The variance composition of broiler traits estimated on a large commercial population

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The world of poultry production over the last decades has seen a spectacular increase in the amount and quality of poultry products. The use of the estimates of individuals' breeding values (EBVs) in breeding programs has contributed to this success. Rates of response to selection depend on the accuracy of EBVs, which in turn are dependent on the accurate estimates of the trait variance and its partitioning. In addition, accurate estimates of variance are of high value to emerging genomic studies of chickens. The composition of the trait variance is population specific and changes with time, especially when populations are under selection, therefore periodical re-assessments of the components are necessary.

Key broiler production traits were analysed for 589,355 individuals over 11 generations. Special attention was given to dam effects on the trait, both environmental and genetic. The analyses involved estimation of variance components of body weight (BWT), female feed intake (LFI), and egg weight at 48 weeks (EWT) using REML methodology in ASREML and identification of the best model using log-likelihood ratio tests. The random effects fitted included direct genetic, maternal genetic and their covariance and maternal environment.

Table 1 Heritability estimates and description of best models

Trait	Best Model	h^2 (SE)	m^2 (SE)	c^2(SE)
BWT	$\mu + \sigma_A^2 + \sigma_D^2 + c_{y.e.}^2 + \sigma_e^2$	0.37 (0.008)	0.019 (0.003)	0.022 (0.002)
LFI	$\mu + \sigma_A^2 + \sigma_D^2 + c_{y.e.}^2 + \sigma_e^2$	0.41 (0.016)	0.017 (0.005)	0.027 (0.004)
EWT	$\mu + \sigma_A^2 + c_D^2 + cov_{AD} + \sigma_e^2$	0.83 (0.109)	0.04 (0.022)	

The results are presented in table 1. The heritability estimates are moderate to high, and the maternal genetic effect is significant for all traits. Result for EWT is contrary to previous suggestions of a decrease in maternal effects with age of the offspring, as it is expressed late in life and yet has the highest maternal effect. The covariances between direct and maternal genetic effects were negative for all traits and significant for EWT at -0.46 (SE 0.156). The negative covariance is believed to be an evolutionary mechanism keeping genotypes at a stable, intermediate optimum (Rauw et al., 1998). In conclusion, the results provide a snapshot of heritabilities currently applicable on commercial broiler populations and indicate that accounting for maternal variances may increase accuracy.

RAUW W.M., KANIS E., NOORDHUIZEN-STASSEN E.N. and GROMMERS F.J. (1998) Undesirable side effects of selection for high production efficiency in farm animals: a review. *Livestock Production Science* 56: 15-33, 1998.