CLA CONTENTS AND OXIDATIVE STABILITY OF KUNCHIANG SAUSAGES FROM PORK FED PALM OIL AND CLA SUPPLEMENTS

K. Intarapichet*, and B. Maikhunthod

School of Food Technology, Institute of Agricultural Technology,
Suranaree University of Technology, Nakhon Ratchasima 30000, Thailand

Key Words: CLA, pork, palm oil, oxidation, sausages

Introduction

The term conjugated linoleic acid (CLA) refers to a group of positional and geometric isomers of octadecadienoic acids with conjugated double bonds. CLA draws much attention in recent years for its anticarcinogenic properties (Ip et al., 1991) as well as being protective against heart disease, diabetes, improving insulin sensitivity and ability to reduce adiposity and increase lean body mass (Park and Pariza, 2007). Extensive research has been conducted to increase CLA content in foods from both ruminant and nonruminant origins. Heat process has been found to induce isomerization of linoleic acid to CLA (Pakdeechanuan et al., 2007). Therefore, the present study was conducted to investigate the CLA contents and oxidative stability of semi-dry pork sausages or kunchiang made from meat of pigs fed palm oil and supplemented with different levels of CLA.

Materials and Methods

The pigs (≈ 60 kg) [Duroc x (Landrace x Large White)] were adapted to the diets containing 2.0% palm oil (PO) only and PO supplemented with 0.5% and 1.0% CLA for 6 weeks at the Suranaree University of Technology Farm. The ham portions of two female pigs of each treatment were used to make kunchiang sausages. The sausage batter contained 65% ground lean meat, 20% pork back fat, 3% water, 10% sugar 1.83% salt, 0.01% nitrite, and 0.16% erythorbate. All ingredients were mixed, stuffed in pig casings, oven dried at 60 ^{o}C overnight then, packed in plastic bags and kept at 25 ^{o}C for 12 days. The sausages were sampled at 3 day intervals for chemical and sensory analyses.

Lipid of the sample was extracted using chloroform:methanol (2:1, V/V) solvent, completely methylated using 0.5 M sodium methoxide in methanol at 50 ^{o}C for 30 min. The CLA methyl esters were analyzed using a gas chromatograph (GC). Four specific isomers of CLA (*c*9,*t*11; *t*10,*c*12; *c*9,*c*11; and *t*9,*t*11; Matreya LLC, USA) were used for identification. The hexanal was analyzed by Static Headspace GC. TBARS was determined by distillation method. Oxidized flavor of cooked sausages were evaluated by eight trained panelists using scoring method. The scores were assigned from 1 for no oxidized flavor to 5 for extremely oxidized.

Statistical analysis was evaluated by randomized complete block design. Analysis of variance was analyzed and comparison of means was done by Duncan's Multiple Range Test. Each animal within the same treatment were treated as a replicate. Chemical analysis of each replicate was performed in triplicate samples.

Results and Discussion

CLA content in batter and kunchiang sausage. Four specific isomers of CLA contents in batter and kunchiang are shown in Figure 1. Significant differences ($P < 0.5$) of the two health benefit CLA isomers, *c*9,*t*11 and *t*10,*c*12, were found in both batter and kunchiang and highest in kunchiang made from pork supplemented with 1.0% CLA. Increasing of *c*9,*t*11 and *t*10,*c*12 in the sausages were more than one fold in both sources of the oil used. Slightly change of *cis,cis* CLA occurred during heating. However, this isomer has no health benefit.

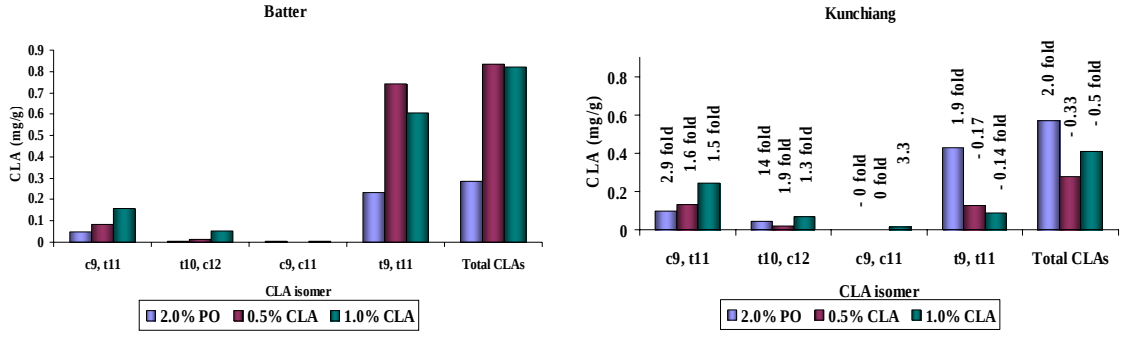

Figure 1. CLA contents in batter and kunchiang sausages made from pig meat fed 2.0% palm oil and 0.5, and 1.0% CLA supplemented in the diets.

Noticeable increasing in *trans,trans* and total CLA were observed in kunchiang made from pork fed with 2.0% palm oil while decreasing was found in the sausages made from pork fed with both CLA levels. This

suggested that lower temperature heating (60 °C) could cause changes of *trans,trans* CLA isomer to *cis,trans* or *trans,cis* one. This is similar to the finding of Shantha et al. (1994) who reported that baking beef at 60 °C obtained higher *c*9,*t*11 CLA isomer than at 80 °C. In addition, palm oil was more readily changed to *trans,trans* form.

Lipid oxidation. Oxidative stabilities as measured by hexanal and TBARS contents are shown in Figure 2. Regardless of time of storage, the sausage made from pork fed with 1.0% CLA supplemented had the lowest ($P < 0.05$) amounts of hexanal and TBARS compared with those of pork fed 2.0% PO and 0.5% CLA supplemented. In general, hexanal and TBARS formation became more rapid during day 3 to day 6 of storage. The hexanal contents were noticeably different in day 9 to day 12 while the TBARS values were found significantly different in day 12. Oxidation of the sausage could be influenced by the CLA contents in the pork raw materials. In this study, pork fed with higher CLA had better oxidative stability. This could be due to the higher initial CLA contents in the batter, which in turn could provide better oxidative protection during storage.

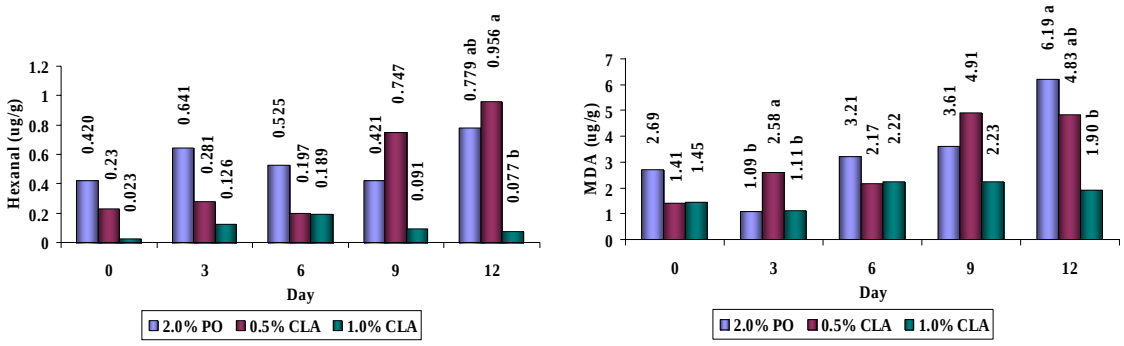

Figure 2. Hexanal and TBARS values of kunchiang sausages affected by 2.0% palm oil and 0.5 and 1.0% CLA supplemented in the diets, during storage at 25 °C.

These results were in agreement with those of Joo et al. (2002) who reported that dietary CLA could reduce lipid oxidation in pork lion.

Oxidized flavor by sensory evaluation. Oxidized flavor of kunchiang sausages evaluated by 8 trained panelists are shown in Figure 3. In general, significant differences of flavor scores were not found among all sausages in the same day of storage. However, the intensity of oxidized flavor increased towards the end of storage. Although significant differences were not observed, the sausages made from pork fed with 0.5 and 1.0% CLA substituted resulted in superior sensory scores. The sausage made from pork fed 1.0% CLA diet had the lowest score at the end of storage.

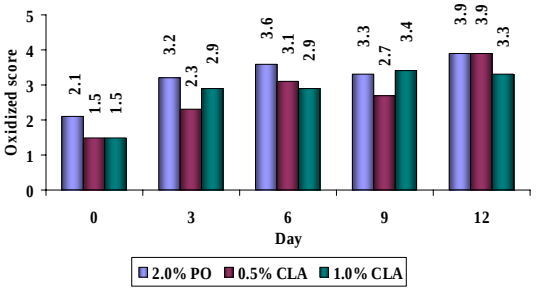

Figure 3. Oxidized flavor score of kunchiang sausages affected by 2.0% palm oil, and 0.5 and 1.0 % CLA supplemented in the diets, during storage at 25 °C

Conclusions

The findings suggested that CLA supplementation in animal diets could top up the health beneficial isomers of CLA (*c*9,*t*11 and *t*10,*c*12) in kunchiang sausages and provide better oxidative stability to the sausages during storage. Low heat process (60 °C) of kunchiang sausage provided lower amounts of harmful isomers (*trans,trans*) of CLA. In this study, single use of palm oil in the diets, high increasing of *trans,trans* fatty acid was observed.

References

Ip, C., Chin, S.F., Scimeca, J.A., and Pariza, M.W. (1991). Mammary cancer prevention by conjugated dienoic derivatives of linoleic acid. *Cancer Research, 51*, 6118-6124.

Joo, S.T., Lee, J.I.,Ha, Y.L., and Park, G.B. (2002). Effects of dietary conjugated linoleic acid on fatty acid composition, lipid oxidation, color, and water-holding capacity of pork loin. *Journal of Animal Science, 80*, 108-112.

Park, Y., and Pariza, M.W. (2007). Mechanisms of body fat modulation by conjugated linoleic acid (CLA). *Food Research International, 40*, 311-323.

Pakdeechanuan, P., Intarapichet, K., and Tongta, S. (2007). Effect of extrusion parameters on conjugated linoleic acids of corn extrudates. *Journal of Agricultural and Food Chemistry, 55*, 1463-1468.

Shantha, N.C., Crum, A.D., and Decker, E.A. (1994). Evaluation of conjugated linoleic acid concentration in cooked beef. *Journal of Agricultural and Food Chemistry, 42*, 1757-1760.