QUALITATIVE PROPERTIES AND CARCASS COMPOSITION OF PIGS FED RACTOPAMINE

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SUMMARY

Qualitative properties were assessed in pork muscles of barrows fed 20 ppm ractopamine for 2, 4 or 6 wk. Carcass muscle was increased 13.5% and fat decreased 11.2% by ractopamine. Slaughter weight did not differ between treatment groups. Ractopamine had no effect on *longissimus* muscle colour, firmness, marbling or Warner-Bratzler shear values. *Longissimus* moisture, ether extractable lipid and protein percentages were unaffected by ractopamine at 2 and 4 wk. At 6 wk ractopamine increased muscle protein and decreased lipid percentages. Activities of calcium dependent proteinases and Cathepsins B, H and L did not differ between muscles from control and ractopamine-fed pigs. Thus, in conclusion feeding 20 ppm of ractopamine to finishing barrows markedly improved carcass composition while maintaining pork quality comparable to control pigs.

INTRODUCTION

Analogues of the catecholamines have been shown to markedly increase skeletal muscle mass with concomitant reduction in fat deposition in livestock species and rodents. They dramatically affect muscle and fat deposition and are thus referred to as repartitioning agents. Because they interact with b-receptors, they also are referred to as b-adrenergic agonists (BAA).

Species differ in response to BAA but the repartitioning affects are observed in all species, Hanrahan et al. (1986). With the increased leanness, and decreased fat deposition by BAA, the effects on qualitative properties may be adversely affected. Thus, the objective of this study was to assess muscle quality in ractopamine fed pigs.

EXPERIMENTAL METHODS

Thirty two barrows (66.4 kg) were allotted to 4 groups of 8 pigs. Eight barrows were slaughtered to assess initial carcass composition and meat quality. The remaining 3 groups of 8 barrows were slaughtered after either 2, 4 or 6 weeks. Four barrows in each slaughter group were fed 20 ppm of the phenethanolamine, ractopamine [1-(4-hydroxyphenyl)-2-(1 methyl-3 (4 hydroxyphenyl) propylamino) ethanol - Eli Lilly and Company, Indianapolis, IN.] in a 16% crude protein corn-soy diet. The other 4 barrows in each slaughter group were fed the same diet without ractopamine.

On slaughter days 4 control and 4 treated pigs were transported to the meat laboratory and slaughtered. Immediately after exsanguination the *semitendinosus* and a portion of the *longissimus* muscle were removed, frozen in liquid nitrogen and stored at -80°C for later analysis. After skin removal and evisceration the carcasses were split into sides and chilled at 2°C. At 24 h postmortem the left side was ribbed between ribs 10-11, to expose the *longissimus* muscle for colour, firmness and marbling scores. Two 5-cm thick chops were cut from the loin at 4 and 6 wk, broiled to 70°C internal temperature and chilled for 24 h for Warner-Bratzler shear. *Semitendinosus* and *longissimus* muscles were powdered for proximate analysis (AOAC), and determination of calcium dependent proteinase (CDP) (Koohmariae et al. 1984) and catheptic enzyme (Moeller et al. 1977) activities. The data were analyzed by t test, Gill (1978).

RESULTS

Ractopamine increased carcass muscle by 2.8, 22.8 and 14.8% above control barrows at 2, 4 and 6 wk, respectively. Carcass fat was decreased by 3.0, 12.0 and 18.8% at 2, 4 and 6 wk, respectively. Subjective scores of muscle colour and firmness did not differ between treatments.

Table 1. Subjective Marbling Score, Warner-Bratzler Shear Values and Total Calcium Dependent Proteinase (CDP) Activity

Characteristic	wk	Control	Ractopamine
Marbling score[a]			
	0	1.5 ± 0.19	
	2	1.5 ± 0.29	1.8 ± 0.48
	4	2.0 ± 0.71	2.0 ± 0.58
	6	2.5 ± 0.64	1.8 ± 0.48
Warner-Bratzler shear, kg[b]			
	4	2.60 ± 0.21	2.84 ± 0.28
	6	3.00 ± 0.12	3.09 ± 0.25
Total CDP activity[c]			
	2	0.54 ± 0.17	0.56 ± 0.12
	4	0.51 ± 0.14	0.63 ± 0.05
	6	0.60 ± 0.15	0.34 ± 0.22

[a]Five point scale: 1 = traces, 5 = abundant.
[b]Kilograms per 1.27 diameter core.
[c]Absorbance at 278 nm per g muscle.

Table 2. Catheptic Enzyme Activities[a,b]

Enzyme	wk	Control	Ractopamine
Cathepsin B			
	2	28.8 ± 1.27	26.2 ± 2.24
	4	19.4 ± 1.26	22.4 ± 0.90
	6	22.8 ± 1.18	23.1 ± 1.51
Cathepsin H			
	2	149.2 ± 3.19	132.5 ± 2.42
	4	106.6 ± 1.94	125.0 ± 1.68
	6	170.6 ± 3.77	222.4 ± 3.83
Cathepsin L			
	2	60.1 ± 1.54	68.5 ± 2.36
	4	46.1 ± 1.26	64.3 ± 1.77
	6	54.4 ± 1.72	73.8 ± 2.26

[a]Catheptic enzyme activities are the total of the sedimentable and unsedimentable fractions for each enzyme.
[b]Activities expressed as μ units·mg protein^{-1}·min^{-1} (1 unit is the release of 1 μmol of product/min).

Moisture content was unaffected by ractopamine. Protein percent tended to increase in ractopamine-fed pigs at 2 and 4 wk and was increased (P = 0.05) at 6 wk. Ether extractable lipid was decreased (P = 0.02) at 6 wk but did not differ at 2 and 4 wk. Marbling score tended to parallel lipid at 6 wk but differences were not significant (Table 1).

Neither shear values nor total calcium dependent proteinase (CDP) (Table 1) and Cathepsins B, H and L activities (Table 2) differed between treatments.

DISCUSSION

The 13.5% increase in muscle and the 11.2% decrease in fat in barrows fed 20 ppm ractopamine are consistent with data, Ricks et al. (1984), Jones et al. (1985), Moser et al. (1986), Anderson et al. (1987a,b), Bekaert et al. (1987), Cole et al. (1987), Crenshaw et al. (1987), Hancock et al. (1987), Prince et al. (1987), van Weerden (1987), Wallace et al. (1987), Williams (1987), Wood and Brown (1987) for carcasses from BAA-treated pigs. Jones et al. (1985) and Wallace et al. (1987) found no effect of 0.25, 0.5 and 1 ppm Cimaterol on marbling but Moser et al. (1986) observed an effect with these same concentrations.

The nonsignificant effect on muscle colour by us also was observed by Jones et al. (1985), Moser et al. (1986), Bebaert et al. (1987), Cole et al. (1987), Wallace et al. (1987) and McKeith (1988 personal communication). Like Jones et al. (1985) we also observed no effect on muscle firmness.

Tenderness was not affected by ractopamine in our study or that by McKeith (1988 personal communication) and van Weerden (1987). In contrast, Jones et al. (1985) and Yen (1988 personal communication) found that Cimaterol increased shear values. Panel scores for tenderness, juiciness, flavour and overall desirability did not differ in ractopamine-fed pigs, McKeith (1988 personal communication).

None of the enzyme activities differed between treatments but Wang et al. (1988) observed a 55 and 70% decrease in CDP-I activity in lambs fed 10 ppm cimaterol for 3 and 6 wk, respectively. They also reported that shear values were increased 14 and 44% at 3 and 6 wk, respectively, by the BAA and suggested that reduced CDP activity contributed to the increased shear values.

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