

Genetic and environmental analysis of the rumination time in the Israeli dairy cows.

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Abstract

Reduction of methane emission may become necessary for sustainable milk production. Several studies indicate a relationship between rumination time and the level of methane emission. The objectives of the current study were to estimate environmental factors affecting daily rumination time in high yielding dairy cattle, genetic parameters for rumination time across parities, environmental and genetic correlations between rumination time and economic traits and to predict the consequence of inclusion of this trait in the Israeli breeding index. The data included more than 30 million daily records from over 77,000 Israeli Holstein cows for rumination time and milk production. A lactation measure of daily rumination time per cow was computed as the residuals from a linear model analysis with rumination time as the dependent variable. The independent variables were days in milk and parity. Because of the shape of the lactation curve for rumination time, records up to 40 DIM and records with > 40 DIM were analyzed separately. The same model was used to analyze daily milk production records. The phenotypic correlation between first and second parity lactations for rumination time was nearly 0.8, and close to 0.7 for milk. The heritability of rumination time was close to 0.44 for parities 1-3. Heritability for milk production decreased from 0.5 in first parity to 0.3 in third parity. For both traits genetic correlations among parities were all > 0.9. Thus, for routine genetic analysis of rumination time, records in the different parities can be considered the same trait. The genetic correlation between rumination time and milk on first parity was 0.25 and increased slightly with increase in parity. Genetic correlations between rumination time, based on the first 40 days in milk, were economically unfavorable with retained placenta but economically favorable with metritis, ketosis and displaced abdomen. Genetic correlations between rumination time and the 9 traits included in the Israeli breeding index; milk, fat, and protein production, SCS, female fertility, herd-life, milk production persistency, calving ease, and calf mortality; were all economically favorable, except for the correlation of 0.17 with SCS. The highest correlation was 0.3 with protein production. The highest environmental correlations between rumination time and the other traits were with milk and protein, both 0.22. With the current index, daily rumination time with a current mean of 536 min and standard deviation of 90 min is expected to increase by 11 minutes per day after 10 years of selection. Inclusion of this trait with an index weight equivalent to 10% of the index should increase rumination time by 19 minutes. All changes in expected gains due to inclusion of rumination time in the index were economically positive, except for fat and SCS. Inclusion of rumination time in the index should result in 1 kg less gain in fat, a miniscule gain of 0.03 for SCS; and gains of 1.5 kg protein, 0.3% female fertility and 5 d herd-life. Even though the case for a genetic correlation between rumination time and methane emission is still weak, inclusion of this trait in the commercial index may be justified, especially considering that equipment is now commercially available for routine recording at reasonable cost.