# CONJUGATED LINOLEIC ACID (CLA) AND THE RATIO OF Omega6:Omega3 FATTY ACIDS ON THE LIPID CONTENT OF CHICKEN MEAT

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## Introduction

Conjugated linoleic acid have been shown to have favorable physiological effects in the lipid metabolism, including a reduction of body fat (West et al., 1998) The use of CLA in association with oils rich in Omega3 fatty acids or in diets that have a balanced ratio of Omega6:Omega3 has optimized the CLA effect (Aydin et al., 2001) showing that the CLA effect depends upon the amount of fatty acids Omega6 and Omega3 in the diet. The purpose of these studies was to evaluate the dietary supplementation of CLA and the ratio of Omega6: Omega3 on the lipids content in the thigh and breast meat of broiler chickens.

## 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 Foods and CLA (Luta-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 meat 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

The total content of lipids breast meat was consistently lower than that of thigh meat (Table 1). An interaction, oil source vs CLA levels was observed on the total lipid content of thigh and breast meat. The use of canola oil and growing CLA levels resulted in a linear reduction (P<0.05, Figure 1) on total lipids of the breast meat. These results can explain a linear reduction (P<0.05) observed in the malonaldehyde content of refrigerated and frozen meat of birds receiving canola oil. However, without CLA, total lipid content of breast meat (1.34%) of birds receiving canola oil was higher (P<0.05) than that of birds on soybean oil (0.89%). This difference in lipid content did not influence the oxidative stability of the breast meat (P>0.05) values obtained for refrigerated (0.140 vs 0.149 mg of malonaldehyde/Kg of meat) at 3 days of storage or frozen (0.193 vs 0.190 mg of malonaldehyde/Kg of meat) breast meat at 75 days of storage from chickens receiving canola or soybean oil, respectively. Birds receiving soybean oil and supplemented with CLA had an abrupt reduction of total lipids on breast meat from 0.89% at 0% CLA to 0.36% at 0.5% CLA followed by a small increase at higher levels of CLA. These results were explained by a quadratic response (P<0.05, Figure 2). These observations may help to explain the reduction (P<0.05) of oxidation on refrigerated and frozen breast meat at 50 and 100 days of storage. For the thigh meat the results of total lipid content were similar to that of breast meat. Birds receiving canola oil without CLA had higher (P<0.05) fat content in the thigh meat (4.12%) compared to soybean fed birds (3.20%). The TBARS (thiobarbituric acid reactive substances) values of refrigerated thigh meat go along with the fat content, where thigh meat of birds fed canola oil had TBARS value of 0.214 compared to 0.158 of birds fed soybean oil. It is hypothesized that this effect observed on the thigh but not on the breast meat was due to the variation on the heme pigment on the two meats. The oxidation of the pigment may have catalyzed the lipid oxidation which corroborates Akamittath et al. (1990) and Monahan et al. (1994). On the other hand, feeding soybean oil with growing levels of CLA produced a linear increase (P<0.05, Figure 3) on thigh meat total lipid content what may be responsible for the lack of difference between oil sources.

Table 1 – Lipid content of broiler meat fed diets with canola or soybean oil and CLA

| LIPID CONTENT ON THIGH MEAT (%) | | | |
|---|---|---|---|
| CLA (%) | SOYBEAN OIL[1] | CANOLA OIL[3] | $\bar{x}$ CLA |
| 0.0 | 3.20b | 4.12a | 3.66 |
| 0.25 | 3.64b | 5.17a | 4.40 |
| 0.5 | 3.73a | 4.45a | 4.09 |
| 0.75 | 3.80a | 3.69a | 3.74 |
| 1 | 4.29a | 3.75a | 4.02 |
| $\bar{x}$ OIL SOURCE | 3.73b | 4.24a | |
| **LIPID CONTENT ON BREAST MEAT (%)** | | | |
| CLA (%) | SOYBEAN OIL[2] | CANOLA OIL[1] | $\bar{x}$ CLA |
| 0.0 | 0.89b | 1.34a | 1.11 |
| 0.25 | 0.66b | 1.33a | 0.99 |
| 0.5 | 0.36b | 1.04a | 0.70 |
| 0.75 | 0.46b | 1.09a | 0.78 |
| 1 | 0.60a | 0.48a | 0.54 |
| $\bar{x}$ OIL SOURCE | 0.59b | 1.05a | |

[a,b] Averages values within the same line with no common superscript differ significantly by the SNK test (P<0.05)
[1] Linear effect (P<0.05)
[2] Quadratic effect (P<0.05)
[3]Cubic effect (P<0.05)

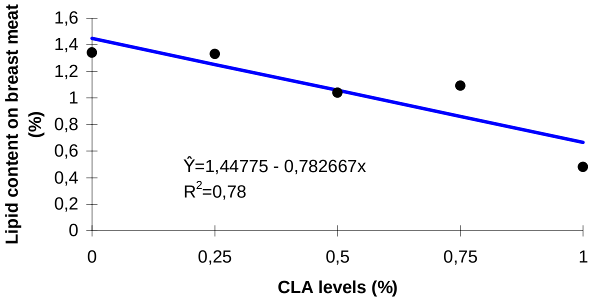


Figure 1. Lipid content on breast meat (%) of broilers fed diets with canola oil and CLA supplementation.

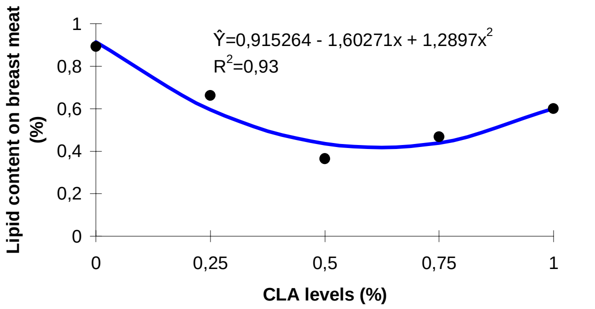


Figure 2. Lipid content on breast meat (%) of broilers fed diets with soybean oil and CLA supplementation.

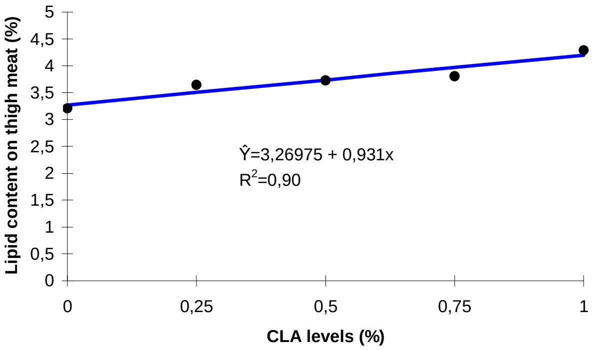


Figure 3. Lipid content on thigh meat (%) of broilers fed diets with soybean oil and CLA supplementation.

## Discussion

The lipid content on breast meat is represented by intramuscular lipids such as cell membrane phospholipids while that the thigh meat is characterised by both intramuscular and intermuscular lipids containing much more triglycerides (Leskanich & Noble, 1997). Dietary supplementation with CLA may change the composition of lipids produced by the liver (Belury & Kempa-Steczko, 1997) as well as reduce the total lipid concentration in rats (West et al., 1998) by alteration of the genetic expression of the lipogenic enzymes (Bauman, 2001). In this study it was shown a synergic effect between CLA and canola oil on the lipid metabolism demonstrated by reduction of thigh and chest lipid content. However, it was observed adipogenic effect on the lipid content of thigh meat with increased levels of CLA in association with soybean oil, showing that the anti-adipogenic effect of CLA can be reversed. Brown et al. (2001) reported that culture of pre-adipocytes supplemented with CLA and sunflower oil (rich in omega 6 fatty acids) resulted in higher content of triglycerides when compared to the cultured treated with only CLA. Therefore, it is reasonable to think that studying the CLA effect on the lipid metabolism it is important to take into consideration the fatty acid composition of the diet as well as the ratio of omega 6 to omega 3 fatty acids. Also, these alterations on the lipid content by CLA supplementation vs oil source resulted in changings in the oxidative stability of meat.

## Conclusion

The lipid content of thigh and breast meat is influenced by the oil source. The CLA response on lipid content in the meat depends upon the source of fat added to the diet.

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