THE EFFECT OF CONJUGATED LINOLEIC ACID SUPPLEMENTATION ON CARCASS CLASSIFICATION AND BACKFAT QUALITY OF SOUTH AFRICAN PIGS

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Abstract – One hundred and forty four Landrace x Large White crossbred pigs weighing on average ±30 kg were randomly divided into 2 groups of 72 pigs each that were assigned to one of two dietary treatments; a control diet supplemented with 1.0% sunflower oil (SFO) and the experimental diet where 0.5% SFO was replaced with 0.5% conjugated linoleic acid (CLA). Each dietary group was divided into 3 gender groups (Boars, Barrows and Gilts) that consisted of 24 pigs each. Each gender group was divided into 2 slaughter weight groups (70 kg and 90 kg) consisting of 12 pigs each. Pigs were fed until the liveweight were ±70 kg for the porkers and ±90 kg for the baconers. Carcass characteristics and backfat (BF) quality of the dietary groups were compared. Animals on the CLA diet had leaner carcasses with thinner BF and higher lean meat content (LMC) compared to animals on the SFO diets. Elevated CLA levels in BF resulted in improved technological properties of BF as demonstrated by a decrease in iodine value (IV) and a decrease in double bond index (DBI).

Key Words – CLA, Hennessey Grading, Pork

- INTRODUCTION

One approach to improve pork quality is supplementation with feed additives, such as CLA, in the growing-finishing diet [1]. In addition to the increased marketing potential of CLA-enriched or “heart-healthy” pork, CLA has the potential to directly increase profitability for both producers and processors. Published studies and preliminary reports of swine trials indicate that feeding CLA-supplemented diets may provide a means by which feed intake and BF can be decreased and percentage lean can be increased without affecting growth rate [1;2]. As pork-processing plants become increasingly mechanised, CLA may provide a nutritional solution to fat firmness problems that may enhance the overall value of extremely lean carcasses [2]. The current South African classification system [3] entails the calculation of LMC by means of a single measurement of backfat thickness (BFT) and muscle thickness (MT) taken by the Hennessy Grading Probe (HGP). These measurements are then used to calculate % LMC. This measurement is made between the 2nd and 3rd last rib, 45 mm from the carcass midline [3]. The aim of the study was to evaluate the effect of dietary CLA supplementation on carcass classification and BF quality of South African pigs under commercial production conditions.

- MATERIALS AND METHODS

Animals

One hundred and forty four Landrace x Large White crossbred pigs weighing on average ±30 kg were randomly divided into 2 groups of 72 pigs each. Groups were then randomly assigned to one of two dietary treatments; a control diet, supplemented with 1.0% SFO and the experimental diet where 0.5% SFO was supplemented with 0.5% CLA and formulated to provide similar energy (13.79.MJ/kgDE) and lysine level (0.14%). Each dietary group was further divided into 3 gender groups (Boars, Barrows and Gilts) that consisted of 24 pigs each. Each gender group was further divided into 2 slaughter weight groups (70 kg and 90 kg) consisting of 12 pigs each. The pigs were housed in groups of 12 pigs per pen. Pigs were provided feed and water *ad libitum*. Pigs were fed until the liveweight of the pigs were ±70 kg for the porkers and ±90 kg for the baconers.

Slaughter and carcass measurements

After a 41 and 68 day feeding period, when the average live weights of the pigs reached 70 kg and 90 kg respectively, the pigs were slaughtered following commercial slaughtering procedures. Pigs were weighed and feed was removed approximately 12 hours before slaughter. The HGP was used to measure BFT, thickness of the *M. longissimus thoracis* muscle, 45 mm off the carcass midline, between the 2nd and 3rd last rib. The % LMC in each carcass was calculated according to the formula [5]: %LMC = 72.5114 – 0.4618BFT + 0.0547MT [BFT = Backfat thickness (mm) and MT = Muscle thickness (mm) at 45 mm from the carcass midline, between the 2nd and 3rd last rib].

Backfat quality

Extraction of lipid from BF was performed according to [6] using chloroform and methanol in a ratio of 2:1. Total lipid was converted to methyl esters by base-catalysed transesteri-fication, with sodium methoxide (0.5 M solution in anhydrous methanol) for 2 h at 30 °C [7]. Fatty acid methyl esters were quantified using a Varian 430-GC flame ionization GC. Double bond index was calculated from fatty acid data as: Σ % of UFA x number of double bonds of each UFA [8]. The Hanus method [9] was used to determine the IV of the extracted fat.

Statistical analyses

An analysis of variance (ANOVA) procedure for balanced data [10] was used to determine the effect of diet, gender and slaughter weight on carcass characteristics and fat quality parameters. The Tukey-Kramer multiple comparison test ($\alpha = 0.05$) was carried out to identify significant differences between treatment means [10].

- RESULTS AND DISCUSSION

Carcass characteristics like BFT, MT and LMC were significantly influenced by slaughter weight. It was observed in Table 1 that porkers (70 kg) had thinner BF and MT and higher LMC compared to baconers (90 kg). This is in agreement with other researchers who stated that increases in slaughter weight (SW) were associated with increased BF depth and MT [11].

According to Table 1 boars generally had thinner BF compared to barrows with the BFT of gilts intermediate to these groups, except for the SFO supplemented groups, where gilts had thinner BF compared to barrows, with the BFT of boars intermediate to these groups. Boars generally demonstrated a lower MT compared to gilts and barrows with the exception of the 90 kg CLA group where boars had a higher MT value compared to gilts and barrows. There was a trend for boars to contain higher LMC compared to gilts and barrows (Table 1). Except for the 90kg SFO barrows had the highest ($p < 0.001$) conformation score (CS) followed by gilts with intermediate CS and then boars with the lowest CS. Other researchers found no statistical difference in CS between genders [12].

Backfat thickness was also significantly influenced by dietary treatment. The average BFT of

CLA supplemented pigs were 14.3 mm compared to SFO supplemented pigs which had an average BFT of 15.1 mm. The CLA supplemented pigs' BFT was below the minimum value of 15 mm BFT for good fat quality proposed by Davenel et al., (1999) [13], while the BFT of SFO supplemented pigs were just above the minimum value of 15 mm. Because LMC is calculated from BFT, LMC was also significantly influenced by dietary treatment. The CLA supplemented pigs had the highest LMC compared to the SFO supplemented pigs, these findings are in accordance with other researchers [14]. According to Davenel et al. (1999) [13] LMC should be less than 57% for good technological fat properties. The LMC of all the pigs in this experiment were higher than 57%. In South Africa, BFT and MT are used to classify pigs into one of six classification groups. Groups P (< 12 mm BFT) and O (< 18mm BFT) are the leanest groups, R, C, U, and S, are the fatter groups. Lean classification groups are more desirable, as producers get paid more for these pigs. Table 2 indicates that in the 70 kg SW group 100% of the boars, 83% of the gilts and 83% of the barrows on the CLA diet obtained P and O classification compared to the 75% of the boars, 100% of the gilts and 66% of the barrows on the SFO diet obtained P and O classification. The same trend was observed in the 90 kg SW group, where 91% of the boars, 58% of the gilts and 33% of the barrows on the CLA diet obtained P and O classification, compared to the 41% of the boars, 75% of the gilts and 25% of

Table 1 Carcass measurements of pigs from the different treatment groups

SW	Diet	Gender	BFT (mm)	MT (mm)	LMC (%)	CS
70	SFO	Boars	12.2^{ab}	44.9^{ab}	69.3^{bc}	3.0^{a}
		Gilts	11.4^{a}	50.3^{ade}	70.0^{c}	3.1^{a}
		Barrows	15.4^{bcd}	48.1^{ac}	68.0^{ab}	3.7^{b}
	CLA	Boars	10.4^{a}	43.9^{a}	70.1^{c}	3.1^{a}
		Gilts	12.6^{ac}	50.2^{ade}	69.4^{bc}	3.2^{a}
		Barrows	13.9^{ad}	49.1^{ade}	68.8^{bc}	3.2^{a}
90	SFO	Boars	16.4^{dg}	52.0^{bcd}	67.8^{ab}	3.0^{a}
		Gilts	15.8^{bcde}	53.9^{ce}	68.2^{ab}	3.2^{a}
		Barrows	19.4^{fg}	53.3^{ce}	66.5^{a}	3.0^{a}
	CLA	Boars	13.9^{ad}	56.0^{de}	69.2^{bc}	3.1^{a}
		Gilts	15.9^{cdf}	53.6^{ce}	68.1^{ab}	3.3^{ab}
		Barrows	19.2^{efg}	53.5^{ce}	66.6^{a}	3.3^{ab}
Sign. Level			$p < 0.001$	$p < 0.001$	$p < 0.001$	$p < 0.001$

Table 2 Percentage of pigs with P and O gradings in the different slaughter, diet and gender groups

SW	70kg			90kg		
	Boars	Gilts	Barrows	Boars	Gilts	Barrows
SFO	75	100	66	41	75	25
CLA	100	83	83	91	58	33

the barrows on the SFO diet. This clearly illustrates that CLA supplementation improved the lean classification of pigs as reported previously [2]. This finding is of practical significance for the South African pig producer, since more pigs being classified as P and O means more profitable pig production.

For BF to have good technological fat properties the IV should be less than 70 [15]. From Figure 1 it is clear that lighter pigs had higher IV than heavier pigs. That is an indication that lighter pigs had a more unsaturated BF with poorer technological properties compared to heavier pigs. It was reported that heavier pigs had a more physiological mature fat with a more saturated fatty acid profile [16]. From Figure 1 it can also be observed that boars always had the highest IV followed by gilts and then barrows. This means that boars had the poorest fat quality, with gilts intermediate and barrows the best fat quality. It was previously reported that boar BF had a more unsaturated fatty acid profile compared to gilts and barrows [15]. From Figure 1 it is clear that BF from pigs on the CLA diets generally had lower IV compared to BF from pigs on the SFO diets. With the exception

Figure 1 Iodine value of pigs from the different treatment groups

of the 70 kg boars all CLA treatment groups had BF IV of less than 70 while only the 70 and 90 kg SFO barrows had BF IV of less than 70. For good fat quality, BF should have a DBI of less than 80 [17]. Five of the CLA treatment groups conformed to this fat quality requirement while only 3 of the SFO treatment groups conformed (Figure 2).

Figure 2 Double bond index of pigs from the different treatment groups

- CONCLUSION

The effect of CLA supplementation on carcass classification was best demonstrated by the higher frequency of P and O classified carcasses from the CLA supplemented group compared to the SFO supplemented groups. This finding is of special practical significance for the South African pig producer, since more pigs being classified as P and O means more profitable pig production. Elevated CLA levels in subcutaneous fat resulted in improved technological properties of BF as demonstrated by a decrease in IV and a decrease in DBI.

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