL ANALYSIS

Data collected were subjected to analysis of variance, and where significant differences were observed, means were further subjected to Duncan’s multiple range test, using SPSS for Windows: 10.1, SPSS inc., [15]. The results were considered as significant when p values were less than 0.05.

Results

At 21 days, body weight was significantly affected by dietary treatment: chicks fed with diets formulated CSM containing 1.5% supplemental lysine presented a better body weight than chicks fed with CSM 3% lysine diets (P<0.01) (Table II). But, no significant difference was obtained between control and treated birds. Furthermore, daily weight gain, daily feed intake and FCR were not affected by CSM-lys supplementation into diets although slight but not significant increases of daily weight gain and feed intake and decrease of FCR were noticed in CSM-1.5% lys group (Table II).

Whereas one bird died in the control group, no mortality occurred in other two groups during all the experimental period.

Discussion

In this study, chicks fed with diets containing CSM supplemented with 1.5% lysine showed significantly higher body weights than birds receiving CSM diets enriched with...
3% lysine. However, no statistically significant difference in body weight, body weight gain, feed intake and FCR was obtained between control group and treated groups. These results were in agreement with previous reports. Indeed, WATKINS et al. [18] reported that until 21 days of age, body weight was not detrimentally affected by 30% CSM used as a protein source in starter diets. Furthermore, dietary free gossypol concentrations were roughly around 60 mg/kg. FERNANDEZ et al. [6] and WATKINS et al. [18] reported using digestibility coefficients from diets that adequate growth was allowed only when inclusion of CSM was 20%. Other studies have shown that CSM had negative effects on chick performance [5, 7, 9]. The presence of gossypol [5], the low lysine content [9], and the reduced protein digestibility [6, 7] could reduce chickens growth. In CSM, the lysine availability is low [7] and this amino acid was considered as the most limiting. True digestibility coefficients (61.2% lysine, 74.2% methionine, 67.2% cystine) were used in this experiment to compensate for reduction of amino acid availability. These values were lower compared to the unique value of 75% used for all amino acids by WATKINS et al. [18]. FERNANDEZ et al. [7] reported coefficients of digestibility in CSM of 64% for lysine, 72% for methionine, and 72% for cystine. Throughout this experiment, feed consumption tended to increase when the dietary levels of CSM increased to 21% and then decreased with dietary levels of 28% CSM, but differences were not statistically significant. Dietary CSM concentrations up to 28% (133 to 504 mg/kg free gossypol) did not induce any significant differences in cumulative body weight from 1 to 21 days from the control group [8]. CHAMRUSPOLLERT et al. [4] reported that excessive dietary lysine could increase the chick’s arginine requirement, because lysine is thought to interfere with the absorption of arginine in the intestine. NOVAK and SCHEIDELER [11] proposed another thesis: high lysine intake would have a detrimental effect on methionine and cysteine assimilation. These 2 arguments could explain why body weight of birds receiving CSM with 3% lysine were significantly lower than those of broilers receiving corn-soy based control or CSM with 1.5% lysine diets (Table II).

The present study also shows that addition of 1.5% lysine to the CSM resulted in FCR similar to the chicks fed with corn and soybean meal-based diets. WATKINS et al. [17] reported that dietary lysine addition (for replacing the small content lost with gossypol) did not notably improve feed efficiency of birds, which were fed with diets containing until 30% of low gossypol-CSM. FERNANDEZ et al. [6] formulated diets based on the total digestible amino acids and the authors were able to show improvement of feed efficiency of chicks fed with 20% CSM diets. But, GAMBOA et al. [8] reported that FCR of broilers receiving 28% CSM was not significantly different from values observed in the control group.

The results further suggest that diets containing 20% CSM supplemented with 1.5% lysine could be administered to broilers and provide satisfactory body weights and FCR.

References

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