

## INFLUENCE OF DIETARY CONJUGATED LINOLEIC ACID ON LIPID METABOLISM AND SERUM LEPTIN CONCENTRATIONS IN FINISHING PIGS<sup>1</sup>

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**Abstract:** Twenty four Polish Landrace fatteners (12 barrows/castrates and 12 females pigs) of mean 70 kg b.w. were assigned into two groups in which complete pelleted feeds were supplemented with 2% sunflower oil (control group), or 2% of conjugated linoleic acid (CLA) (experimental group). The CLA preparation contained 61,3 % CLA isomers (Edenor UKD 6010, Henkel). Blood was collected at slaughter at 108 kg b.w. Total cholesterol, triglycerides, HDL and glucose were determined in serum by enzymatic spectrophotometric assays. Serum leptin concentrations were determined with a commercially available RIA procedure (Multi-Species Leptin RIA Kit, Linco Research, MO). CLA supplement caused the significant increase ( $P < 0.05$ ) of total cholesterol and HDL level in serum with a trend to increased serum leptin ( $P = 0.07$ ). The effect of fatteners sex on leptin level and studied fat lipid variables in blood serum was not stated. These data suggest that dietary addition of CLA in finishing pigs altered lipid metabolism to produce higher concentrations of serum total cholesterol, HDL and leptin.

**Key words:** pigs, conjugated linoleic acid, blood, leptin, lipid metabolism

### Introduction

Leptin is a protein hormone secreted mainly by adipose tissue cells. It is believed that leptin is a factor controlling body weight and a link between adipose tissue metabolism and the central nervous system (Campfield *et al.* 1996). Berg *et al.* (2003) in their studies with 6 breeds of pigs showed that serum concentrations of leptin vary and the level of this hormone is related to growth rate and carcass quality.

Researches carried out on different animal species confirm the significant effect of the conjugated fatty acids on lipids metabolism and fattening degree of carcasses (Tsuboyama-Kasaoka *et al.* 2000; Thiel-Cooper *et al.* 2001; Tischendorf *et al.* 2002). The hypocholesteremic activity of CLA is also very important because it caused the decrease of LDL fraction of cholesterol in a blood. This fraction is responsible for arteriosclerosis changes formation in blood vessels (Lee *et al.* 1994; Nocolosi and Latinen 1996).

The aim of this study was the evaluation of the effect of 2% CLA addition used in the diet in last period of fattening on leptine level and chosen lipid indicators in fatteners' blood.

### Material and methods

The experiment was conducted on 24 Polish Landrace fatteners both sexes (12 barrows/castrates and 12 females pigs), divided into 2 groups. After the fatteners reached 70 kg of body weight obtained in their rations: control group – 2% addition of sunflower oil; experimental group - 2% addition of CLA oil (Edenor UKD 6010, Henkel). The fatteners were kept in groups – 6 animals in each pence. They were fed according to Nutrient Requirements of Pigs (PAN, 1993). The standard fodder contained: 15,3% of crude protein, 2,1% of crude fat, 12,62 MJ of matabolizable energy, 8,2 g of lysine, 5,4 g of methionine together with cysteine and 5,4 g of threonine. Daily rations were divided into two meals with free access to the water. Supplements of 2% CLA and 2% of sunflower oil were added to morning meal. The research were finished with slaughter of all animals after reaching 108 kg of body weight. The level of glucose, total cholesterol, cholesterol fractions and triglycerides were indicated using enzymatic methods with diagnostic tests of Cormay firm in samples of blood serum collected at slaughter. The leptine was indicated in blood serum using RIA method with Multi-Species Leptin RIA Kit (Linco Research, Inc., St. Charles, MO). Obtained results were verified statistically by variance analysis and D-Duncan test using Statgraphics Plus 4.0 packet.

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*Results and discussion*

The sunflower oil and the oil CLA preparation used in the experiment contained conjugated linoleic acid in the following amounts, 0.1 and 61.3%, respectively, of the total fatty acid content (Table 1). CLA oil contained 61,3% of CLA isomers with following composition: C18:2 tt – 0.8%; C18:2 c9t11 – 9.1%; C18:2 t8c10 – 9.5%; C18:2 c11t13 – 10.5%; C18:2 t10c12 – 10.2%; C18:2 cc – 21.2%.

The use of 2% of CLA addition to feed ration for growing fatteners caused the increase of daily gains, the decrease of fodder use and limitation of fattening degree of carcasses (Table 2). This last indicator was characterised by the decrease of average back fat thickness, evaluated basing on 5 measurements ( $P < 0.01$ ), and the increase of carcass meatiness. The changes of studied physiological indicators in blood serum are shown in table 3. Conjugated linoleic acid significantly increased the total cholesterol and its HDL fraction content in blood serum ( $P < 0.05$ ). The increasing tendency of leptine level in the experimental group (obtaining 2% CLA addition) was observed ( $P = 0.07$ ). The effect of fatteners sex on leptine and other studied lipid indicators content was not observed in fatteners' blood serum.

*Table 1. Composition of fatty acids in oil (% of total fatty acids)*

Fatty acids	Sunflower oil	Oil preparation CLA
C 12:0	-	0.2
C 14:0	0.1	0.1
C 16:0	6.5	4.4
C 16:1	0.1	0.1
C18:0	3.5	1.8
C 18:1	25.6	29.4
C 18: 2 <i>n</i> -6	63.8	2.0
CLA	0.1	61.3
C 18:3 <i>n</i> -3	0.1	-
C 20:0	0.2	-
C 20:1	-	0.3
C 20: 4 <i>n</i> -6	0.4	-
C 20 :5 <i>n</i> -3	-	-
C 22:0	0.6	0.3
C 22:1	-	0.1
Saturated fatty acids (SFA)	10.90	6.80
Monounsaturated fatty acids (MUFA)	24.70	29.80
Polyunsaturated fatty acids (PUFA)	64.40	63.30
PUFA <i>n</i> -3	64.20	63.30

*Table 2. Fattening results and carcass quality assessment (n=12)*

Traits	Factors				SEM*
	CLA in fodder		Sex		
	Control group	Experimental group	Females	Barrows	
Empty body weight (kg)	108.6	108.9	108.8	108.7	0.3
Mean daily gain (g)	828	838	846	821	7
Feed intake (kg/kg)	3.03	2.99	2.97	3.06	0.03
Cold carcass weight (kg)	84.1	81.8	82.1	83.93	0.90
Cold dressing percentage (%)	79.07	78.30	78.68	78.70	0.26
Meatiness (%)	55.88	57.54	56.49	56.93	0.45
Mean backfat thickness from 5 measurements (mm)	21 A	19 B	19	20	1
Weight of loin (kg)	6.59	6.70	6.57	6.72	0.08
Loin eye area (cm <sup>2</sup> )	53.19 A	57.70 B	56.01	54.88	0.80
Meat of right ham (kg)	8.93	9.16	9.02	9.07	0.06
Meat content of ham (%)	73.56	73.51	73.76	73.31	0.65

\* standard error of the mean ; A, B –  $P < 0.01$

Corino *et al.* (2002) in studies carried out on rabbits showed the influence of dietary CLA on the limitation of triglycerides and total cholesterol content in blood serum. The increasing tendency of leptine level was also observed. Triglycerides content was higher in males' blood but the leptine level was higher in blood of females. These authors state that CLA addition to rabbits' diet limits the carcasses fatness by increasing of lipids' metabolism. Similar results to these obtained in this research were got by Tischendorf *et al.* (2002). These authors did not observe the influence of CLA on the decrease of HDL/LDL proportion in blood serum. Contrary to it Stangl *et al.* (1999) stated the increase of LDL fraction and total cholesterol to HDL proportion in the blood of fatteners obtaining 1% of CLA addition to their diet.

Table 3. The leptin level and some physiological indicators in fattener's blood serum (n= 12)

Item	Factors				SEM
	CLA in fodder		Sex		
	Control group	Experimental group	Females	Barrows	
Leptin (ng/ml)	3.67	4.17	3.91	3.92	0.29
Glucose (mg/dl)	77.12	85.17	83.47	78.81	6.22
Total cholesterol (mg/dl)	90.48 a	97.91 b	93.02	95.37	1.91
HDL (mg/dl)	44.73 a	50.05 b	46.89	47.89	1.26
LDL (mg/dl)	27.75	29.26	27.83	29.18	1.46
HDL/LDL	1.78	1.84	1.77	1.85	0.14
Total cholesterol/HDL	2.05	1.97	2.00	2.01	0.04
Triglycerides (mg/dl)	86.84	93.01	88.33	91.53	3.69

a, b – P< 0.05

#### Conclusion

2% addition of CLA into fatteners' diet in the last period of fattening improves the carcasses quality by limitation of their fattening degree and by increase of their meatiness. CLA supplement used in this research caused the increase of total cholesterol level and HDL cholesterol fraction level in the blood serum. It is suggested that leptine is the mediator between the CLA influences on lipid conversions in pigs.

## UTICAJ KONJUGOVANE LINOLNE KISELINE U ISHRANI NA METABOLIZAM LIPIDA I KONCENTRACIJE LEPTINA U SERUMU KOD TOVLJENIKA

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Dvadesetčetiri tovljenika rase poljski landras (12 nerastova/kastrata i 12 ženki) srednje telesne težine od 70 kg je podjeljeno u dve grupe gde je u obroke koji su se sastojali od kompletnih peletiranih hraniva dodavano 2% suncokretovog ulja (kontrolna grupa) ili 2% konjugovane linolne kiseline sunflower oil (CLA) (eksperimentalna grupa). Preparat CLA je sadržavao 61,3 % CLA izomera (Edenor UKD 6010, Henkel). Krv je uzimana na klanju pri telesnoj težini od 108 kg. Određivani su ukupni holesterol, trigliceridi, HDL i glukoza u serumu korišćenjem spektrofotometrijske enzimске analize. Koncentracije leptina u serumu su određivane korišćenjem dostupne komercijalne RIA procedure (Multi-Species Leptin RIA Kit, Linco Research, MO). Dodavanje CLA u obrok je izazvalo signifikantno povećanje (P< 0.05) ukupnog holesterola i nivoa HDL u serumu sa trendom opadanja vrednosti leptina u serumu (P= 0.07). Uticaj pola tovljenika na nivo leptina i ispitivane promenljive vrednosti lipida u serumu nije registrovan. Ovi podaci sugerisu da je dodavanje CLA u obroke za tovljenike promenilo metabolizam lipida i proizvelo veće koncentracije ukupnog holesterola, HDL i leptina u serumu.

*Ključne reči:* svinje, konjugovana linolna kiselina, krv, leptin, metabolizam lipida

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