Investigating variation in distance travelled by sheep grazing *ad libitum* pasture

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The next frontier in phenotyping in animal production is being enabled through GPS technology. In extensive grazing systems animals need to walk to obtain energy (grass) and water. A number of factors influence the distance an animal will travel within a day, including but not limited to their energy requirements, the type of feed they are consuming, the grazing behaviour of the animal, its health status and its general motivation for moving (Díaz Falú *et al.* 2014).

This study reports on between animal variation and repeatability of distance travelled (DT) by sheep within *ad libitum* pasture grazing systems. Data was generated using 100 custom made GPS collars, deployed on 300 one-year-old ewes (the ewes were randomly allocated to one of three groups (Group 1-3)), located on a flat property in inland Southland, New Zealand. The ewes were provided *ad-libitum* access to a ryegrass dominant pasture with minimum pasture cover of 2000kg DM/ha, in paddocks one to two hectares in size. The GPS collars were deployed on the ewes for a period of one week. At the end of the week period the collars were immediately re-deployed on the next group of ewes. After the collars had been deployed on the third group, collar deployment was repeated starting with the first group. Ultimately each animal had up to two periods of data available (Period 1 and 2). Issues with the collars, GPS componentry and batteries meant only 111 animals had data for both periods. A further 154 animals had data for a single period. The GPS data was analysed using ArcGIS to determine the distance travelled within a 24-hour period (day) starting at midnight the day the collars were fitted and ending at midnight the night before the collars were removed. Given variability in paddock sizes and feed available between groups of animals and even within group between days and periods, the distance an animal travelled in a day was expressed as a proportion of the group average for the day and then multiplied by the global mean. Variance and covariance components were estimated using restricted maximum likelihood (REML) procedures fitting an animal model in ASReml, with day within period fitted as a repeated measure, and the two time periods considered as different traits.

The average DT was 3.4 ± 0.89 km/day. Phenotypically, there was a large range in coefficients of variation (CV) between days for individual animals, ranging from 4% (consistent) to 72% (inconsistent), with an average CV of 17%. There was a three-fold difference in the average DT between the animals (1.7 ± 0.47 to 5.2 ± 0.22 km/day). Using a repeated records animal model, considering the two weeks of data as different traits, the phenotypic and genetic correlations were 0.46 ± 0.04 and 0.91 ± 0.12 respectively. The phenotypic relationship is shown in Figure 1. The very high genetic correlation supports that the two traits are very similar, if not the same trait over at least short periods of time, suggesting that reduced data sets could be utilised in larger studies.

Given distance travelled has an associated energy cost, the large (threefold) variation in distance covered by individual animals highlights the need to incorporate individual distance travelled when considering traits such as residual feed intake where most models commonly only account for live weight and live weight gain.

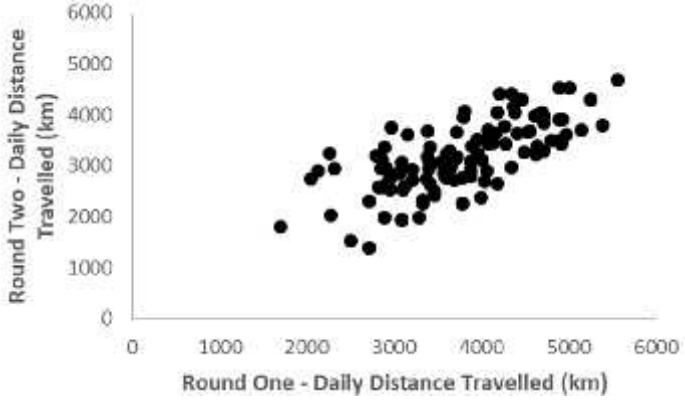

Figure 1. Plot of average daily distance travelled between the first and second rounds of measurement for 111 maternal ewes (each round was a seven day measurement period, with the two rounds three weeks apart).

References

Díaz Falú EM, Brizuela MÁ, Cid MS, Cibils AF, Cendoya MG, Bendersky D (2014). *Livestock Science* **161:**147-157