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Variability in growth performance, carcass characteristics, and meat quality is partly related to litter size and birth weight of pigs

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Introduction: There is some evidence that, within litter, low birth weight pigs not only grow slower and have fatter carcasses but also meat quality traits like drip loss or shear force are impaired compared to their high birth weight siblings (1,2). Because the variability of birth weight (**BtW)** is greater in large compared to small litters, the aim of the present study was to test the hypothesis that effects of BtW on growth performance, carcass characteristic, and meat quality differ when pigs originate from small or large litters. We investigated whether birth weight of the pig or litter size is related to post-mortem proteolysis of various proteins such as titin, nebulin, and integrin and how the degree of degradation is related to pork quality traits.

Material and Methods

Litter size

20 litters from multiparous Swiss Large White sows

- **Large litter size** : 10 litters with ≥ than 14 piglets born/litter
- **Small litter size** : 10 litters with ≤ than 10 piglets born/litter

Birth weight

From within small and large litters, 60 barrows were selected with:

- Lightest birth weight (**L-BtW**)
- Nearest to the average birth weight (**M-BtW**)
- Heaviest birth weight (**H-BtW**)

Growth performance

- Body weight and feed intake measured each week

Carcass characteristic

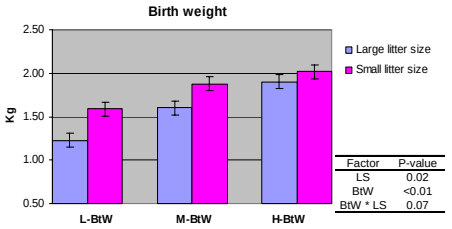
- Hot carcass weight
- Carcass yield
- Percentage lean meat
- Percentage back fat
- Organ weight

Meat quality traits in Longissimus muscle (LM) between the 10th to 12th rib

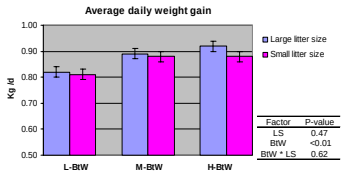
- pH 24 h (post-mortem)
- Colour (L*,a*,b*-values)
- Drip loss (after 48h)
- Thaw loss
- Shear force

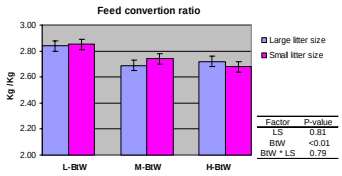
Proteolysis in LM 30 min, 24 and 72 h post-mortem

- **titin** and **nebulin:** SDS-PAGE
- **integrin:** Western-blot

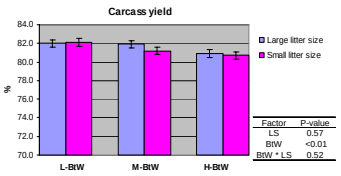


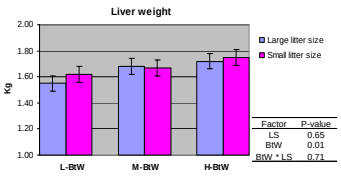
Growth performance





Carcass characteristics



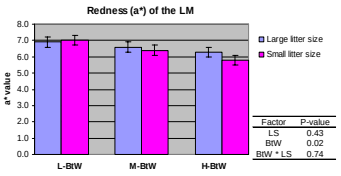


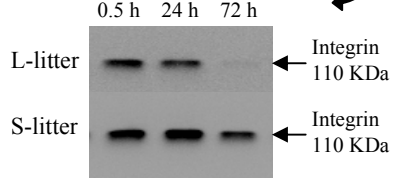
Meat quality and proteolysis

Relative abundance of intact integrin 72 h post-mortem

	L-BtW	M-BtW	H-BtW
L-litter	0.091	0.095	0.064
S-litter	0.103	0.157	0.243

Factor	*P*-value
LS	0.08
BtW	0.64
BtW * LS	0.33





Correlations between the relative abundance of intact integrin, titin, and nebulin and pH 24 h, drip loss, thaw loss, and shear force values

	pH 24 h	Total drip loss	Thaw loss	Shear force
Integrin[a]				
0.5 h	0.10 (*P*=0.44)	-0.12 (*P*=0.37)	-0.13 (*P*=0.31)	-0.16 (*P*=0.22)
24 h	**0.22 (*P*=0.09)**	**-0.34 (*P*<0.01)**	**-0.26 (*P*=0.05)**	-0.01 (*P*=0.93)
72 h	0.02 (*P*=0.89)	-0.16 (*P*=0.23)	-0.09 (*P*=0.48)	**0.21 (*P*=0.10)**
Titin[a]				
0.5 h	-0.03 (*P*=0.83)	-0.01 (*P*=0.96)	-0.06 (*P*=0.71)	-0.01 (*P*=0.95)
24 h	0.11 (*P*=0.42)	-0.20 (*P*=0.13)	**-0.21 (*P*=0.08)**	**0.22 (*P*=0.09)**
72 h	-0.03 (*P*=0.83)	-0.14 (*P*=0.29)	-0.06 (*P*=0.90)	**0.23 (*P*=0.07)**
Nebulin[a]				
0.5 h	-0.07 (*P*=0.62)	-0.11 (*P*=0.38)	-0.18 (*P*=0.30)	-0.14 (*P*=0.30)
24 h	0.07 (*P*=0.58)	-0.01 (*P*=0.92)	-0.08 (*P*=0.91)	0.05 (*P*=0.69)
72 h	-0.07 (*P*=0.60)	-0.20 (*P*=0.12)	-0.14 (*P*=0.23)	**0.27 (*P*=0.04)**

[a]Ratios are calculated as the intensity of the intact protein band of each sample over the intensity of the intact protein band in the internal designated densitometry standard.

Conclusions: The present results confirm the marked effect of BtW on growth performance and carcass characteristic. However, the hypothesised impact on meat quality traits could only be partly demonstrated. Although the litter size affected average BtW of the L- and the M-BtW barrows, its impact on growth performance, carcass, and meat quality was minor. The present study confirms the relationships between protein degradation and some of the most important meat quality parameters.

1) GONDRET, F., LEFAUCHEUR, L., LOUVEAU, I., LEBRET, B., PICHODO, X., & LE COZLER, Y. (2005) Livest. Prod. Sci., 93: 137-146.
2) REHFELDT, C. & KUHN, G. (2006) J. Anim. Sci., 84: E113-E123.

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