

Maternal low and high protein diets during pregnancy in gilts have long-lasting effects on the endocrine and immune response in their offspring

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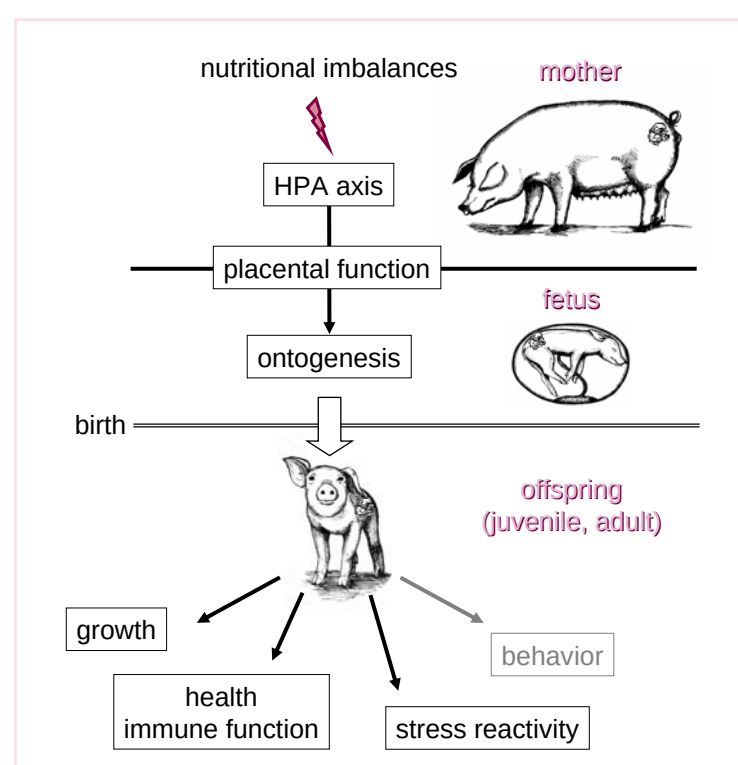
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Introduction

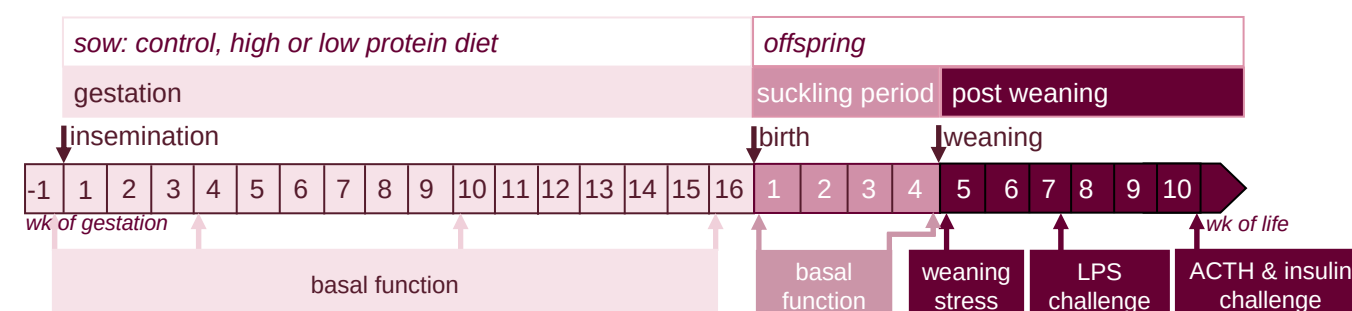
The exposure to environmental influences such as malnutrition during pregnancy can have long-term consequences on the development of the offspring.

Thus, an inadequate nutrient supply and/or maternal hormones can cause fetal growth retardation, metabolic changes as well as alterations of immune function and stress-sensitive systems in the offspring.



Hypothesis of prenatal programming by nutritional imbalances.
HPA axis; hypothalamic-pituitary-adrenal axis

Materials and Methods



Forty-two German Landrace sows (first parity) were fed isoenergetic diets with high (30% CP), low (6% CP) or control (12% CP) protein levels throughout gestation. The offspring was reared by foster sows until weaning on postnatal day (PND) 28.

Salivary cortisol and serum protein of sows was measured during gestation.

In the offspring, birth weight was determined and serum IgA as well as IgG levels were measured on PND 1, 27 and 180.

Plasma cortisol, catecholamines and IL-6 concentrations were quantified under challenge conditions (weaning, LPS-, ACTH- and insulin challenge).

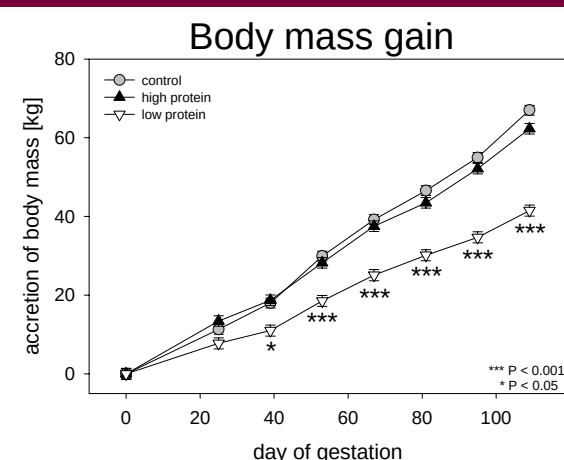
Objective:

Determination of the effects of low and high protein intake in pregnant gilts on their growth development and the stress reactivity and immune function of their offspring.

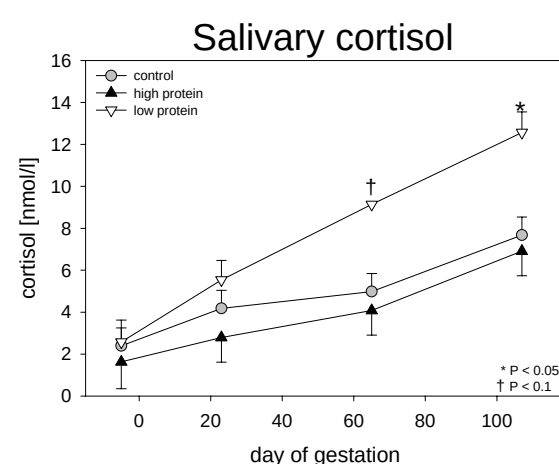
Results



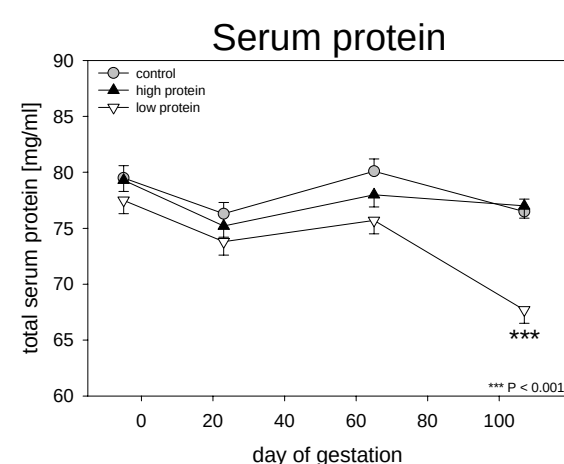
Sows:



Sows from the low protein diet group showed a reduced body mass development during gestation.



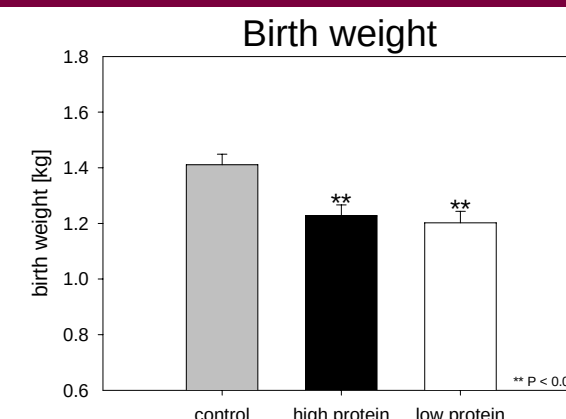
From mid-gestation, sows from the low protein diet group had significantly elevated cortisol levels.



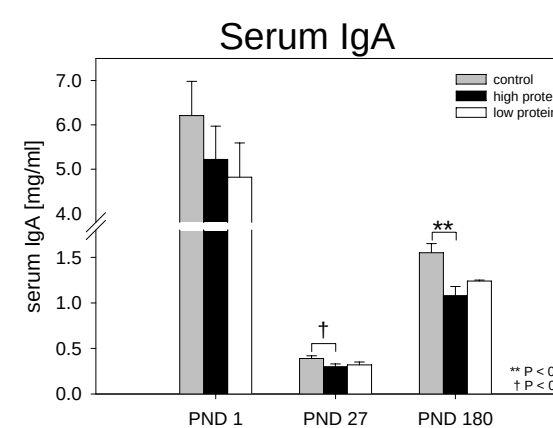
Serum protein levels were reduced in sows from low protein diet group at the end of gestation.



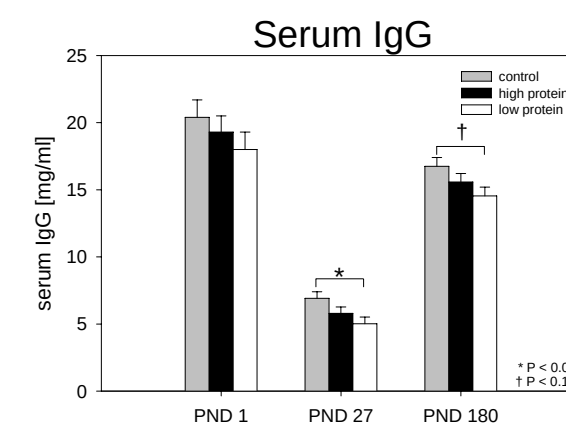
Offspring:



Low and high protein diets of sows reduced the birth weight of their piglets.



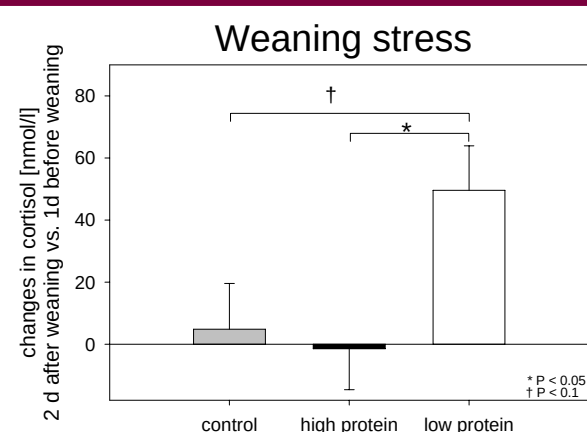
The high protein diet caused a persistent decrease of the IgA levels in the offspring on PND 27 and 180.



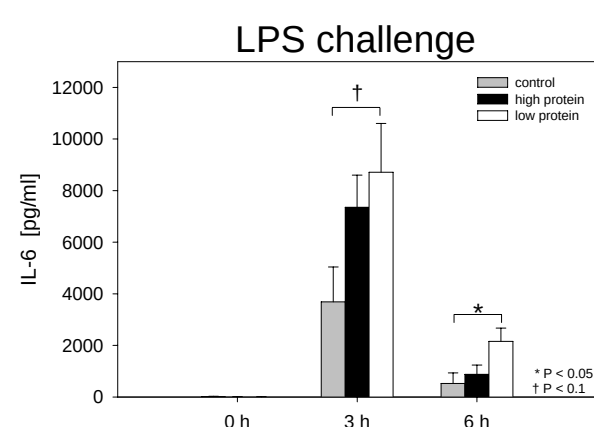
IgG concentrations were reduced in the offspring from sows of the low protein diet group.



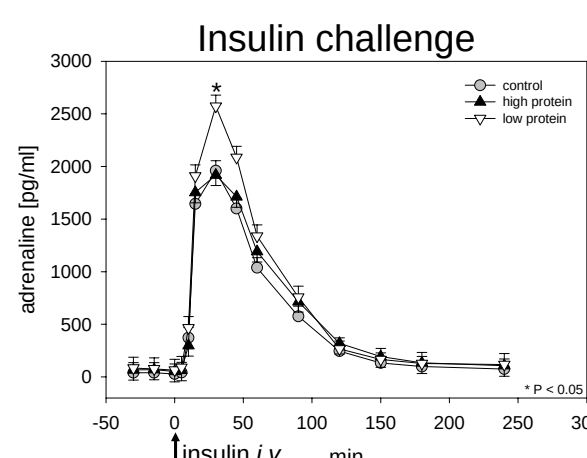
Offspring - Challenge:



The cortisol response to weaning stress was increased in piglets from low protein sows.



Offspring from the low protein sows displayed higher IL-6 concentrations after application of LPS.



Offspring from low protein sows showed a significantly increased response of plasma adrenaline due to insulin-induced hypoglycemia.

Conclusions

The results show that an inadequate protein supply during pregnancy in pigs affects the neuroendocrine stress regulation as well as immunocompetence in their offspring.

Offspring from sows with low protein supply showed long-term consequences on the HPA and SAM system with increased stress responses during challenge situations. Furthermore, high and low maternal protein supply caused persistent imbalances of humoral immunity in the offspring.

It is assumed that chronically increased maternal glucocorticoids contribute to the alterations of stress-sensitive systems and the immune system. These alterations may serve to improve the adaptation of the deprived offspring to the post-partum environment.

Further studies are required to reveal the mechanisms of maternal protein supply on the stress reactivity and immune function in the offspring.

Acknowledgements

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