

SUMMARY

The objective of this study was to determine what production and economic effects the replacement of genetically modified (GMO) soybean meal [conventionally, solvent-extracted soybean meal, or SE-SBM] by extruded soybean cake [extruded SB cake], supplemented with feed yeast and amino acids: methionine, lysine and arginine in diets for broiler chickens would have on various parameters. The SE-SBM content in the starter was reduced from 33.0% (control group) to 25, 18 and 0.0% for the experimental groups, while the extruded SB cake content was increased from 0.0% (control group) to 10% (low), 18.0% (medium) and 40.25% (high level), respectively. The content of SE-SBM in grower and finisher was lowered from 30.0% (control group) to 23.0; 15.0 and 0.0% the in experimental groups while the extruded SB cake content went up from 0.0% (control group) to 10.0% (low); 18.0% (medium) and 37.53% (high level), respectively. The above amounts of feeds were consequently followed by a 0, 25, 50 and 100% reduction of protein derived from SE-SBM in feed concentrates. In Experiment 1, an additional factor considered was chicken sex, and in Experiment 2, L-arginine supplementation. We studied the impact of experimental factors on: body weight in 21 and 42 day old chickens, their mortality rate, feed intake and conversion, carcass quality, chemical composition of breast and leg muscles, blood plasma contents, apparent intestinal digestibility of proteins and amino acids and the costs of broiler production.

Expeller oil pressing from seeds increased the amount of trypsin inhibitor in extruded SB cake by approximately 9.3%, while the extrusion of SB cake at a temperature of 120-138°C reduced its content from 22-25 to 2.5-4.2 mg/g of feed.

- Experiment 1: Growth and Digestibility

The split-plot design was used to carry out this experiment with two experimental factors, 640 Ross 308 hybrid broiler chickens assigned to 8 groups (extruded SB cake content, sex), and 8 replications with 10 chickens each. The replacement of SE-SBM by extruded soybean cake in feed mixes at a level of 25, 50 and 100% of soybean proteins at day 42 significantly reduced chicken body weight in the experimental groups by 4.5; 5.7 and 7.7%, respectively ($P < 0.05$). Body weight of male chicks was higher by 8.8% than in female chicks ($P < 0.05$).

The mortality rate of chickens in the control group was 3.7% while in the experimental groups it averaged 2.8% with significant differences among individual groups ($P < 0.05$). Losses were significantly lower in the first and third experimental groups than in the other ones ($P < 0.05$).

There were no significant differences in feed intake and conversion among groups, though feed intake by male chicks was significantly higher than by females ($P < 0.05$).

The replacement of SE-SBM with extruded SB cake and yeasts at all levels caused a significant absolute reduction in muscle content in both breast and leg muscles ($P < 0.05$). No significant differences in the chemical composition of breast muscles were observed in the chickens from the individual experimental groups ($P > 0.05$). The replacement of one soybean feed by the other in feed mixes and experimental diets resulted in significantly lower glucose, triglyceride, protein and total cholesterol contents in chicken plasma ($P < 0.05$).

The complete replacement of SE-SBM by extruded SB cake combined with yeasts reduced intestinal digestibility of total protein compared to the control group ($P < 0.05$), with no significant differences between the control and both first and second experimental groups. The replacement of one soybean feed by the other (the second and third experimental groups) significantly lowered apparent intestinal digestibility of histidine, threonine and glycine ($P < 0.05$), while the complete replacement of both soybean feeds significantly reduced apparent intestinal digestibility of arginine, phenylalanine, isoleucine, leucine, lysine, valine, alanine, cystine and glutamic acid.

- Experiment 2 - Growth and Digestibility

The split-plot design was used to carry out this experiment with two experimental factors, 640 Ross 308 hybrid broiler chickens assigned to 8 groups (extruded cake content, L-arginine), 8 replications and with 10 chickens each. At 42 days of life, the replacement of SBM with extruded soybean cake in broiler chicken diets to the level of 25, 50 and 100% of protein derived from soybean feedstuffs resulted in a significant reduction of body weight: by 2.8, 1.6 and 8.8%, respectively, compared to the control group fed with SBM ($P < 0.05$). L-arginine supplementation had a positive effect on broiler body weight throughout the growing cycle ($P < 0.05$).

The highest broiler mortality rate was observed in the first experimental group in both phases of the growing cycle ($P < 0.01$). L-arginine supplementation significantly increased chicken mortality in the first phase, and throughout the entire growing cycle ($P < 0.05$).

While partial replacement of SE-SBM by extruded SB cake in diets at the level of 25 and 50% of soybean protein did not significantly affect feed intake by chickens, the complete replacement significantly reduced its intake in relative values by 13.1% ($P < 0.05$). L-arginine supplementation in diets did not significantly affect feed intake ($P > 0.05$). Full switching of both SB feedstuffs in diets significantly reduced the weight of hot and cold carcasses by 13.2 and 13.4%, respectively, and carcass yield by 1.8% of the relative value ($P < 0.05$). The weight of hot and cold carcasses and carcass yield were significantly higher for males than for females. L-arginine supplementation had a significant impact on chicken dead weight, and the addition of this amino acid also significantly influenced the weight of hot and cold carcasses ($P < 0.05$), however, no significant differences were observed in carcass weight among the groups ($P > 0.05$).

The replacement of SE-SBM by extruded SB cake in feed mixes reduced the weight of breast muscles but the significant value was recorded only for complete replacement of soybean feeds ($P < 0.05$). The weight of individual cuts and body organs accounted for in the dead weight carcass analysis was significantly higher in broilers supplemented with L-arginine compared to the group with no L-arginine supplementation, except for adipose tissue ($P < 0.05$).

The substitution of soybean meal with extruded SB cake did not affect the chemical composition of the breast and leg muscles. The addition of L-arginine to the diets increased dry matter content, total protein and crude ashes in breast muscles, and significantly reduced fat content ($P < 0.05$).

The increased content of extruded SB cake in the diets significantly reduced triglyceride, total cholesterol and high-density lipoprotein content in the blood plasma ($P < 0.05$). Increased levels of L-arginine in the diets did not have a significant impact on plasma glucose, protein and triglycerides ($P > 0.05$) but it significantly lowered total cholesterol and high-density lipoprotein ($P < 0.05$).

The 100% replacement of SB feeds in pelleted growers and finishers reduced apparent intestinal digestibility of crude protein ($P < 0.05$) in chickens, while their replacement by 50 and 100% decreased the digestibility of arginine, phenylalanine, isoleucine, leucine, threonine and valine. A significant increase in lysine and threonine digestibility was found with 50 and 100% replacement of soybean feeds, while apparent intestinal digestibility of endogenous amino acids, including alanine, aspartic acid, cystine, glycine, glutamic acid, proline and serine, decreased. The addition of L-Arginine to feed mixes significantly increased apparent intestinal digestibility of arginine, isoleucine and glycine ($P < 0.05$). The replacement of soybean feedstuffs in feed mixes and diets for chickens reduced economic efficiency of broiler production in the experimental groups by 4.3, 2.7 and 6.9% in Experiment 1 and by 1.3, 3.2 and 6.9% in the other experiment, respectively. The economic performance of chicken growing did not depend on sex or arginine supplementation.

Balice 04.07.2017