NUTRITIONAL INTERVENTION TO RESTORE VALUE OF LITTLE PIGS

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I. INTRODUCTION

Low birth weight (LBW) pigs are associated with greater mortality, slower growth rates and decreased pork quality [1], and account for up to 25% of progeny [2]. When compared to average weight pigs (AvBW), LBW pigs show a lower total number of muscle fibres with larger cross-sectional area [1], which have a propensity to lead to an increased rate of post-mortem pH decline and higher drip loss [3]. They also have an increased content of heat-stable collagen [1]. Fat deposition in LBW pigs occurs some 20 days earlier than in AvBW pigs, and they are consistently found to have a higher intramuscular fat (IMF) content, with larger adipocytes [1]. The ability to nutritionally manipulate eating quality is well established. D'Souza et al. [4] improved IMF through a 15% reduction in lysine to energy ratio of the diet, although response to reduced vitamin A was mixed. Tenderness can be improved with the inclusion of dietary lecithin to reduce muscle collagen content [5]. The inclusion of nutrients such as vitamin E, magnesium and betaine to reduce lipid oxidation and improve water-holding capacity are well established [6]. The characteristics of the LBW pig and the application of nutritional interventions may allow us to improve the eating quality of LBW pigs, recovering lost production value.

II. MATERIALS AND METHODS

Male piglets were identified at birth and graded as having normal (> 1.25 kg) or low (< 1.20 kg) weight. At weaning (20.3 ±0.04 d), 44 AvBW (1.47 ±0.020 kg) and 48 LBW pigs (1.03 ±0.019 kg) were selected and maintained under commercial practice until nine weeks of age. At this point they were allocated to dietary treatments (control (C) or eating quality (EQ)), such that the study was a 2 x 2 factorial design with birth weight group and diet as factors. All pigs were immunocastrated at 13 and 17 wks of age. Control diets reflected commercial feed formulations (wheat/barley, soybean/canola/meat meal). The EQ diet contained similar ingredients but with a 15% reduction in the lysine to energy ratio from 9-18 wks of age, and a 10% reduction from 19 wks. Soy lecithin at 2%, vitamin E (200 ppm), a premix with 75% lower vitamin A content, and betaine (1.5 kg/t) were included. Magnesium sulfate (equivalent to 3.2 g Mg/pig/day) was included in the diet for the final week before slaughter. Pigs were slaughtered over three weeks, such that comparison between AvBW and LBW pigs occurred on a fixed slaughter weight rather than time basis. Pigs were processed at a commercial abattoir (backloading CO_2 stunner, steam scald system, quick chill tunnel and equalisation chiller). *Longissimus thoracis et lumborum* (LTL) samples from the caudal end were collected 24 h after slaughter, vacuum-packed and maintained at 0-4 °C until processing at 48 h. Drip loss was measured via the filter paper method [7], NPPC marbling was assessed, objective colour score by Minolta and Warner-Bratzler Shear Force (WBSF) utilising a GR-151 Warner-Bratzler Shear Machine [8]. Data analysis was via a GLM ANOVA (GenStat 20th Ed, VSN International) with significance at P <0.05.

III. RESULTS AND DISCUSSION

LBW pigs remained lighter than AvBW pigs throughout the experiment, taking approximately seven days longer to meet minimum market weights (P<0.001, Table 1). Dressing percentage tended to be lower in LBW pigs fed the EQ diet (P=0.087), whilst fat depth at the last rib was higher for LBW pigs (P=0.008). Drip loss was significantly reduced in AvBW pigs receiving the EQ diet (P=0.002) compared with other treatments, and they also had reduced cooking loss compared to LBW pigs receiving the

EQ diets (P=0.013). Marbling score was higher in AvBW pigs (P=0.021) and they were paler in colour (P<0.001). Pigs receiving the EQ diets tended to have a lower WBSF (P=0.099). Reduced LBW pig growth reflects previous work [1]. LBW pigs compromised muscle biology appears unable to respond to EQ diets as effectively as AvBW pigs, whilst low marbling suggests limited adipocytes to enlarge.

Table 1 Growth performance, carcass characteristics and LTL meat quality parameters of average (AvBW) and low birth weight (LBW) pigs fed either control (C) or eating quality (EQ) diets.

	Treatment					P-values		
Item	AvBW,C	AvBW,EQ	LBW,C	LBW,EQ	SED[1]	Weight	Diet	Weight x Diet
Slaughter weight, kg	108	110	106	106	2.33	0.040	0.548	0.506
Days to slaughter, d	148[a]	152[b]	154[c]	154[c]	0.77	<0.001	0.001	<0.001
Hot carcass weight (HCW), kg	85.6	88.5	84.1	82.0	1.89	0.003	0.813	0.064
Dressing, %	79.4	80.6	79.7	77.9	1.24	0.171	0.631	0.087
Fat depth (HCW[2]), mm	13.5	12.3	14.4	14.5	0.75	0.008	0.317	0.204
Chill weight loss, %	2.2[b]	1.3[a]	2.0[ab]	2.4[b]	0.39	0.139	0.390	0.016
Drip loss, %	5.8[a]	2.7[b]	5.4[a]	5.1[a]	0.58	0.019	<0.001	0.002
Cook loss, %	23.4[ab]	22.5[a]	23.0[ab]	23.8[b]	0.48	0.151	0.916	0.013
pH ultimate	5.54	5.48	5.54	5.53	0.03	0.353	0.089	0.279
NPPC marbling	2.1	2.2	1.7	1.8	0.23	0.021	0.525	0.899
L*	56.2	56.4	52.7	54.2	0.95	<0.001	0.184	0.360
WBSF, N	20.6	18.9	21.3	20.5	1.04	0.138	0.099	0.554

[1]SED, standard error difference of the means; NPPC, National Pork Producers Council standards; [2]HCW as a covariate

IV. CONCLUSION

LBW pigs remained compromised throughout their growing period, and despite having a greater carcass fatness they had a lower marbling score than AvBW pigs. The EQ diet had limited impact on fat deposition but did impact water-holding capacity as indicated by reduced chill, drip, and cook loss, especially in AvBW pigs. Whilst lecithin inclusion may have reduced collagen synthesis as indicated by a lower WBSF. However, the approach undertaken was not able to restore value to the little pig.

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