Data integration to improve the prediction of individual dry matter intake of dairy cows

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Monitoring individual dry matter intake of dairy cows is important for nutritional management, early detection of disease, etc. Nowadays, we have several precision livestock farming technologies that allow us to automatically measure the time dairy cows spend around the feeding area, i.e. feeding time, and some researchers are developing models to estimate individual intake from that variable. However, there are other variables related to intake that could be automatically monitored and it can be expected that a multivariate approach (multi-sensor) could lead to better predictions. The objective of this study was to explore the potential of data integration in order to improve individual dry matter intake prediction models. We have used a database containing records from two feeding trials carried out in an experimental farm of northern Italy: 12 cows x 12 days and 14 cows x 10 days. We applied a stepwise regression to daily dry matter intake as the dependent variable and daily feeding time, cow body weight, daily change in body weight, week of lactation, energy corrected daily milk production, NDF content in the diet and particle size (percentage below 19 mm and percentage below 8 mm) as independent variables. Using our database, the linear regression between intake and feeding time has a R^2 of 0.06 and a standard error of 3.94 kg/day. However, the stepwise regression model procedure includes cow body weight, energy corrected daily milk production, feeding time, particle size expressed as percentage below 8 mm and daily change in body weight and has a R^2 of 0.62 and a standard error of 2.51 kg/day. Data integration has enabled an important improvement in the prediction model, but more research is needed in some aspects, e.g. the effect of data granularity (in our database, we have daily and weekly measured data) or the inclusion of new data (rumination time, climate data, etc) into the model.