WBC Abstract Submission

Small Ruminants

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Genetic parameters for health traits in a multi-breed sheep population

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Objectives: The objective of the study was to quantify the genetic variation present in three key health related traits (i.e., lameness, dagginess and mastitis) and their genetic association with body-related traits (i.e., body condition score (BCS), live weight (LW), muscle depth and fat depth) in a multi-breed Irish sheep population.

Materials and Methods: Records were available on 35,282 animals (i.e., lambs and adults) from the Sheep Ireland database between the years 2009 and 2015, inclusive. Each trait was measured by trained technicians. Mastitis was measured as a binary trait (0=no mastitis; 1=mastitis). Lameness was visually assessed on a 3-point scale (0=not lame, 1=slightly lame, 2=moderately to severely lame). Dagginess, a measure of the build-up (or lack thereof) of faecal material around the hindquarter of the animal, was measured on a 5-point scale: 1=clean to 5=faecal material covering the breech area and extending down the hind legs. Live weight was recorded using a pre-calibrated (electronic) scales. Both muscle depth and fat depth were measured using ultrasound scanning. BCS was subjectively assessed on a scale of 1 (extremely emaciated) to 5 (over-fat). Animals without a known sire were excluded, as were all rams (i.e. male animals ≥365 days old) and ewes that had previously been used as embryo transfer donors. Variance components were estimated using linear animal mixed models. Fixed effects included in the model were the breed proportion of the animal, coefficients of heterosis and recombination, parity/age group, and the age difference from the median of each parity/age group; an additive genetic effect and residual effect were both fitted as random terms with the animal pedigree considered via a numerator relationship matrix.

Results: The heritability estimate for dagginess and lameness across all data were 0.13 (SE=0.01) and 0.07 (SE=0.01), respectively. The heritability estimates for LW and BCS were 0.28 (SE=0.02) and 0.12 (SE=0.02), respectively. Mastitis, which was only measured in ewes, had an estimated heritability of 0.04 (SE=0.04). Muscle depth and fat depth had heritability estimates of 0.05 (SE=0.01) and 0.30 (SE=0.06), respectively and were measured only in lambs. Body related traits were all strongly phenotypically correlated; the phenotypic correlations between LW and BCS, muscle depth and fat depth were 0.52, 0.42 and 0.26 respectively. The phenotypic correlations between dagginess and BCS, LW and muscle depth were -0.09, -0.03, and -0.06, respectively. Weak genetic and phenotypic correlation existed among lameness, mastitis and dagginess. Similarly, weak genetic correlations existed between LW and dagginess, or between lameness and mastitis while the phenotypic correlations between LW and dagginess, lameness and mastitis were -0.03, -0.09 and -0.03, respectively. The genetic correlation between lameness and BCS was -0.51 (SE=0.13) while the genetic correlation between dagginess and muscle depth was -0.26 (SE=0.13). Body related traits were strongly correlated with each other; the genetic correlations between BCS and LW, muscle depth and fat depth were 0.76, 0.45 and 0.40, respectively. The genetic correlations between LW and muscle depth and LW and fat depth were both 0.75, while the correlation between muscle depth and fat depth was 0.81.

Conclusions: Ample genetic variation exists for all the health traits investigated in the current study indicate that genetic improvement in dagginess, lameness and mastitis is possible. Furthermore, knowledge of the correlations between the health and production traits indicates that it is possible to select for improved health traits without compromising on production gains.