Parent-of-origin effects in birth weight in Large White piglets: Disentangling genomic imprinting and maternal effects

R. E. Jahnel[1,2], N. Reinsch[1], A. Lepori[3,4], N. Khayatzadeh[3], C. Kasper[5]

[1]*Research Institute for Farm Animal Biology (FBN), Wilhelm-Stahl- Allee 2, 18196 Dummerstorf, Germany,* [2]*Centre for Genetic Improvement of Livestock, Department of Animal Biosciences, University of Guelph, Guelph, ON, N1G 2W1 Canada,* [3]*Suisag AG, Allmend 10, 6204 Sempach, Switzerland,* [4]*ABS Global, Inc., USA,* [5]*Agroscope, Animal GenoPhenomics, Rte de la Tioleyre 4, 1725, Posieux, Switzerland*
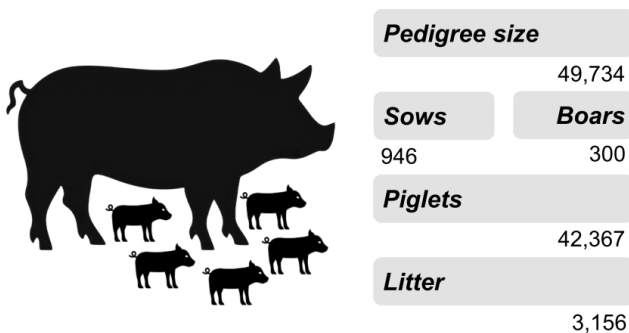
Background

For a sustainable pork industry, piglets' birth weights play a pivotal role in the survival and homogenous growth of litters. Epigenetic phenomena, such as parent-of-origin effects, including maternal effects (Alves et al., 2018) and genomic imprinting (de Koning et al., 2000) influence the expression of the trait. However, if only one epigenetic effect is accounted for in the model, the effects might be confounded in each other.
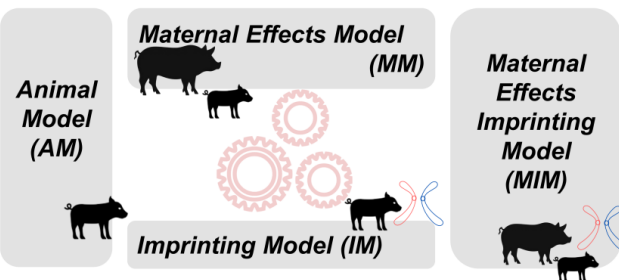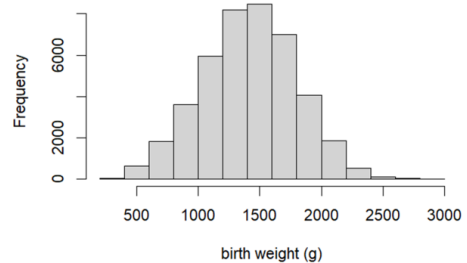
Objectives

The objective of this study was to separate genomic imprinting effects and maternal effects and to investigate the significance of the effects on birth weights in Swiss Large White piglets.

Animal data and Methods

Pedigree size	
	49,734

Sows	*Boars*
946	300

Piglets	
	42,367

Litter	
	3,156

Animal Model (AM)

Maternal Effects Model (MM)

Imprinting Model (IM)

Maternal Effects Imprinting Model (MIM)

Birth weights — Maternal effects — Gametic effects as dam

$$y = Xb + Zm + Za_s + Za_d + e$$

Contemporary group, parity, sex — Gametic effects as sire — Residual effects

Birth weights

Distribution of birth weights in gram

Significance of parent-of origin effects

Log Likelihood Ratio Test (P Value)		Alternative Hypothesis		
		IM	MM	MIM
Null Hypothesis	AM	<0.001	<0.001	<0.001
	IM	-	-	<0.001

Genetic Parameters

Maternal effects	Maternal h²: 0.06	
0.03	Gametic effects as sire	Direct h² : 0.14
-0.11	-0.23	Gametic effects as dam

Genetic Correlations

Take away

Maternal effects and imprinting effects influence the expression of birth weights in piglets.

References:

Alves, K., Schenkel, F. S., Brito, L. F., & Robinson, A. (2018). Estimation of direct and maternal genetic parameters for individual birth weight, weaning weight, and probe weight in Yorkshire and Landrace pigs. Journal of Animal Science, 96(7), 2567-2578.

de Koning, D. J., Rattink, A. P., Harlizius, B., Van Arendonk, J. A., Brascamp, E. W., & Groenen, M. A. (2000). Genome-wide scan for body composition in pigs reveals important role of imprinting. Proceedings of the National Academy of Sciences, 97(14), 7947-7950.

Agroscope — good food, healthy environment

UNIVERSITY of GUELPH · H. WILHELM SCHAUMANN STIFTUNG · fbn · SUISAG

Schweizerische Eidgenossenschaft
Confédération suisse
Confederazione Svizzera
Confederaziun svizra

Swiss Confederation

Federal Department of Economic Affairs, Education and Research EAER
Agroscope