CONJUGATED LINOLEIC ACID (CLA) AND THE RATIO OF ω6:ω3 FATTY ACIDS ON THE LIPID CONTENT OF CHICKEN GIBLETS

Surama F. Zanini[1], Geraldo, L. Colnago[2], Fernando P. Casagrande[1], Vanessa R. Lima[1]
[1]Department of Veterinary Sciences, PO Box 16, CEP 29500-000 Espirito Santo Federal University, Alegre (ES), Brazil, E-mail: surama@cca.ufes.br
[2]Department of Animal Sciences, Fluminense Federal University, Brazil, E-mail: colnago@tropical.com.br

Introduction

Studies on animals have shown that CLA lowers body fat (Park et al., 1997) and increases lean body mass (Dugan et al., 1997). Brown et al. (2001) reported that culture of pre-adipocytes supplemented with CLA and sunflower oil resulted in higher content of triglycerides when compared to the cultured treated with only CLA, showing that the anti-adipogenic effect of CLA on the pre-adipocytes can be reversed. Therefore, it is reasonable to think that in studying the CLA effect on the lipid metabolism is important to take in consideration the fatty acid composition of the diet as well as the ratio of omega 6 to omega 3 fatty acids. The objetive of these studies were to evaluate the use of CLA and the ratio of ω6:ω3 in the diet on the lipid content in the giblets of broilers.

Material and Methods

Two studies were conducted simultaneously using 100 male or female Ross broiler chickens with 21 days of age at the start of the experiment. The experimental design was a completely randomized, in a factorial arrangement 2 x 5 (two oil sources, i.e., soybean or canola oil and five levels of CLA supplementation, i.e., 0.0, 0.25, 0.50, 0.75 and 1.00%). The oils used were supplied by Bünge alimentos and CLA (Lucta-CLA 60) by BASF. The control diet had 4% soybean or canola oil. CLA levels were obtained by isometrically replacing soybean or canola oil in the control diets. The lipids contained in the chicken giblets were extracted using the technique of Folch et al. (1957). The F test at 5% of significance was used to compare results between sources of oils when interactions were not detected. When there was an interaction ($P<0.05$), it was used the SNK test to compare results between sources of oils. Regression analysis was used to report the effects of CLA levels.

Results

An interaction, oil source vs CLA levels was observed on the total lipid content of heart, liver and gizzard. The use of soybean oil and growing CLA levels resulted in a linear increase ($P < 0.05$) of total lipids on the liver. Birds fed soybean oil had a higher ($P<0.05$) fat liver content (1.72%) than that of birds receiving canola oil (1.38%). These results confirm the observation of heavier ($P<0.05$) livers (1.92%) for birds receiving soybean oil in comparison with that of canola oil fed birds (1.68%). For birds fed the canola oil diets the liver fat content was better explained by a cubic response. The lowest fat liver content (0.81%) was observed for birds fed canola oil supplemented with 0.75% of CLA differing ($P<0.05$) from that of livers of chickens fed soybean oil (2.18%). This go along well with the total serum cholesterol content of males (129.6 x 156.8 mg/100 ml) and females (99.6 x 157.8 mg/100ml) for birds fed canola or soybean oil, respectively. The gizzard fat content of birds fed soybean oil with growing levels of CLA showed a linear increase ($P<0.05$). Without CLA supplementation gizzard fat content was higher ($P<0.05$) for birds fed canola oil (6.23%) in comparison to that of birds fed soybean oil (4.48%). However after 0.50% of CLA supplementation this difference did not show up anymore between oil sources. Heart fat content 7.57% was lower ($P<0.05$) for birds fed soybean oil with 0.25% CLA in comparison with 13.25% of heart fat content of birds fed canola oil with 0.25% CLA. Contrary to what was observed with fat liver content, birds receiving canola oil had higher ($P<0.05$) heart fat content (11.03%) than those receiving soybean oil (9.21%). However, as occur in the liver, there was a lower ($P<0.05$) heart fat content (8.78%) for birds receiving canola oil with 0.75% CLA in comparison with those receiving soybean oil with 0.75% CLA (10.61%).

Discussion

The use of CLA in association with oils rich in ɤ 3 fatty acids or in diets that have a balanced ratio of ɤ 6:ɤ 3 has optimized the CLA effect (Aydin et al., 2001) showing that the CLA effect depend upon the amount of fatty acids ɤ 6 and ɤ 3 in the diet. Therefore, since CLA has the potential of alter the genetic expression of the lipogenic enzymes (Bauman, 2001), it was showed in this study a synergic effect between CLA and canola oil on the lipid metabolism demonstrated by reduction of liver and heart lipid content at 0.75% of CLA when compared to that of soybean oil. However, it was observed adipogenic effect with increased levels of CLA in association with soybean oil

Conclusion

The lipid content of liver and heart is influenced by the oil source used. The CLA response on lipid content in the giblets depend upon the source of fat added to the diet.

Acknowledgements

The authors are grateful to the National Research Council (CNPq) for financial support and to the Basf Animal Nutrition and Bunge Foods S.A. for technical support.

References

Aydin R, Pariza, M.W., Cook, M.E. 2001. Olive oil prevents the adverse effects of dietary conjugated linoleic acid on chick hatchability and egg quality. **J Nutr**., 131: 800-6.

Bauman, D. Update on conjugated linoleic acids (CLA). 2001. Cornell Nutrition Conference. **Proceedings.** Oct. 16018, Ithaca, NY.

Brown, M., Evans, M., McIntosh, M. 2001. Linoleic acid partially restores the triglyceride content of conjugated linoleic acid-treated cultures of 3T3-L1 preadipocytes. **J. Nutr. Biochem.**, 12: 381-387.

Dugan, M. E. R., Aalhus, J. L., Schaefer, A. L., Kramer, J. K. G. 1997. The effect of conjugated linoleic acid on fat to lean repartitioning and feed conversion in pigs. **Canadian Journal of Animal Science**, 77: 723-725.

Folch, J.; Less, M.; Stanley, S. 1957. A simple method for the isolation and purification of total lipids from animal tissues. **J. of Biol. Chem**., 226: 497-509.

Park, Y., Albright, K. J., Liu, W., Storkson, J. M., Cook, M. E., Pariza, M. W. 1997. Effect of conjugated linoleic acid on body composition in mice. **Lipids**, 32: 853–858.