

# DISEASE IMPACT ON CARCASS COMPOSITION AND MEAT QUALITY OF PIGS SELECTED FOR HIGH AND LOW RESIDUAL FEED INTAKE

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**Abstract** – The objective of this research was to test the hypothesis that selection for differences in feed efficiency changes the response to a disease challenge. Pigs divergently selected for low and high residual feed intake (11<sup>th</sup> generation of ISU RFI project) were inoculated with *Mycoplasma hyopneumoniae* and *Lawsonia intracellularis* (MhLI) at approximately 68 kg live weight to elicit a dual respiratory and enteric health challenge. Pigs were grown to market weight (approximately 125 kg) and harvested using standard commercial procedures to evaluate carcass composition and meat quality. Dressing percentage from infected pigs was lower than controls. Differences in purge, color, cook loss, moisture, and protein were due to genetic line and were not impacted by the health challenge.

**Key Words** – feed efficiency, *Lawsonia intracellularis*, *Mycoplasma hyopneumoniae*

## I. INTRODUCTION

Residual feed intake (RFI) is defined as the difference between expected and observed feed intake based on average daily gain and backfat. Low RFI (LRFI) pigs are more feed efficient than high RFI (HRFI) counterparts. The objective of this study was to determine the extent to which a dual respiratory and enteric bacterial infection impacted carcass composition and meat quality of pigs divergently selected for RFI. We were specifically interested in the interaction of RFI and health challenge. It was hypothesized that line and challenge would impact carcass composition and pork quality.

## II. MATERIALS AND METHODS

A 2 x 2 factorial design was used to design this project. One hundred barrows from the 11<sup>th</sup> generation of pigs from the Iowa State University RFI selection project were used. Half of the pigs (approximately 68 kg) were placed in an adjacent room and inoculated with *Mycoplasma hyopneumoniae* and *Lawsonia intracellularis* (MhLI), after a three-week adjustment period. Forty-seven of these pigs were fed until market weight (approximately 125 kg) and harvested using standard commercial procedures. Shrink was calculated as the weight loss of pigs during transportation and lairage. Carcass weight, dressing percentage, and fat free lean (%) were evaluated. Loins were removed and chops were cut (2.54 cm). Two chops were weighed at 1 and 3 days postmortem to determine purge loss. Chops for quality evaluation were vacuum packaged and aged 14 days before measuring pH, color, marbling, cook loss, and star probe. Chops for proximate analysis were frozen 1 day postmortem, homogenized in liquid nitrogen, and analyzed [1].

## III. RESULTS AND DISCUSSION

Carcass data (Table 1) showed there were no significant differences ( $P > 0.05$ ) for genetic line, health challenge, or line x health challenge interaction for shrink, carcass weight, or fat free lean. Control pigs had a higher dressing percentage than pigs challenged with MhLI early during growth. The explanation for decreased dressing percentage is not known, but it may be due to thickened viscera from the *Lawsonia* infection.

Table 1 Main effects of RFI line and infection and interaction of line x infection on carcass composition traits: shrink (%), carcass weight (kg), dressing (%), and fat free lean (FFL; %)

Item	Treatment				SEM	P-value		
	LRFI Control	HRFI Control	LRFI Infected	HRFI Infected		RFI Line	Infection	RFI Line x Infection
Shrink (%)	4.16	4.14	4.29	4.42	0.065	0.858	0.519	0.818
Carcass (kg)	93.72	92.07	91.86	95.52	0.850	0.584	0.646	0.131
Dressing (%)	78.07	77.89	77.38	77.25	0.197	0.698	0.049	0.930
FFL (%)	49.61	48.82	51.42	49.01	0.594	0.249	0.292	0.387

Neither line or health challenge affected star probe, subjective marbling scores, or fat content ( $P > 0.05$ , Table 2). Chops from LRFI animals exuded less purge and decreased cooking loss ( $P < 0.05$ ). This may indicate an improved water holding capacity of loin chops from LRFI pigs. This is consistent with previous results [1]. Chops from LRFI pigs also consisted of a higher percentage moisture and protein than chops from HRFI animals ( $P < 0.05$ ).

Table 2 Main effects of RFI line and infection and interaction of line x infection on fresh loin chop quality and proximate composition

Item	Treatment				SEM	P-value		
	LRFI Control	HRFI Control	LRFI Infected	HRFI Infected		RFI Line	Infection	RFI Line x Infection
pH	5.52	5.47	5.53	5.48	0.014	0.028	0.802	0.850
Hunter L	46.29	50.53	47.76	50.34	1.030	0.003	0.463	0.193
Subjective Color	3.60	2.91	3.23	3.07	0.148	0.031	0.456	0.058
Subjective Marbling	1.77	1.97	1.58	1.92	0.088	0.284	0.425	0.624
Purge (%)	2.46	3.85	2.62	3.59	0.346	0.009	0.908	0.614
Cook Loss (%)	19.63	22.93	19.31	22.54	0.947	0.001	0.663	0.965
Star Probe (kg)	5.74	6.00	6.12	5.91	0.090	0.761	0.697	0.248
Moisture (%)	73.94	73.31	73.87	73.26	0.179	0.010	0.727	0.931
Protein (%)	25.08	24.49	24.96	24.45	0.161	0.027	0.607	0.814
Fat (%)	1.53	1.98	1.61	2.00	0.123	0.128	0.707	0.845

#### IV. CONCLUSION

Results depict improved quality attributes of pork from pigs selected for LRFI. Pork loin quality of market weight pigs was not influenced by a dual respiratory and enteric health challenge early in the growth period, but dressing percentage of control pigs was higher than pigs that had been health challenged early in growth.

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#### REFERENCES

1. Arkfeld, E. et al. 2015. Composition and quality characteristics of carcasses from pigs divergently selected for residual feed intake on high- or low-energy diets. *J. Anim. Sci.* 93: 2530-2545.