

INCREASED INCLUSION OF SULFUR AMINO ACIDS IN GROWING-FINISHING PIG DIETS IMPROVED MEAT QUALITY

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Abstract – The aim of this study was to assess the effect of increasing total sulfur amino acid (TSAA) supply on pigs' carcass and meat quality traits. A corn-soybean meal-based diets supplying standard TSAA requirement (CON) was compared to two other diets supplemented with DL-methionine (DLM) or DL 2 hydroxy 4 methyl (thio) butanoic acid (HMTBA) at +25% above TSAA requirement. Male and female piglets, were fed with the different diets from 11 to 110 kg over a 20-week period. *Longissimus* muscle (LM) from female pigs fed DLM and HMTBA treatments had both reduced ($P<0.05$) drip loss compared with CON group. Interestingly, for female, pH_{45min} value was higher in the HMTBA group than in the DLM and CON groups, while, for male, L*_{45min} value was higher in the HMTBA group than in the DLM- and CON groups. Shear force of LM tended ($P=0.06$) to be decreased by increased consumption of TSAA compared to CON. Collectively, increased inclusion of TSAA in growing-finishing pig diets appeared to improve meat quality.

Key Words – Drip loss, Marbling score, Shear force

I. INTRODUCTION

Met and Cys account for the majority of total sulfur amino acids (TSAA) in pigs. Met is involved in the formation of glutathione, one of the main cellular antioxidants [1], and provides S-adenosylmethionine which plays a crucial role in promoting adipogenesis in muscle [2]. However, data are lacking about the effect of increasing TSAA on meat quality. The objective of this study was to determine the effects of increasing TSAA by 25% on meat quality in growing-finishing pigs.

II. MATERIALS AND METHODS

A total of 144 (half females and half castrated males) crossbred [Duroc×(Landrace×York)] piglets (11.16±0.23 kg) were divided, on the basis of body weight (BW) and gender, into 36 pens. Each pen of pigs was fed one of three diets with each diet replicated 6 times by male and female pens, respectively. The control (CON) diet was formulated according to the NRC (2012) [3] recommendations and the two other diets were formulated by supplementation of DL-methionine (DLM) or DL 2 hydroxy 4 methyl (thio) butanoic acid (HMTBA) at 125% of the TSAA present in the CON diet. At the end of 20-weeks experimental period, one pig with average BW (~110kg) was selected from each pen and slaughtered. Carcass traits were measured according to the Chinese guidelines [4]. The percentage of lean meat was calculated [5]. Drip loss was determined as described [6]. Meat color values (L*=lightness, a*=redness, b*=yellowness) were determined at 45min and 24h postmortem using a CR-400 Chroma Meter. Marbling score were determined according to NPPC guidelines [7], and cooking loss was determined as described [8]. Warner-Bratzler shear force (WBS) was determined using a Texture Analyzer [1]. Data were analyzed using PROC GLM procedures of SAS (9.4 release for Windows) with the model including the effects of diet, sex, and the diet×sex interaction. The differences between means were considered significant at $P<0.05$.

III. RESULTS AND DISCUSSION

Male pigs had higher ($P<0.05$) backfat depth and marbling score, but lower ($P<0.05$) lean meat percentage, shear force and loin eye area (Table 1). For pigs fed the CON diet, drip loss of LM was higher in females than in males. However, the DLM- and HMTBA-fed females had lower ($P<0.05$) drip loss than the CON-fed females, suggesting improvement of water-holding capacity (WHC) in muscle following increased level of dietary TSAA. Juiciness is positively correlated with the WHC and intramuscular fat (IMF) content [1],

and improved flavor and juiciness were observed when IMF levels increased approximately by 2.5% [9]. Enhancing the WHC of meat is one of the way that IMF content affects juiciness [10]. Therefore, it was proposed that increasing levels of TSAA in growing-finishing pig diets might affect adipogenesis in muscle. Increased marbling score evaluated at 45 min further supported this notion. In addition, given that protein oxidation might also affect WHC in porcine LM [3], it is necessary to evaluate the antioxidant status of muscle to explain the improved WHC following increased inclusion of dietary TSAA. Interestingly, pH_{45min} value was higher in the HMTBA-fed females than in the DLM- and CON-fed females, while L*_{45min} value was higher in the HMTBA-fed males than in the DLM- and CON-fed males. The increased pH value suggested a decrease in muscle glycolytic potential postmortem, and the increased lightness value suggested increased content of myoglobin in muscle [1]. Shear force of LM tended ($P=0.06$) to decrease by increased consumption of TSAA as DLM and HMTBA, suggesting the positive effect of increased TSAA on improvement of tenderness, a common index of the consumers pork quality.

Table 1 Effect of dietary treatment and sex on carcass and meat quality traits of finishing pigs.

Item	CON		DLM		HMTBA		SEM	<i>P-value</i>		
	Male	Female	Male	Female	Male	Female		<i>Diet</i>	<i>Sex</i>	<i>Diet × Sex</i>
Final body weight, kg	108.8 ^{abc}	105.7 ^{bc}	109.1 ^{ab}	104.4 ^c	111.1 ^a	109.2 ^{ab}	3.89	0.08	0.02	0.69
Dressing percentage, %	78.41	77.51	77.62	78.29	78.45	77.58	1.08	0.99	0.32	0.14
Lean meat, %	59.98 ^b	63.04 ^a	59.74 ^b	64.46 ^a	60.17 ^b	63.33 ^a	2.23	0.81	<0.01	0.60
Loin eye area, cm ²	79.79 ^{ab}	87.89 ^a	79.56 ^{ab}	82.28 ^{ab}	74.42 ^b	85.15 ^a	7.33	0.39	0.01	0.41
Backfat depth #, mm	26.24 ^a	20.45 ^b	26.30 ^a	21.63 ^b	25.68 ^a	21.71 ^b	3.2	0.89	<0.01	0.78
pH _{45min}	6.61 ^{ab}	6.42 ^b	6.55 ^{ab}	6.39 ^b	6.46 ^b	6.88 ^a	0.28	0.21	0.81	0.02
Color parameters										
L* _{45 min}	37.29 ^b	38.10 ^{ab}	37.81 ^b	38.11 ^{ab}	39.72 ^a	36.93 ^b	3.49	0.56	0.25	0.01
a* _{45 min}	3.34	3.6	3.23	3.05	3.07	3.51	1.49	0.43	0.40	0.45
b* _{45 min}	2.82	2.80	2.97	3.04	3.08	2.85	1.18	0.59	0.71	0.74
Shear force, kg	2.97 ^{ab}	3.64 ^a	2.38 ^b	3.01 ^{ab}	2.67 ^b	2.90 ^{ab}	0.65	0.06	0.03	0.67
Marbling score										
45min	2.83 ^{ab}	2.58 ^b	2.58 ^b	2.83 ^{ab}	3.5 ^a	3.33 ^a	0.59	0.01	0.78	0.54
24h	2.92 ^{ab}	2.67 ^{ab}	3 ^{ab}	2.58 ^b	3.08 ^a	2.67 ^{ab}	0.42	0.86	0.02	0.86
Drip loss, %	1.74 ^b	2.14 ^a	1.81 ^{ab}	1.57 ^b	1.57 ^b	1.61 ^b	0.23	0.02	0.51	0.05
Cook loss, %	31.20	29.48	28.90	28.38	31.05	28.74	5.13	0.58	0.28	0.86

^{abc} Means within a row with no common superscripts are significantly different ($P<0.05$). # The average values of backfat depth determined at first rib, last rib and last lumbar vertebra

IV. CONCLUSION

Differences in drip loss between genders suggested the TSAA requirement of female pigs may be underestimated by NRC recommendation. Increased dietary level of TSAA by 25% of that as recommended by NRC is beneficial to muscle WHC of females. Increased inclusion of dietary TSAA appeared to improve tenderness of muscle independently to the gender. HMTBA showed a positive effect on marbling score and pH value at 45 min, which warrants further study to find biochemical explanation for these differences.

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