

Birth weight affects muscle fiber size and myosin heavy-chain isoform gene expression in the longissimus muscle of slaughter pigs (Das Geburtsgewicht beeinflusst die Grösse der Muskelfasern und die Genexpression der vier Isoformen der schweren Myosinketten im langen Rückenmuskel beim Schwein). G. Bee* and J.-Y. Deru – Posieux

Birth weight (BtW) of pigs is an important economic trait, which affects pre- and early post-weaning survival rate, postnatal growth as well as carcass characteristics. In the last decades genetic selection towards larger litters entailed increased intra-litter variation in BtW and lower overall mean BtW. Low BtW in large litters is caused by intrauterine growth retardation due to greater competition of foetuses for maternal nutrients. Reduced intrauterine growth affects myogenesis resulting in lower myofiber hyperplasia and greater myofiber hypertrophy. The aim of the study was to assess the effect of BtW on myofiber size and type distribution as well as the gene expression of the 4 myosin heavy-chain isoforms (MyHC I, 2a, 2x, 2b) in the longissimus dorsi (LD) muscle of slaughter pigs.

Methods: From 21 litters the lightest (L: 1.07 ± 0.06 kg) and heaviest (H: 1.90 ± 0.06 kg) barrows within each litter were selected. All barrows were offered from weaning (11.3 ± 1.06 kg BW) to slaughter (102.1 ± 1.06 kg BW) standard starter, grower, and finisher diets. Growth performance and carcass characteristics were established. Furthermore, myofibers of the LD collected at slaughter were stained and classified as slow oxidative (SO), fast oxidative-glycolytic (FOG) or fast glycolytic (FG), and myofiber area and distribution were determined. In addition, in the same samples the mRNA expression of each MyHC isoform were quantified (1). Total MyHC I, 2a, 2x, and 2b expression (normalized to corresponding endogenous β -actin levels) and relative expression of each MyHC isoform (expressed as the percentage of the total expression of the 4 MyHC) was calculated. Data were analyzed with the MIXED procedure (SAS Inst. Inc., Cary, NC). The model used included the BtW as fixed and litter as the random effect.

Results: Compared to H barrows, L barrows grew slower (0.54 vs. 0.57 kg/d; $P = 0.02$) from birth to slaughter and consequently were older (190 vs. 177 d; $P < 0.01$) at slaughter. In the grower and finisher period L barrows consumed more feed (204 vs. 193 kg; $P < 0.01$) and were less efficient (gain to feed: 367 vs. 380 g/kg; $P = 0.01$) than H barrows. Carcasses of the L barrows had lower ($P = 0.02$) lean percentage (55.0 vs. 56.5%) and higher ($P \leq 0.03$) percentages of subcutaneous (14.9 vs. 13.4%) and omental fat (1.8 vs. 1.5%) than H barrows. The average myofiber size was larger (3361 vs. $2927 \mu\text{m}^2$) in L than H barrows. The differences in myofiber size resulted from larger ($P \leq 0.03$) SO (2958 vs. $2561 \mu\text{m}^2$) and FOG (2672 vs. $2227 \mu\text{m}^2$) but not FG fibers. Because the loin eye area did not (L: 54.5 vs. H: 52.7 cm^2 ; $P = 0.33$) differ among BtW groups, the findings on myofiber size suggested that L barrows had less myofibers than H barrows. Myofiber type distribution was not ($P \geq 0.18$) affected by the BtW. Expression of MyHC 2a (+89%), 2x (+203%) and 2b (+284%) was greater ($P < 0.04$) and tended ($P = 0.09$) to be greater for MyHC I (+90%) in L compared to H barrows. Relative expression of each MyHC was not ($P \geq 0.41$) affected by the BtW.

Conclusions: The present results confirmed that in pigs born with a low BtW growth performance and carcass characteristics was impaired. Furthermore, low BtW was associated with greater hypertrophy and lower hyperplasia of myofibers, which has been hypothesized to cause greater carcass fatness and to negatively affect pork quality traits. The greater MyHC isoform gene expression in the L barrows corroborated with the larger myofibers.

- 1) DA COSTA, N., BLACKLEY, R., ALZUHERRI, H. and CHANG, K. C., (2002): Quantifying the temporospatial expression of postnatal porcine skeletal myosin heavy chain genes. J. Histochem. Cytochem. 50, 353-364.

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