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Milk and meat production

Impact of litter size and birth weight on growth performance, carcass characteristics, and meat quality in pigs

J. Bérard¹, M. Kreuzer² and G. Bee^{*1}

¹*Agroscope Liebefeld-Posieux, Research Station ALP, 1725 Posieux, Switzerland*

² *ETH Zurich, Institute of Animal Science, 8092 Zurich, Switzerland*

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Increasing the number of the piglets born per litter:

- leads to a decrease in birth weight, especially in piglets with low birth weight (Foxcroft, 2007).
- Low birth weight pigs: **grow slower, worse carcass characteristics and meat quality traits** than their high birth weight siblings (Bee, 2004; Bee et al., 2006a; Gondret et al., 2005b; Gondret et al., 2006a; Quiniou et al., 2002; Rehfeldt and Kuhn, 2006).
- Intrauterine crowding leads to:
 - poor placenta development
 - increasing of fetus competition for maternal nutrients
 - in poorer growth performance, carcass characteristic, and meat quality at slaughter (Foxcroft, 2007).

Hypothesis: effects of Birth weight (BtW) on:

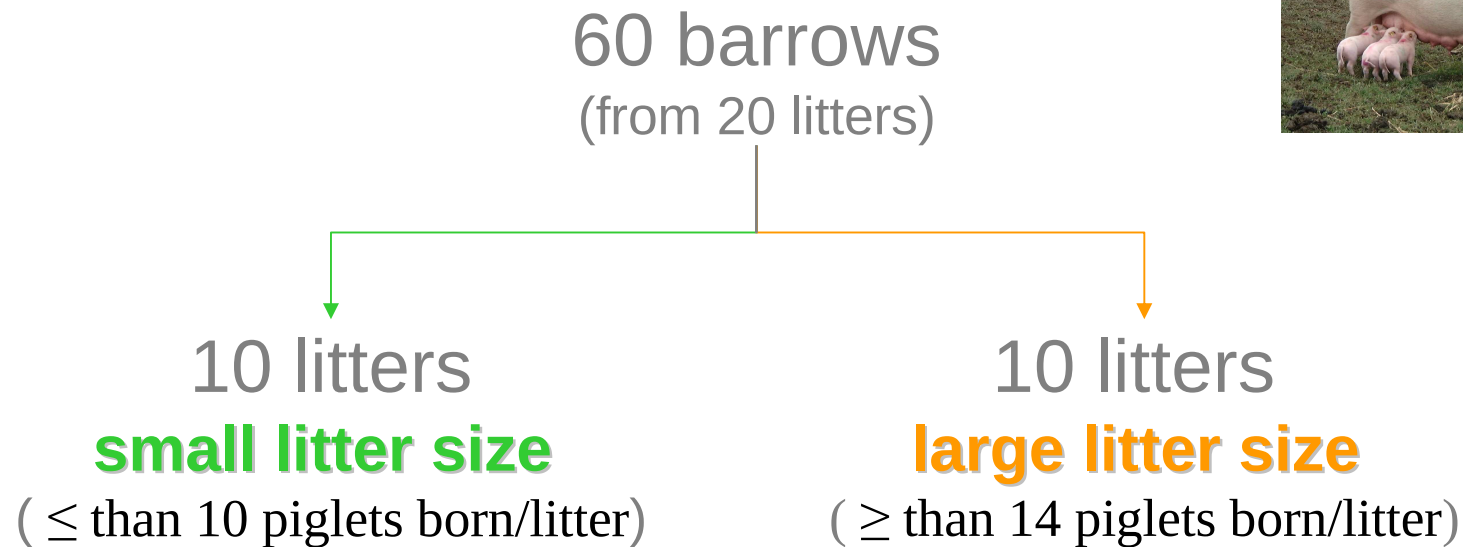
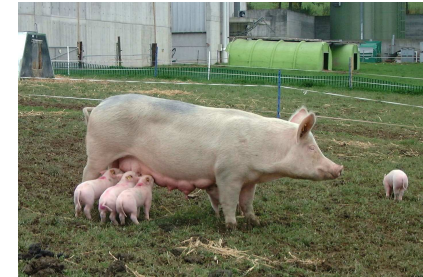
- growth performance
- carcass characteristics
- meat quality

differ when pigs originate from small or large litters.

Investigation whether birth weight of the pig or litter size is related to post-mortem proteolysis of various proteins and how the degree of degradation is related to pork quality traits.



Experimental design



3 piglets were selected per litter

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



Analysis

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) and in the dark portion of semitendinosus (STD)

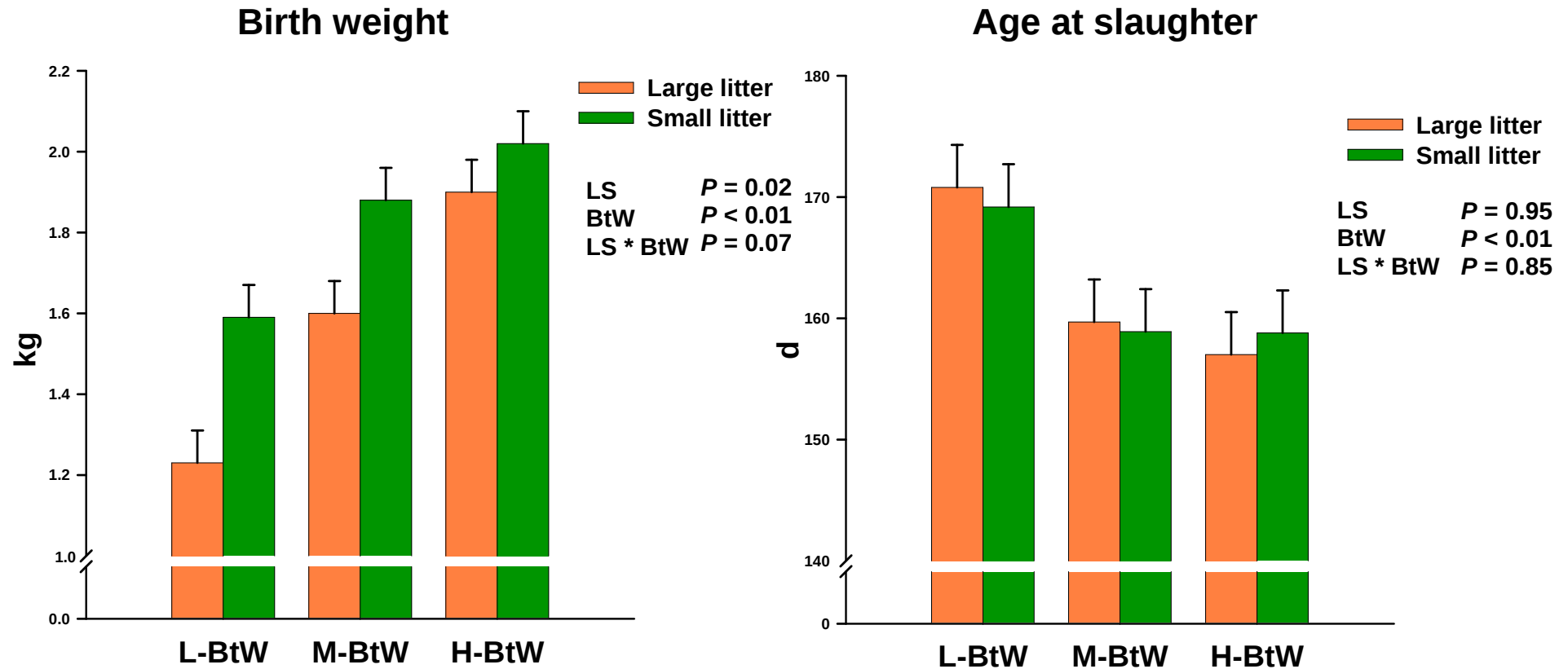
- pH 24 h (post-mortem)
- Colour (L^* , a^* , b^* -values)
- Drip loss (after 48h)
- Thaw loss
- Shear force



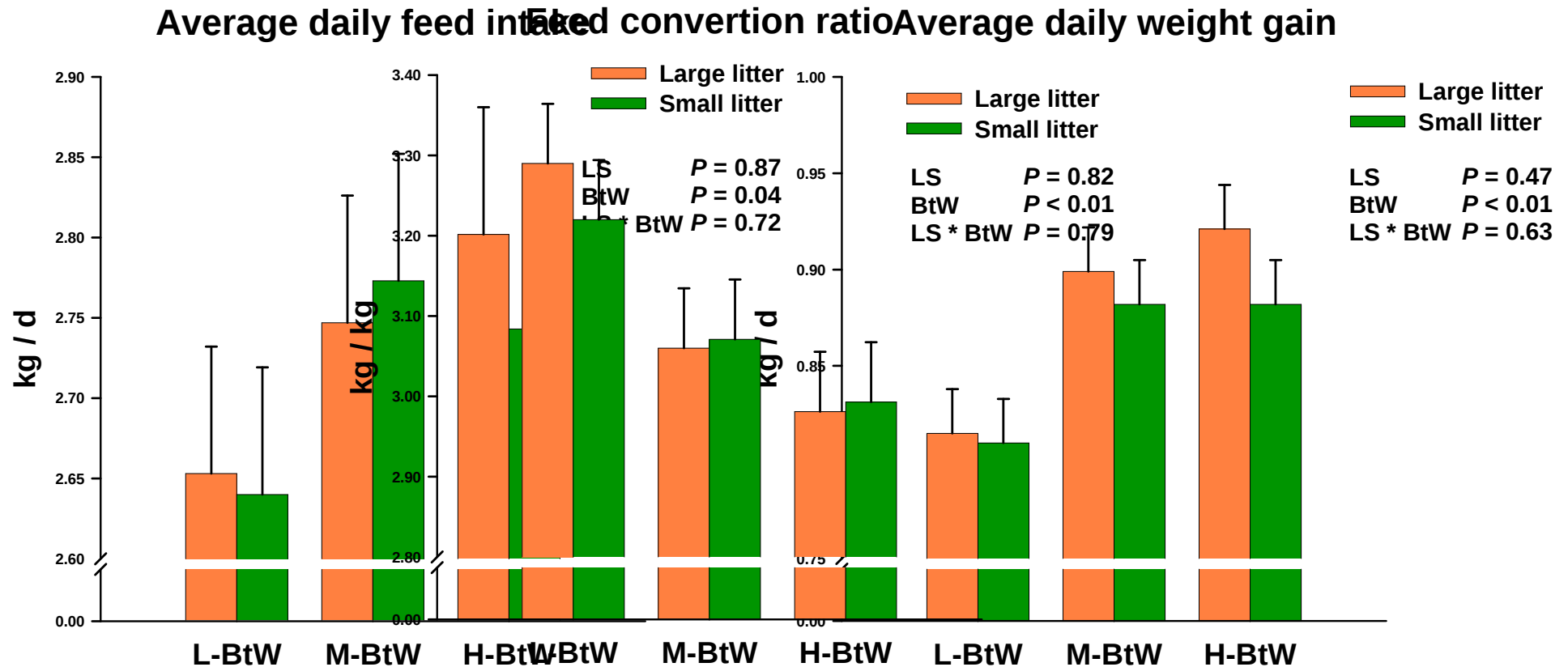
Proteolysis in LM 30 min, 24 and 72 h post-mortem

- **titin** and **nebulin**: SDS-PAGE
- **integrin** and **desmin**: Western-blot
- **μ -** and **m-calpain**: casein zymography

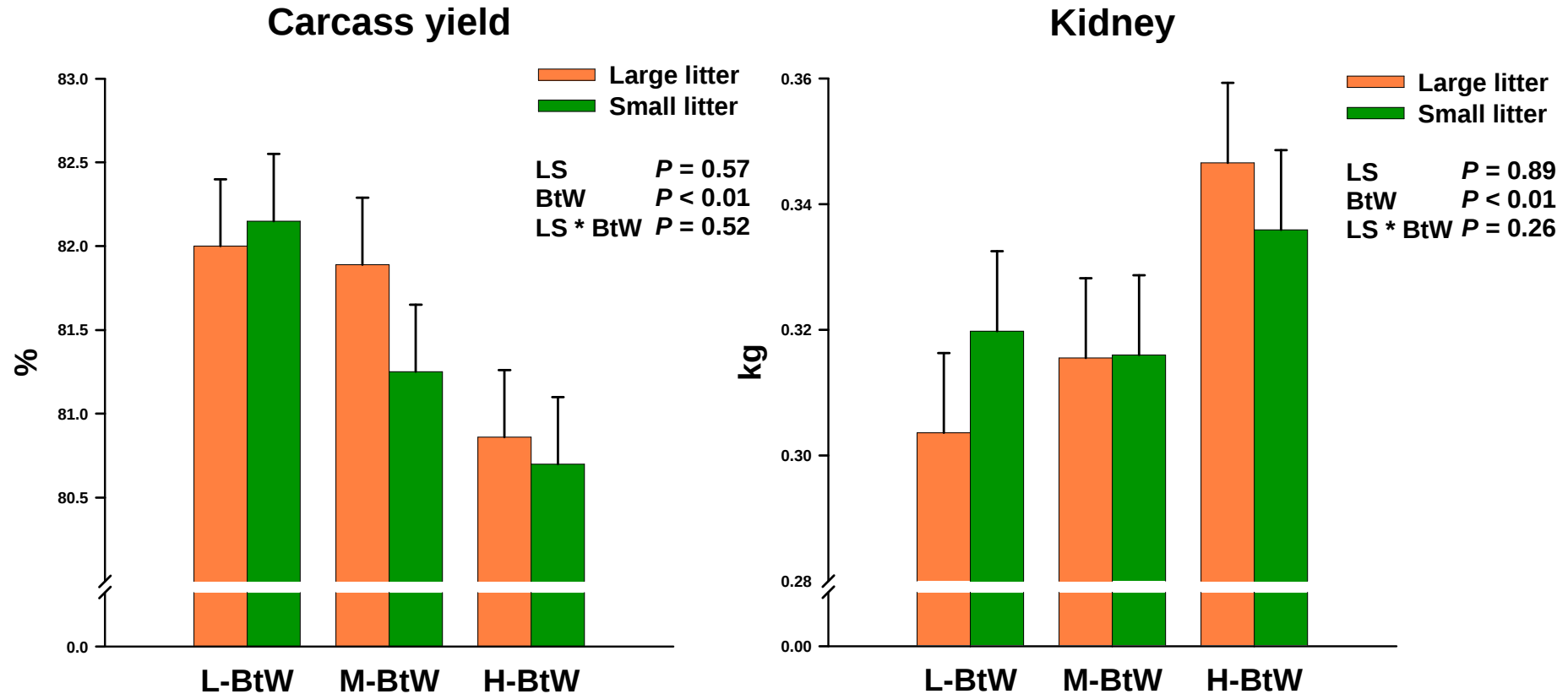




In agreement with our findings, Quiniou et al. (2002) reported that average birth weight of the litter is lower in large compared to small litters.



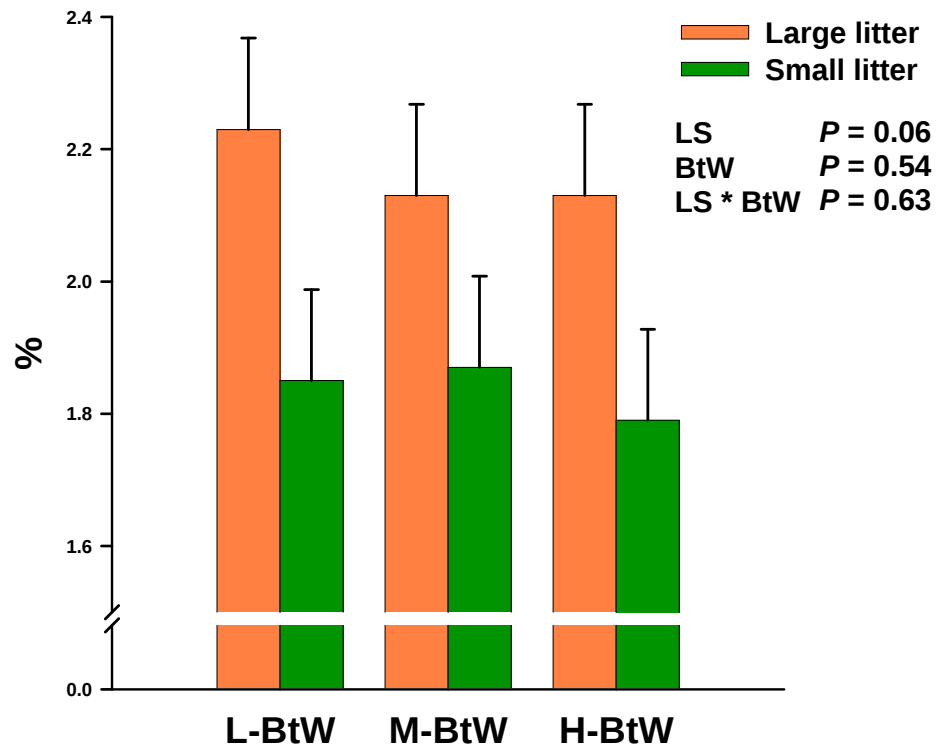
The observed differences were in agreement with results of previous studies. (Bee et al., 2006a; Gondret et al., 2005b; Rehfeldt and Kuhn, 2006).



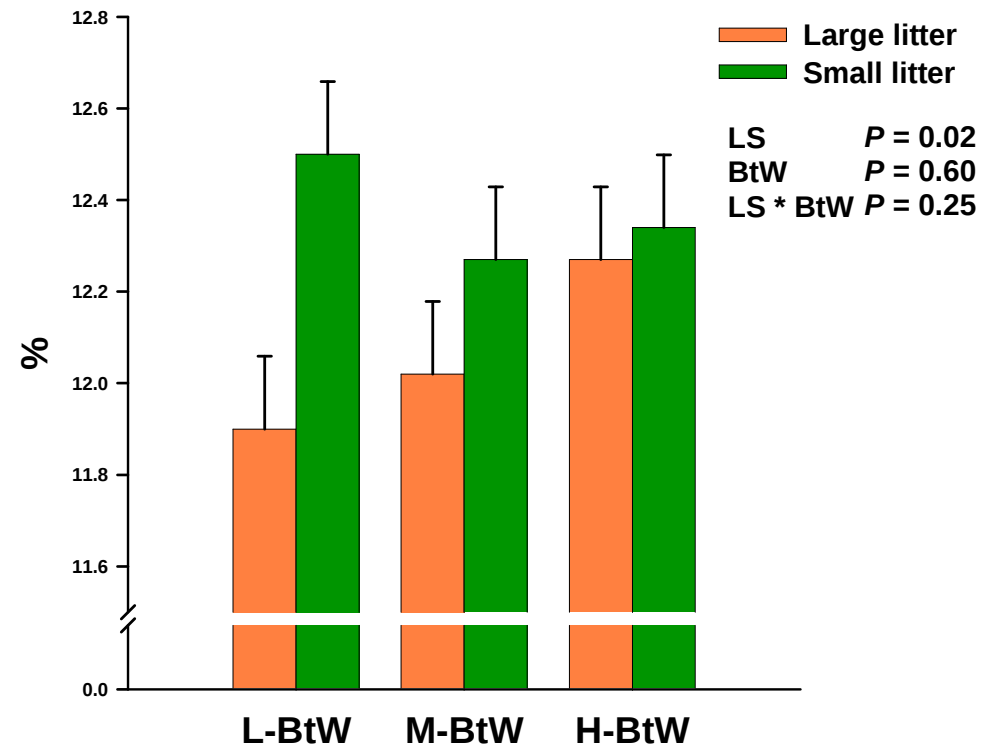
Results of carcass yield %, liver and kidney are in accordance to findings of Rehfeldt and Kuhn (2006).



Omental fat

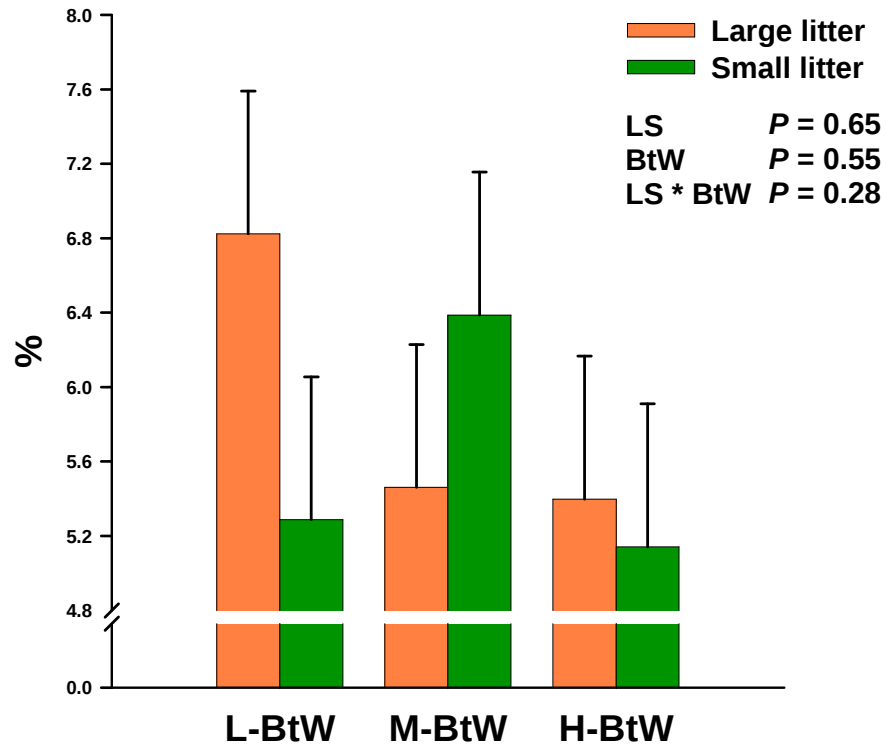


Shoulder



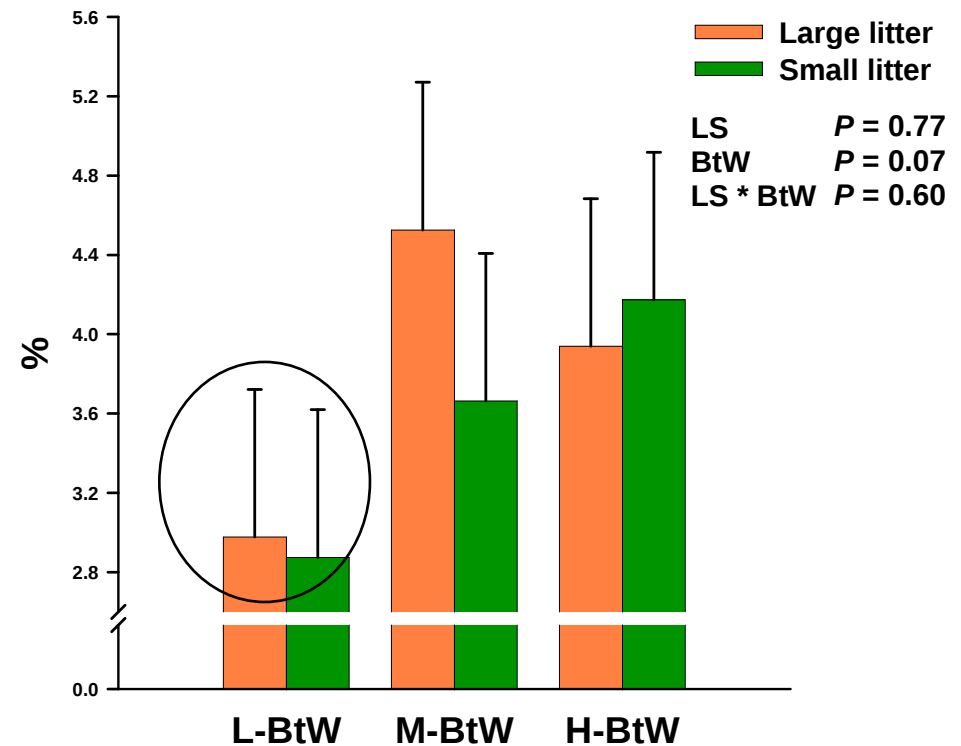


Drip loss 48 h in LD



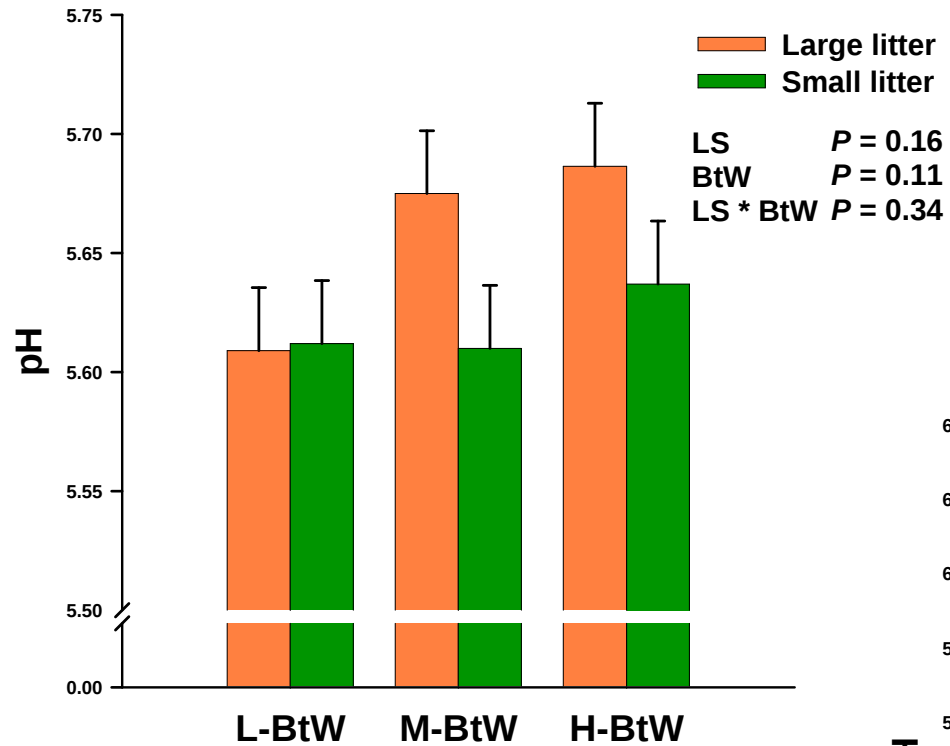
Drip loss 48 h post-mortem

Drip loss 48 h in STD



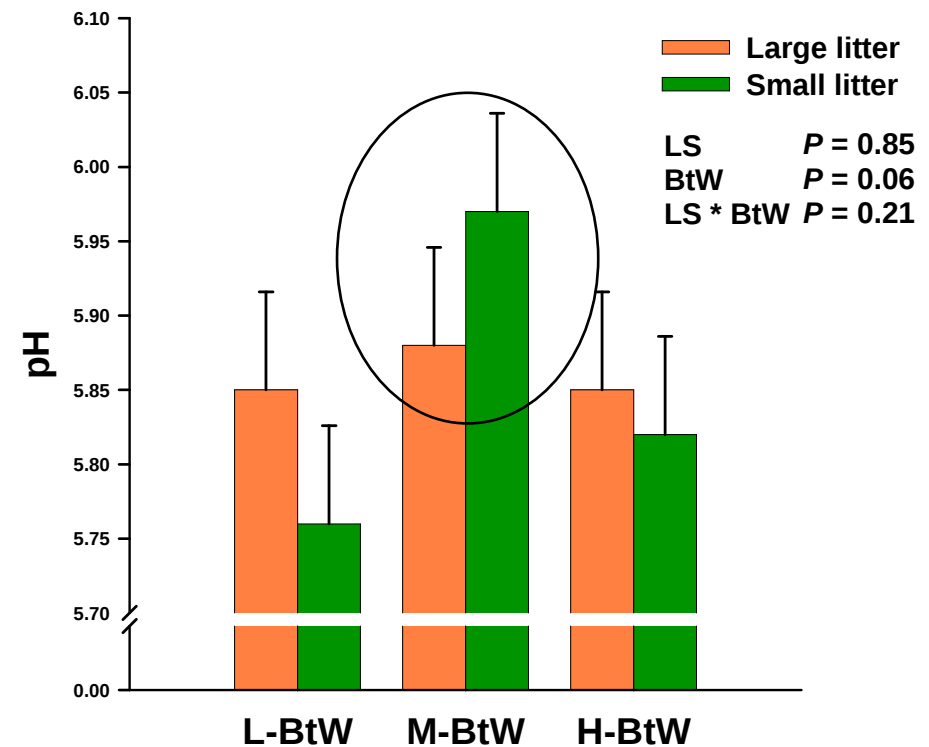


pH 24 h in LD



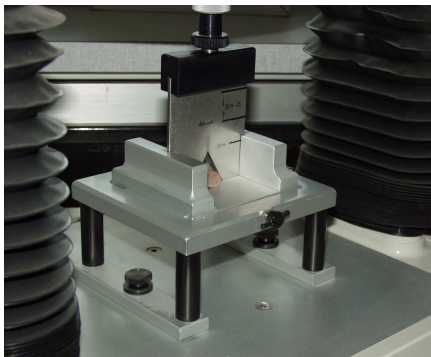
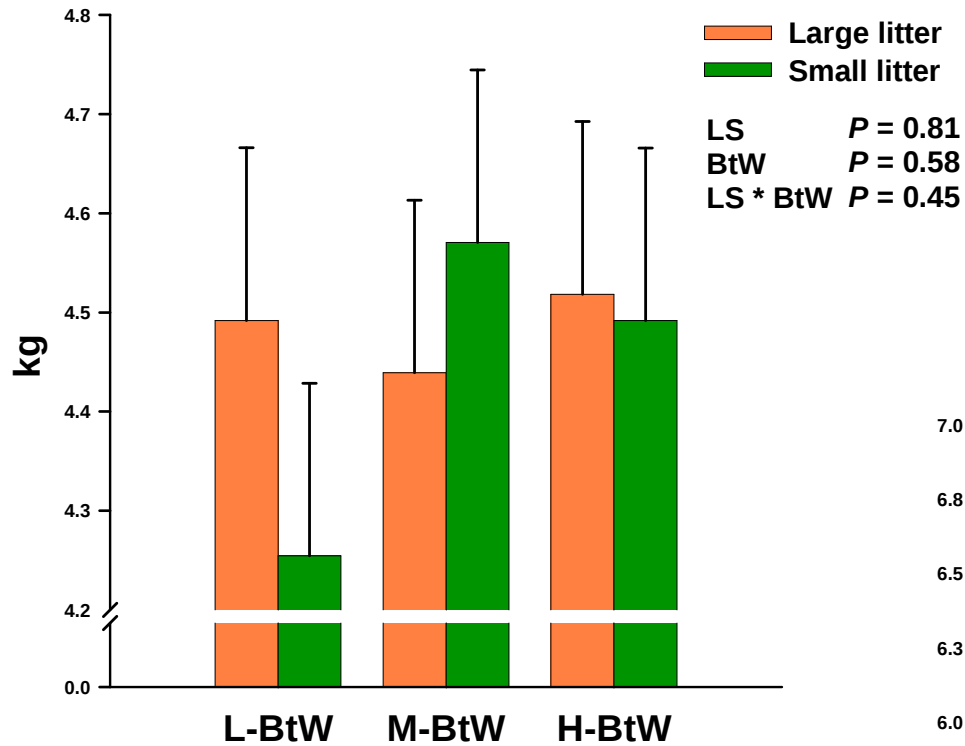
pH 24 h post-mortem

pH 24 h in STD



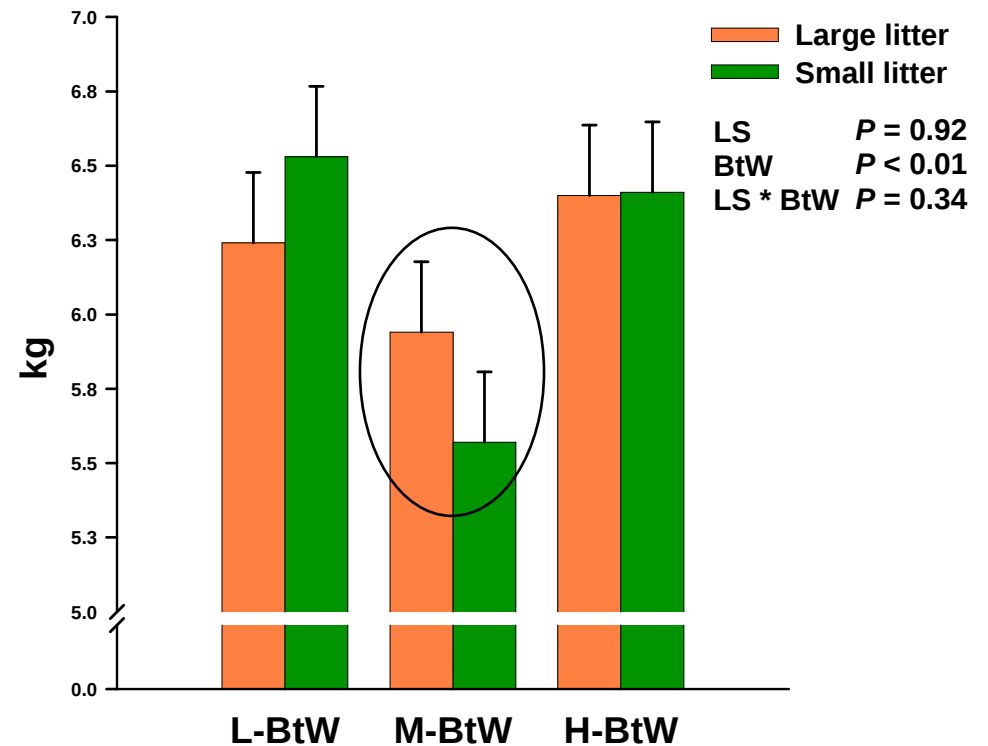


Shear force peak in LD



Warner-Bratzler shear force

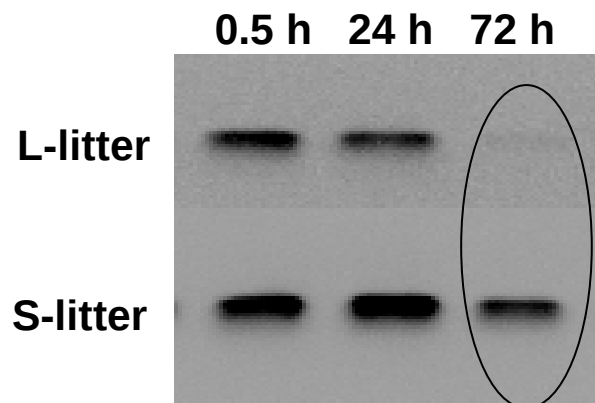
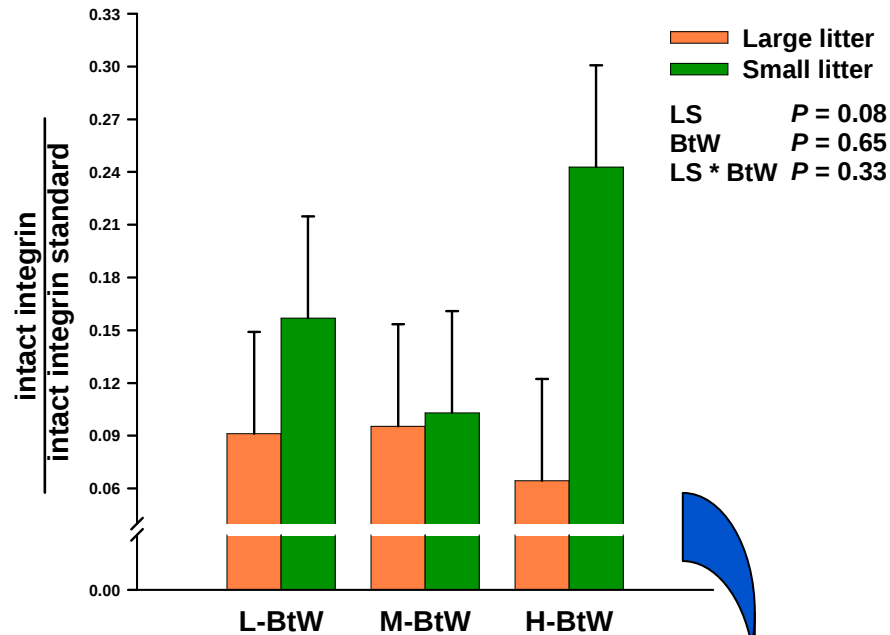
Shear force peak in STD



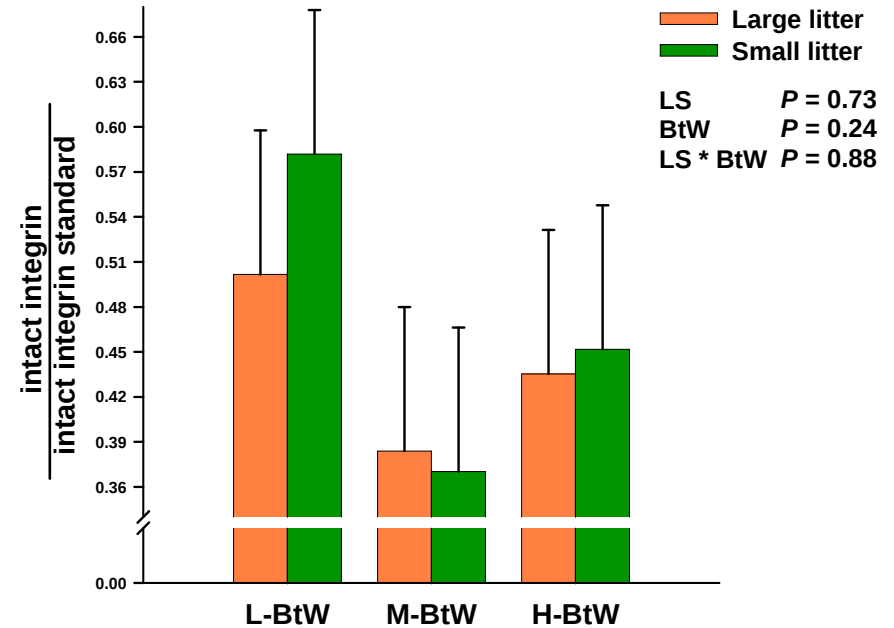


Integrin 72 h post-mortem

Relative abundance of intact integrin in LD



Relative abundance of intact integrin in STD

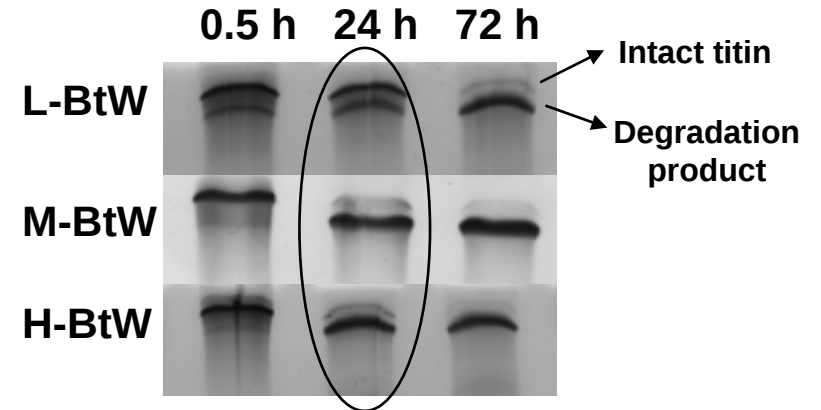
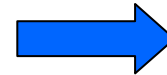
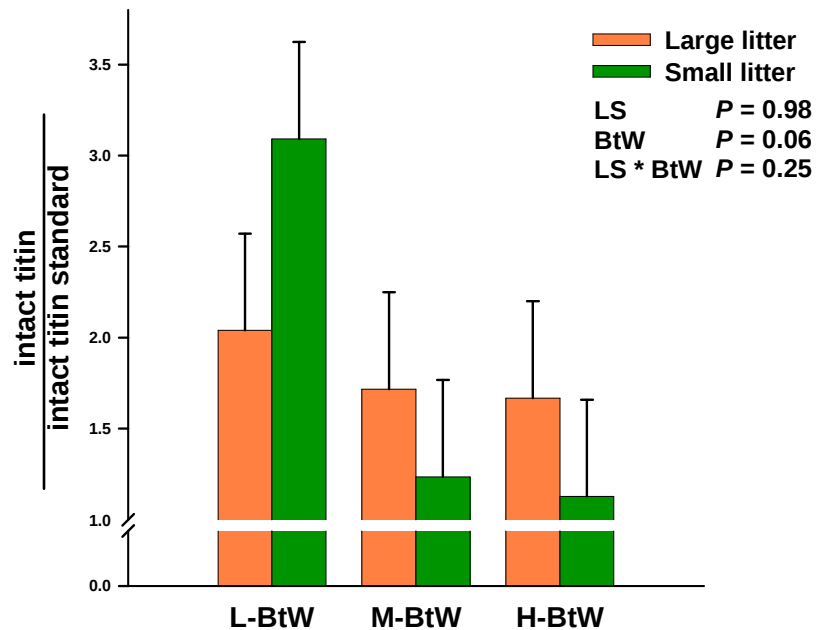


	Intact integrin		
	0.5 h	24 h	72 h
Drip loss 48h in Longissimus	-0.12 ($P=0.37$)	-0.34 ($P<0.01$)	-0.16 ($P=0.23$)
Drip loss 48h in Semitendinosus	-0.07 ($P=0.61$)	-0.16 ($P=0.22$)	-0.31 ($P=0.01$)

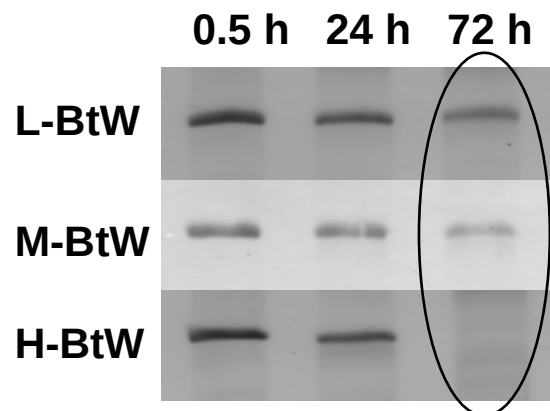
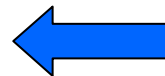
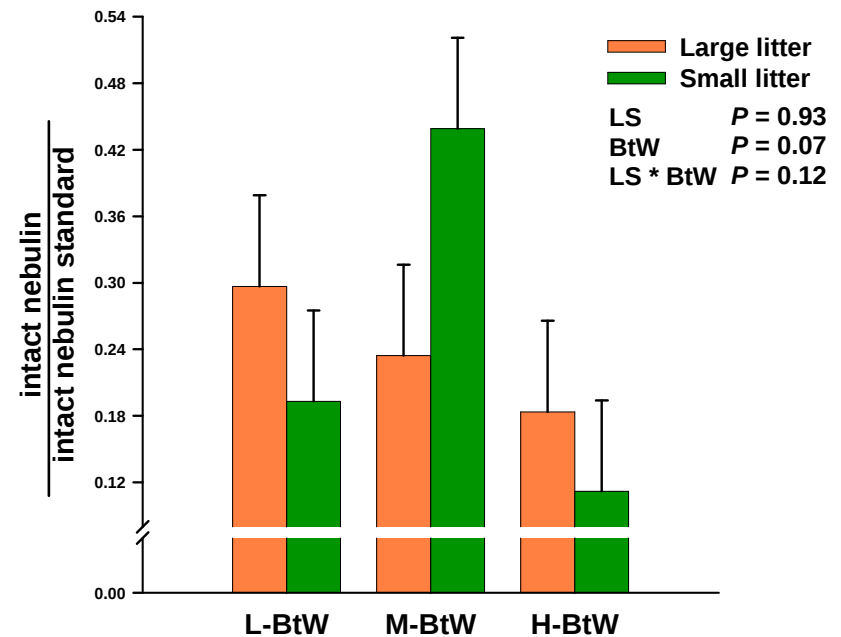


Titin and Nebulin

Relative abundance of intact titin 24 h in LD



Relative abundance of intact nebulin 72 h in LD





BtW

The present results confirm the marked effect of birth weight on growth performance and carcass characteristics.

L-BtW barrows have the lowest post natal growth performance

The hypothesized impact on meat quality traits could only be partly demonstrated.

Litter size

Litter size affected average birth weight of the L-BtW and M-BtW barrows, but its impact on growth performance, carcass characteristics and meat quality was minor.

Proteolysis

The present study confirms the relationship between protein degradation and some of the important meat quality parameters.

The present findings revealed that the extent of proteolysis influenced differently meat quality traits.

Higher integrin degradation is associated with poor meat quality traits

Higher titin and nebulin degradation are associated with better meat quality traits.



In the context of this experiment

- investigation of types, cross-sectional area (CSA) and total number of fibers (TNF) in the two muscle to confirm or deny some hypothesis formulated.



For further experiments

- investigation of the number of the fetus at 75 d of gestation and fetus muscles fiber typing for better understanding the influence of the intrauterine crowding.
- 2-dimentional electrophoresis to point out different protein degradations in L- and S-litter.



Thank you for your attention

