飼糧添加共軛亞麻油酸對閹公豬生長性能及屠體性狀之影響（1）

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摘要

本試驗旨在探討飼糧中添加共軛亞麻油酸(Conjugated linoleic acid, CLA)，對肥育期畜試黑豬一號（TLRI Black Pig No. 1, TBP）閹公豬生長及體組成之影響。選取體重約 60 kg之畜試黑豬一號閹公豬50頭，分成 A、B、C、CA 及 CB 等 5 組，每組 10 頭，採任食、個飼。對照組（C組）在試驗期間均餵飼以玉米及大豆粕為主，粗蛋白質含量 15%、粗纖維 6% 與消化能 3,250 kcal/kg 之基礎飼糧， A 組及 B 組豬隻從體重 60 kg 至 120 kg 全期飼予基礎飼糧中分別添加 CLA 1.5 及 3 g/kg 之飼糧，CA 組及 CB 組豬隻則在肥育前期（試驗開始至體重 90 kg止）餵飼基礎飼糧，從體重 90 kg 起分別餵飼添加 CLA 1.5 及 3 g/kg 之飼糧。豬隻於體重達 121.0 kg 時結束生長試驗並屠宰，測定屠體性狀；採集第 10-11 肋骨間背最長肌 (*Longissimus dorsi* muscle, LM) 樣品，進行肉色、化學成分和脂肪酸組成等分析。試驗結果顯示，對照組（C組）豬隻之日增重顯著地較 B 組為小，每日平均飼料攝食量較 A 組及 B 組少（$P < 0.05$），各組間之飼料換肉率則相近。在屠體性狀方面，試驗全期飼糧添加 3 g/kg 共軛亞麻油酸組（B組）豬隻的腹脂厚度，顯著地較其他四組為薄，瘦肉率顯著較 C 組及 CA 組高，CB 組的屠體脂肪率較 C 組為低（$P < 0.05$）。B 組背最長肌中的粗脂肪含量顯著較 C 組高，CB 組及 CA 組粗脂肪中的多元不飽和脂肪酸比例較 C 組及 A 組為高（$P < 0.05$）。此外，A 組及 B 組在肥育前期的每日平均飼料攝食量分別顯著地較 C 組提高 17.6% 及 25.1%，生長速率也提高 15.1% 及 24.0%（$P < 0.05$），肥育後期 CB 組的生長速率及飼料換肉率則分別較 C 組改善 12.6% 及 20.3%（$P < 0.05$）。試驗結果顯示，飼糧中添加 CLA 具有促進肥育期畜試黑豬一號閹公豬生長及改善屠體性狀的效果。

關鍵詞：畜試黑豬一號、共軛亞麻油酸、閹公豬、生長性能、屠體性狀。

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緒言

共軛亞麻油酸 (Conjugated linoleic acid, CLA) 是亞麻油酸（Linoleic acid）的同分異構物。Griinari and Bauman（1999）指出，CLA是多元不飽和脂肪酸（polyunsaturated fatty acid, PUFA），在反芻動物的瘤胃經由異構化 (isomerisation) 及（或）生物氫化作用 (biohydrogenation)，以及在動物的脂肪組織或乳腺經由去飽和作用的產物。在天然食物中所含的主要為順式 (*cis, c*) 9，反式(*trans, t*) 11 CLA (Ip *et al.,* 1994 ; Kramer *et al.,* 1997 ; Sehat *et al.,* 1998)，其中又以綿羊肉（Wachira *et al.,* 2002）、牛肉（Racs *et al.,* 2004）和牛乳及其製品（Chin *et al.,* 1992 ; Lin *et al.,* 1995）中含量最高；一些特定的微生物在單胃動物的大腸經由酵素轉化機制（enzymatic conversion mechanism）也會產生 CLA，但是大部分無法吸收，因此豬肉中含量僅 0.6 mg/g fat（Chin *et al.,* 1992）。商業製品的 CLA 主要含有 *c*9 , *t*11 及 *t*10 , *c*12 等兩種型式，係由於兩者對生物的功能不同(Burdge *et al.,* 2004 ; Petridou *et al.,* 2003)。*c*9 , *t*11 CLA 具有抗癌症（Ip *et al.,* 1991 ; Knekt *et al.,* 1996）、促進乳腺增生（Ip *et al.,* 1994）及抗糖尿病 (Moloney *et al.,* 2007) 的效果，食物中 *c*9 , *t*11 CLA的含量與齧齒類動物的攝食量呈負相關 (Lawson *et al.,* 2001)。*t*10,*c*12 CLA則有抑制脂蛋白脂肪分解酵素活性 (Park *et al.,* 1999 ; Pariza *et al.,* 2001)、促進脂質分解、抑制脂肪前驅細胞 (preadipocyte) 分化、脂肪細胞增大及脂質生成作用 (Poirier *et al.,* 2006)、抑制胰島素分泌而影響能量代謝（Poirier *et al.,* 2006）、抑制體脂肪蓄積（Park *et al.,* 1999; Ryder et *al.,* 2001），進而改變體組成。

在豬隻的研究方面，Ostrowska *et al.* (1999) 及 Weber *et al.* (2006) 均指出，飼糧中添加 CLA 可改善飼料效率，提高日增重（Sun *et al.,* 2004 ; Wiegand *et al.,* 2001, 2002），增加飼糧採食量（Lai et al., 2005 ; Sun *et al.,* 2004）。Thiel-Cooper *et al.* (2001) 研究發現，飼糧中添加 CLA 有改善生長肥育豬飼料轉換及減低體脂肪含量的效果，Dugan *et al.* (1997) 謂，飼糧添加 2 % 的 CLA 可提高背最長肌的粗脂肪比例與肌間脂肪含量，Lauridsen *et al.* (2005) 及 Weber *et al.*(2006）證實，餵飼含 CLA 的飼糧可提高豬隻脂肪組織中的飽和脂肪酸（saturated fatty acid, SFA）及降低單元不飽和脂肪酸（monounsaturated fatty acid, MUFA）含量。

現階段國產肉豬體型仍以肉品市場需求為導向，而黑豬則以大體重較符合市場需求。畜試黑豬一號肉豬之體重高於 125 kg 後，其拍賣售價明顯較民間黑豬低，且閹公豬售價明顯較肉女豬差 (蘇等，2005a)，兩者達到 8元/kg 之價差。蘇等 (2004) 調查指出，畜試黑豬一號肉豬從體重 50 kg 飼養至 130 kg 期間，閹公豬每日飼料攝食量較肉女豬多 ($P < 0.01$)，飼料換肉率則較肉女豬差 ($P < 0.05$)，於體重 100-120 kg 時，屠體品質較肉女豬為差，顯示閹公豬屠體品質需設法改善之。本研究旨在探討飼糧添加共軛亞麻油酸，對畜試黑豬一號閹公豬生長性能及屠體品質的改善效果。

材料與方法

Ⅰ. 試驗動物及處理

選取畜試黑豬一號閹公豬 50 頭，分成 A、B、C、CA 及 CB 等 5 組，每組 10 頭，從體重約 60 kg 開始試驗，採個飼，飼糧及飲水任飼，其中 CA 組有 1 頭豬隻於試驗期間死亡。對照組（C 組）餵飼以玉米及大豆粕為主，粗蛋白質含量 15%、粗纖維 6% 與消化能 3,250 kcal/kg 的基礎飼糧 (表 1)；A 組及 B 組豬隻在全期試驗期間均餵飼基礎飼糧分別添加Luta-CLA® 60（BASF Co.，Germany；含 CLA 60%，主要成分為*c*9, *t*11及 *t*10, *c*12 CLA各28% ）2.5及5.0 g/kg，使 A 組及 B 組飼糧中分別含 CLA1.5 及 3 g/kg 之飼糧，CA 組及 CB 組豬隻則在肥育前期（試驗開始至體重 90

kg）餵飼基礎飼糧，而從體重 90 kg 開始，分別餵飼與 A 組及 B 組相同之飼糧（添加 CLA 1.5及3 g/kg）至試驗結束。豬隻於體重達 121.0±2.5 kg 時結束生長試驗並屠宰，測定屠體性狀。採集第10-11肋骨間背最長肌 (*Longissimus dorsi* muscle, LM) 樣品，進行肉色、化學成分和脂肪酸組成等測定。本試驗動物於畜產試驗所產業組豬場內飼養，動物之使用、飼養及實驗內容，通過畜產試驗所「實驗動物審查小組」審查。

表 1. 基礎飼糧組成

Table 1. Composition of the basal diet

Ingredient	kg
Yellow corn, CP 7.6%	596.9
Soybean meal, CP 43.5%	155.0
Sorghum distillers grain, DM 88.1%	100.0
Alfalfa meal	105.0
Molasses	15.0
Limestone, pulverized	9.0
Dicalcium phosphate	12.0
Salt	4.0
Choline chloride	0.6
Vitamin premix[a]	1.0
Mineral premix[b]	1.5
Total	1000.0
Calculated value	
Crude protein, %	15.02
Crude fiber, %	6.02
Lysine, %	0.68
Digestible energy, kcal/kg	3254

[a] Each kg of diet supplied as follows: Vitamin A, 6000 IU; Vitamin D_3, 800 IU; Vitamin E, 20 mg; Vitamin K_3, 4 mg; Vitamin B_2, 4 mg; Vitamin B_6, 1 mg; Vitamin B_{12}, 0.02 μg; Niacin, 30 mg; Pantothenate, 16 mg ; Folic acid, 0.6 mg; Biotin, 0.01 mg; Choline chloride, 50 mg.

[b] Each kg of diet supplied as follows: Fe, 140 mg; Cu, 20 mg; Mn, 4 mg; Zn, 120 mg; I, 0.45 mg.

Ⅱ. 測定項目及方法

(i) 生長性能與背脂厚度

試驗期間記錄飼糧攝食量，試驗前期每2週磅重1次，後期（達屠宰體重前5-10 kg）則每週磅重1次，計算每日平均飼料攝食量（average daily feed intake, ADFI）、日增重（average daily gain, ADG）及飼料換肉率（gain/feed, G/F）。

(ii) 屠體性狀

參考台灣區肉品發展基金會（1988）方法，豬隻屠宰前磅秤體重，經屠宰、放血及去內臟後測量屠體重，量取屠體長度（由第1肋骨至最後腰椎）、左側屠體腹脂厚度（腹部、肚臍部及鼠蹊部與第1肋骨、最後肋骨及最後腰椎對應處）、背脂厚度（去皮後，量測第1肋

骨、最後肋骨及最後腰椎處），描繪第10及11肋骨間背最長肌之腰眼面積，秤取左側屠體經大部分切後的瘦肉及脂肪之重量，計算瘦肉率與脂肪率，公式為瘦肉率＝(左側屠體瘦肉重× 2) /屠體重× 100；脂肪率＝(左側屠體脂肪重× 2)/屠體重× 100。

(iii) 肉色及大理石紋測定

1. Minolta L, a, b值測定

參考Means *et al.* (1987) 的方法，以色差計(Color reader, Minolta Co., Ltd., Japan)，測定背最長肌表面之亮度值 (L值)、紅色值 (a值) 和黃色值 (b值)。L值為亮度，數值越大表示越明亮，越小表示越暗沉；a 值為紅色度，數值越大表示越鮮紅，負值表示偏綠；b 值為黃色度，數值越大表示越偏黃，負值表示偏藍；每次測定不同的 3 點取平均值，每一樣品 2 重複，求其平均值。

2. 肉色及大理石紋評級

取左側屠體第 10-11 肋骨間背最長肌，順肌纖維走向將肉橫切成 2 cm 厚度肉片，以美國豬肉生產協會之豬肉品質標準板（NPPC, 1999）主觀感官判讀。肉色評級以 1-6 分表示，數值低表示淡色，數值高表示深色，大理石紋評級則以 1-10 分表示，數值低表示肉中肌間脂肪含量少，數值高表示肉中肌間脂肪含量多。

(iv) 背最長肌化學成分及脂肪酸組成分析

1. 樣品前處理

採集左側屠體第 10-11 肋骨間背最長肌，先去筋膜及脂肪後，切成 2 cm 寬之正方形肉條，然後使用絞肉機 (Butcher Boy, TCA-12)、通過 3/16 吋之絞盤，絞碎、混合後採樣測定。

2. 化學成分測定

依照AOAC (1990) 之方法，進行豬肉水分、粗蛋白質、粗脂肪及灰分含量測定。

3. 脂肪酸組成分析

依照蘇等（2006）參考Sukhija and Palmquist（1988）方法，進行樣品處理及分析。

Ⅲ. 統計分析

利用 SAS 統計分析系統的一般線性模式程序 (General linear model procedure) 進行變方分析 (SAS, 2002)，並以鄧肯氏新多變域測定法(Duncan's New Multiple Range Test)，比較各處理組最小均方平均值(LSMEAN)間差異顯著性。

結果與討論

在肥育前期（體重60 kg至體重90 kg）飼糧中添加 CLA 者，A 組之 ADFI 顯著地較 C 組提高 17.6%（圖1），B 組則提高 25.1%；B 組的 ADG 也顯著地（$P < 0.05$）較C組提高 24.0%，而各組間的 G/F 相近。肥育後期（體重90 kg至試驗結束）B 組的 ADFI 顯著地較 C 組提高 14.5%（圖2），CB 組的 G/F 較 C 組提高 20.3%（$P < 0.05$），ADG 也比 C 組提高12.6%。就整個試驗期而言，在肥育期畜試黑豬一號閹公豬飼糧中添加共軛亞麻油酸（表2），各組豬隻在試驗開始及結束的日齡差異均不顯著，對照組（C組）的 ADG 較 B 組小($P < 0.05$)，ADFI 則較 A 組及 B 組少 ($P <0.05$)，G/F 以 CB 組的 0.247 顯著地較 A 組 及 B 組為佳，並較 C 組提高7.8%，此結果與肥育前期飼糧中添加 CLA 不影響 G/F，而肥育後期添加較高量的 CLA （3 g/kg diet）可顯著地提高 G/F 有關。研究指出飼糧中添加 CLA 可改善飼料效率 (Dugan *et al.,* 1997 ; Ostrowska *et al.,*

1999 ; Thiel-Cooper *et al.,* 2001 ; Weber *et al.,* 2006)，提高 ADG（Ip *et al.,* 1991 ; Sun *et al.,* 2004 ; Wiegand *et al.,* 2001, 2002），增加 ADFI（Lai *et al.,* 2005 ; Sun *et al.,* 2004）之結論與本試驗結果一致。惟 Weber *et al.* (2006) 指出，飼糧添加 CLA 會顯著減少豬隻 ADFI，則與本試驗結果相左。

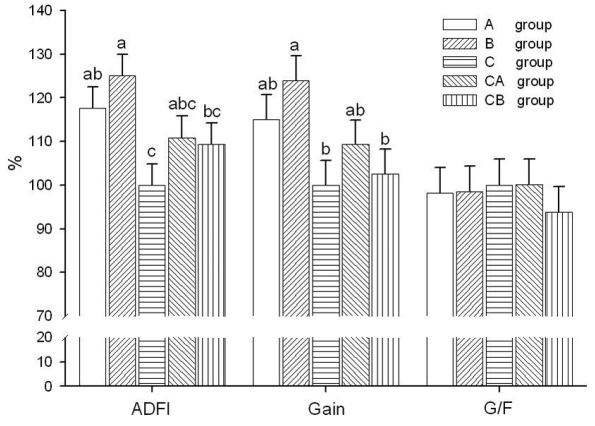

圖 1. 肥育前期（體重60-90 kg）飼糧中添加共軛亞麻油酸對畜試黑豬一號閹公豬飼料攝食量、日增重及飼料換肉率之影響 (以處理組與對照組比較)。

Fig. 1. Effects of dietary conjugated linoleic acid supplementation on the feed intake, gain rate and G/F of the TLRI Black Pig No. 1 barrows from BW 60 kg to 90 kg (expressed as percentage difference of treatments and control group).* C: control group; A, B: group provided 1.5,3.0 g/kg CLA diet from BW 60 kg to 120 kg; CA, CB: group provided 1.5, 3.0 g/kg diet from BW 90 kg to120 kg.

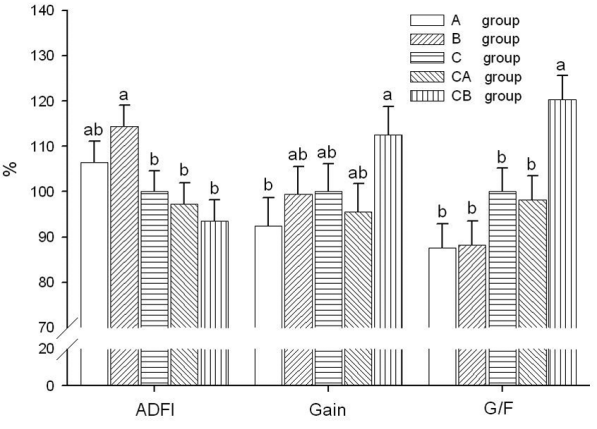

圖 2. 肥育後期（體重90-120 kg）飼糧中添加共軛亞麻油酸對畜試黑豬一號閹公豬飼料攝食量、日增重及飼料換肉率之影響 (以處理組與對照組比較)。

Fig. 2. Effects of late-finishing (BW from 90 to 120 kg) dietary conjugated linoleic acid supplementation on the feed intake, gain rate and G/F of the TLRI Black Pig No. 1 barrows (expressed as percentage difference of treatments and control group).* C: control group; A, B: group provided 1.5,3.0 g/kg CLA diet from BW 60 kg to 120 kg; CA, CB: group provided 1.5, 3.0 g/kg diet from BW 90 kg to120 kg.

表 2. 飼糧中添加共軛亞麻油酸對畜試黑豬一號閹公豬生長性能之影響

Table 2. Effects of dietary CLA supplementation on the growth performance of the TLRI Black Pig No. 1 barrows

Group	C *	A	B	CA	CB	SEM
Initial						
Age, day	152.5	151.2	150.2	145.7	157.4	4.5
BW[1], kg	60.4	60.0	59.7	59.7	60.7	0.6
Final						
Age, day	262.5	254.6	248.6	254.4	259.6	6.2
BW, kg	120.3	121.2	120.9	122.0	120.8	0.8
ADG, kg	0.557^{b}	0.586^{ab}	0.627^{a}	0.581^{ab}	0.594^{ab}	0.018
ADFI, kg	2.44^{c}	2.75^{ab}	2.98^{a}	2.55^{bc}	2.43^{c}	0.10
Gain/feed	0.229^{ab}	0.217^{b}	0.212^{b}	0.230^{ab}	0.247^{a}	0.009

* C: control group; A, B: group provided 1.5,3.0 g/kg CLA diet from BW 60 kg to 120 kg; CA, CB: group provided 1.5, 3.0 g/kg diet from BW 90 kg to120 kg.

$^{a, b, c}$ Means within the same row without the same superscript are significantly different ($P < 0.05$).

[1] BW: body weight; ADG: average daily gain; ADFI: average daily feed intake.

飼糧中添加 CLA 對畜試黑豬一號閹公豬屠體性狀之影響列於表 3，各組間之屠體重、屠體長度、背脂厚度與左側屠體背最長肌重量均相近。B 組豬隻左側屠體第 10-11 肋骨間的腰眼面積與 CB 組相近，而顯著地較 C 組與 A 組為大 ($P < 0.05$)，腹脂厚度較其他四組為薄 ($P < 0.05$)，瘦肉率則較 C 組及 CB 組高($P < 0.05$)，而 C 組的脂肪率較 CB 組 為高($P < 0.05$)。C 組的瘦肉率較 A、B 及 CA 等組為低、脂肪率較 CB 組高，腰眼面積較 B 組及 CB 組為小，和多位研究者(DeLany and West, 2000 ; Gatlin *et al.,* 2002 ; Ostrowska *et al.,* 1999 ; Ramsay *et al.,* 2001 ; Wiegand *et al.,* 2002)指出，飼糧中添加 CLA 可提高屠體的瘦肉量、增大腰眼面積，降低脂肪組織蓄積之結果相似。

表 3. 飼糧中添加共軛亞麻油酸對畜試黑豬一號閹公豬屠體性狀之影響

Table 3. Effects of dietary CLA supplementation on the carcass characteristics of the TLRI Black Pig No. 1 barrows

Group	C*	A	B	CA	CB	SEM
Carcass weight, kg	100.1	98.4	98.4	100.9	100.5	1.0
Carcass length, cm	103.2	102.7	101.6	103.2	102.8	0.9
Left side carcass						
Backfat thickness, mm	23.8	21.3	22.0	24.7	22.8	1.3
Bellyfat thickness, mm	23.9^{a}	24.5^{a}	17.6^{b}	24.2^{a}	23.0^{a}	1.3
LEA[2], cm^2	38.65^{b}	39.65^{b}	43.35^{a}	41.10^{ab}	43.43^{a}	1.05
LM weight, kg	2.87	2.96	3.04	2.93	3.11	0.10
Belly weight, kg	4.53^{ab}	4.21^{b}	4.26^{b}	4.74^{a}	4.51^{ab}	0.15
Lean, %	48.09^{c}	50.03^{ab}	50.63^{a}	50.05^{ab}	49.19^{bc}	0.42
Fat, %	13.57^{a}	12.96^{ab}	12.95^{ab}	12.77^{ab}	10.82^{b}	0.72

* C: control group; A, B: group provided 1.5,3.0 g/kg CLA diet from BW 60 kg to 120 kg; CA, CB: group provided 1.5, 3.0 g/kg diet from BW 90 kg to120 kg.

$^{a, b, c}$ Means within the same row without the same superscript are significantly different ($P < 0.05$).

[2] LEA: loin eye area; LM: *Longissimus dorsi* muscle.

飼糧中添加共軛亞麻油酸對畜試黑豬一號閹公豬背最長肌的化學成分及肉色之影響列於表 4。B 組豬隻背最長肌中的粗脂肪含量顯著地較 C 組為高，水分含量則較低 (P < 0.05)，A 組也有粗脂肪含量較 C 組高、水分含量較低的趨勢，此與 Dugan *et al.* (1997) 的研究結果一致，而 CA 及 CB 組豬隻 LM 的化學成分均與 C 組相近，推測係因豬隻採食含 CLA 飼糧的期間較短所致。Cameron and Enser (1991) 及Wood *et al.* (1996) 均證實，豬背最長肌中的脂肪含量，與其肉質風味、多汁性及嫩度均呈正相關，顯示在 TBP 閹公豬肥育期飼糧中添加 3 g/kg 的 CLA 有提升肉質之效果。食肉色澤受肌肉水分含量與肌肉色素、肌間脂肪等因素所影響（Janky and Froning, 1973），本試驗參照 NPPC (1999) 肉色及大理石紋主觀評級結果，B 組 LM 的肉色指數顯著地較 C 組高（表4），和 B 組 LM 的 a 值較 C 組為高之趨勢相似，各組間大理石紋指數相近，而 L 值以 CB 組和 A 組顯著地較 B 組和 CA 組高。此與陳等（1991）指出，屠肉的 a 值與 L 值呈負相關之論述相似。

表 4. 飼糧中添加共軛亞麻油酸對畜試黑豬一號閹公豬背最長肌化學成分及肉色之影響

Table 4. Effects of dietary CLA supplementation on the chemical compositions and color of *Longissimus dorsi* muscle of the TLRI Black Pig No. 1 barrows

Group	C*	A	B	CA	CB	SEM
Compositions, %						
Crude fat	2.67^{b}	3.49^{ab}	4.60^{a}	2.85^{b}	3.24^{ab}	0.49
Crude protein	21.92	21.97	21.61	22.12	21.60	0.23
Moisture	74.19^{a}	73.15^{ab}	72.62^{b}	74.03^{a}	74.14^{a}	0.42
Ash	1.10	1.12	1.10	1.13	1.10	0.02
Color						
L value	54.8^{ab}	57.4^{a}	51.8^{b}	52.5^{b}	57.7^{a}	1.5
a value	4.3	4.3	6.0	5.5	5.2	0.9
b value	9.6	10.2	9.5	10.4	10.7	0.4
Score						
Color	2.20^{b}	2.39^{ab}	2.90^{a}	2.61^{ab}	2.72^{ab}	0.17
Marbling	2.11	2.23	2.70	1.88	2.44	0.29

* C: control group; A, B: group provided 1.5,3.0 g/kg CLA diet from BW 60 kg to 120 kg; CA, CB: group provided 1.5, 3.0 g/kg diet from BW 90 kg to120 kg.

[a, b] Means within the same row without the same superscript are significantly different (P＜0.05).

在 LM 的脂肪酸含量方面（表5），A 組及 B 組的 SFA 含量顯著地較 CA 組高，CA 組及 CB 組的 PUFA 較 A 組及 C 組為高（P < 0.05），而 LM 脂質中的 MUFA 含量各組間相近。B 組及 CA 組 LM 中*c*9,*t*11 CLA 的含量較其餘三組為高（P < 0.05），而 B 組及 C 組未檢出 *t*10,*c*12 CLA，且 C、A 及 CA 三組中亦分別僅有 1 頭豬的背最長肌中測得含有 *t*10, *c*12-CLA，此與研究 (Ip *et al.,* 1994 ; Kramer *et al.,* 1997 ; Sehat *et al.,* 1998) 指出，天然食物中所含的 CLA 以 *c*9, *t*11 型式為主之結果一致。*t*10 ,*c*12 CLA 具有抑制脂質生成 (Poirier *et al.,* 2006) 及抑制體脂蓄積（Park *et al.,* 1999 ; Ryder *et al.,* 2001）等效果，此與本試驗中全期餵飼 3g/kg 飼糧組（B組）豬隻的腹脂厚度顯著地較對照組為薄，及 CB 組的脂肪率較低之結果相符。蘇（2004）及蘇等（2005b）均指出，畜試黑豬一號在體重 105-120 kg 時，脂肪細胞及脂質合成能力均顯著地較 LYD 三品種雜交肉豬大及強，A 組及 CA 組之背脂與腹脂厚度，以及脂肪率均與對照組相近，是否係由於添加量太少所致，尚待評估。亞麻油酸（$C_{18:2}$）及次亞麻油酸（$C_{18:3}$）是 LM 中主要的 PUFA，也是人體的必需脂肪酸。英國 Department of Health (1994)指出，油脂之 PUFA/SFA 比值大於 0.40 者，有益人體健康，

惟 PUFA/SFA 比值愈大，受氧化而酸敗的速度也會愈快。本試驗 CA 組與 CB 組的 PUFA/SFA 顯著地較 C 組及 A 組為高，惟各組均低於 0.40。

表 5. 飼糧中添加共軛亞麻油酸對畜試黑豬一號閹公豬背最長肌脂肪酸含量（%）之影響

Table 5. Effects of dietary CLA supplementation on the fatty acid composition (%) of *Longissimus dorsi* muscle of the TLRI Black Pig No. 1 barrows

Group	C*	A	B	CA	CB	SEM
$C_{8:0}$	0.70	0.77	0.98	0.93	0.93	0.12
$C_{10:0}$	0.12	0.10	0.11	0.11	0.10	0.01
$C_{12:0}$	0.09	0.10	0.08	0.09	0.08	0.01
$C_{14:0}$	1.45^{ab}	1.47^{ab}	1.51^{a}	1.40^{ab}	1.34^{b}	0.05
$C_{16:0}$	26.81	27.35	26.92	26.23	26.42	0.37
$C_{16:1}$	3.62^{a}	3.41^{ab}	3.42^{ab}	3.49^{ab}	3.01^{b}	0.17
$C_{18:0}$	15.02^{ab}	15.65^{a}	15.32^{ab}	14.20^{b}	15.39^{ab}	0.45
$C_{18:1}$	40.93^{a}	40.53^{ab}	38.91^{b}	39.44^{ab}	39.17^{ab}	0.62
$C_{18:2}$	8.82^{b}	8.34^{b}	9.96^{ab}	11.25^{a}	10.66^{a}	0.57
*c*9, *t*11 CLA	0.11^{b}	0.10^{b}	0.22^{a}	0.17^{a}	0.10^{b}	0.02
*t*10, *c*12 CLA	0.04	0.02	ND	0.04	ND	--
$C_{18:3}$	1.08	0.98	1.01	1.12	1.11	0.05
$C_{20:0}$	0.19^{b}	0.20^{b}	0.26^{a}	0.18^{b}	0.19^{b}	0.02
$C_{22:0}$	0.19	0.30	0.27	0.24	0.26	0.05
$C_{22:1}$	1.03^{b}	1.00^{b}	1.41^{a}	1.46^{a}	1.55^{a}	0.13
SFA[3]	44.46^{ab}	45.72^{a}	45.23^{a}	43.20^{b}	44.48^{ab}	0.65
MUFA	45.58	44.94	43.74	44.39	43.73	0.63
PUFA	9.96^{b}	9.35^{b}	11.05^{ab}	12.41^{a}	11.79^{a}	0.58
PUFA/SFA	0.29^{ab}	0.27^{b}	0.24^{b}	0.35^{a}	0.30^{ab}	0.02

* C: control group; A, B: group provided 1.5,3.0 g/kg CLA diet from BW 60 kg to 120 kg; CA, CB: group provided 1.5, 3.0 g/kg diet from BW 90 kg to120 kg.

[a, b, c] Means within the same row without the same superscript are significantly different ($P < 0.05$).

[3] SFA: total saturated fatty acid ($C_{8:0}$ +$C_{10:0}$ +$C_{12:0}$ +$C_{14:0}$ +$C_{16:0}$ +$C_{18:0}$ +$C_{20:0}$ +$C_{22:0}$); MUFA: total monounsaturated fatty acid ($C_{16:1}$+$C_{18:1}$+$C_{22:1}$); PUFA: total polyunsaturated fatty acid ($C_{18:2}$+$C_{18:3}$); ND: Not detectable.

結論

畜試黑豬一號閹公豬在肥育期飼糧中添加3 g/kg CLA，肥育前期(體重60-90 kg)可顯著提高日增重及飼料攝食量，肥育後期(體重90至120 kg)則可顯著地改善飼料換肉率。試驗全期飼糧添加3 g/kg CLA，則顯著地減少屠體的腹脂厚度，提高瘦肉率（$P < 0.05$），脂肪率也較對照組為低，背最長肌中的粗脂肪含量顯著地較對照組高。故畜試黑豬一號閹公豬在肥育期飼糧中添加CLA具有促進生長及改善屠體性狀的效果。

誌謝

本試驗承畜產試驗所產業組（豬）同仁協助動物飼養與屠體性狀測定，營養組協助背最長肌化學成分及脂肪酸組成分析，謹誌謝忱。

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Effects of dietary supplementation of conjugated linoleic acid on the growth and carcass characteristics of TLRI Black Pig No.1 barrows(1)

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Abstract

The purpose of this study was to investigate the effect of dietary supplementation of conjugated linoleic acid (CLA) on the growth, carcass quality and lean meat composition of TLRI Black Pig No.1 (TBP) barrows. A total of 50 TBP barrows, with body weight (BW) 60.1 kg, were divided into 5 groups. The first group (C group) was control which was provided with the basal diet. The A and B groups were fed basal diet with two dietary levels of CLA, 1.5 g/kg and 3.0 g/kg for pigs weighing from 60 kg to 120 kg. The CA and CB groups were provided with two dietary levels of CLA 1.5 g/kg and 3.0 g/kg from BW 90 kg to 120 kg. The feeding trial was terminated when pigs reached 121.0 kg. The growth performance, carcass characteristics, color and marbling score, pork color, chemical and fatty acid composition were measured. Pigs of A and B groups had higher ($P < 0.05$) daily feed intake (ADFI) and B group had higher daily gain (ADG) ($P < 0.05$) than C group. For carcass characteristics, the pigs of B group had thinner ($P < 0.05$) bellyfat thickness than others and significantly ($P < 0.05$) higher lean and crude fat percentage, larger ($P < 0.05$) loin eye area than the C and CA group. Besides, pigs of the CB and CA groups had higher ($P < 0.05$) PUFA in LM than A and C groups. In conclusion, dietary supplementation of CLA for pigs raised from BW 60 kg to 90 kg had higher ($P < 0.05$) ADFI than C group and the ADG was also increased 15.1 ($P > 0.05$) and 24.0% ($P < 0.05$), respectively. The supplementation of 3.0 g/kg CLA started from BW 90 kg had higher G/F ($P < 0.05$) and ADG ($P > 0.05$). TBP barrows fed CLA during the finishing stage had higher ADG and the better carcass quality.

Key words: Barrow, Carcass characteristics, Conjugated linoleic acid, Growth performance, TLRI Black Pig No.1.

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