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Feed efficiency is a key trait to integrate in breeding programs, particularly in order to limit the feed-food competition and the environmental impact of livestock production. The calculation of feed efficiency criteria requires individual feed intakes to be recorded, which is too expensive in small ruminants to be reasonably proposed. An option to make this trait more affordable is to predict feed intake or efficiency from a variety of predictors that can be easily recorded. As it has been evidenced that the animal metabolism is one of the main biological function underlying feed efficiency, we propose to examine the predictability of feed efficiency related traits from plasma metabolome. Plasma samples from 265 Romane male lambs fed a 100% concentrate diet were analysed with NMR. NMR spectra were divided into 877 buckets of 0.01 ppm, and the considered values were the area under the curve of each bucket. These variables were CLR transformed before multivariate analyses (sparse Partial least squares, sPLS) used for prediction. Prediction performances of feed intake and RFI were assessed through 5-fold nested cross-validation repeated 50 times, i.e. over 250 models. Accuracies of prediction from NMR buckets were compared to the accuracy obtained from body weights, growth, body composition (called zootechnical traits hereafter).

As a result, we highlighted that buckets did not improve the prediction of feed intake from zootechnical traits: an average R^2 of 0.7 was obtained from zootechnical traits with or without buckets, against 0.2 from buckets only. For RFI, R^2 were below 0.1 whatever the set of predictors. Considering whole spectra did not help predict feed efficiency nor feed intake. However, the main buckets involved in RFI prediction were consistent with metabolites previously associated to feed efficiency: such as beta-hydroxyisovaleric acid or L-tyrosine.