Development of the musculoskeletal system of the hind limb of the newborn piglet: are smaller piglets only small?

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Introduction

The underlying mechanism for the reduced performance in L piglets is unclear. Thus this study aimed to assess (linear mixed modelling using JMP) in L and normal birth weight (N) piglets at 0, 4, 8 and 96 h (n=32):
- the morphometrics of the right hind limb
  - Body mass (mean ± SD)
  - Mass of main extensor muscles (mm. glutei, hamstrings, m. quadriceps femoris, m. gastrocnemius)
  - Skeletal hind limb length (mean ± SD)
- and the associated forcefulness (+ normalized for size) (mean ± SD)
  - $F_{\text{iso-max}}$ = a. PCSA
  - PCSA: physiological cross section area (muscle volume (muscle mass x muscle density ($p = 1.06 \times 10^3$ kg m$^{-3}$))/fascicle length)

Experimental set-up

Low birth weight/low vitality (L) piglets showed: a reduced motor performance and a lag in neuromotor skill at birth.

Results and discussion

These results indicate that L piglets are overall smaller than N piglets. The shorter SHLL is consistent with stride and step length being shorter for L piglets than for N piglets (see introduction), with shorter legs leading to shorter steps.

Because of their decreased muscle mass, L piglets have a smaller PCSA and hence a reduced $F_{\text{iso-max}}$. However, the fact that a lower body mass is associated with a lower muscle mass and hence a reduced absolute force generating capacity does not tell us much about muscle development.

We see that the normalized $F_{\text{iso-max}}$ is higher for L than N piglets. In other words, L piglets have a larger normalized force generating capacity, indicating that the development of their muscles (given their birth weight) is not lagging behind.

Conclusion: Based on these data, we can say that force generating capacity cannot explain the observed force deficit in L piglets and as such the effect of intrauterine crowding on locomotor performance.

Note: Differing letters indicate statistical differences (p<0.05). For age groups Differing letters indicate statistical differences (p<0.05). For age groups