

Interest and limits of two methods to characterize the individual variability in feeding behaviour of barn-dried hay measured continuously in dairy goats

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Take home message The segmentation-clustering method applied to barn-dried hay dry matter intake measured continuously can better characterise individual feeding behaviour pattern than fitting data with a simple exponential model.

Introduction Barn-dried hay might be a good option to produce a palatable forage of good nutritional value with safer conditions than a field-dried hay. This study aimed to compare two methods to characterize individual variability in feeding behaviour of dairy goats, because this trait is highly variable and might be linked to performances in ruminants (Dado *et al.*, 1994).

Materials & methods Feeding behaviour was assessed on 24 dairy goats housed in individual crates and fed concentrates (1100 gDM/d) and *ad libitum* barn-dried hay (15 % refusals) twice a day for 7 days. Dry matter hay intake (DMIh) was weighted continuously. Individual cumulative hay dry matter intakes were fitted using an exponential model ($DMIh = a(1 - e^{-bt})$). The data concerning the intake evolution after the afternoon allowance were also characterised by a segmentation-clustering method (Giger-Reverdin *et al.*, 2012). To describe the major interrelations across the variables, a principal component analysis (PCA) was performed on milk yield (MY), body weight (BW), DMIh between afternoon and morning milking (DMIAft), DMIh during 180st minutes after afternoon allowance (DMI 180), the ratio $P180 = DMI180/DMIAft$, number of eating bouts (Neb), intake and duration of the first eating bout estimated by the segmentation-clustering method (Int1steb and Dur1steb), parameters *a* et *b*, the initial rate of intake (*ab*) and residual mean square error (RMSE) of the equations.

Results & discussion Barn-dried hay was very palatable as total DMI was 26 % higher than a prediction based on body weight and milk yield (Sauvant *et al.*, 2018). Around 58 % of the total variance was explained by the first 2 components (PC) of the PCA (Figure 1). The short distances between the same parameters of the exponential model for the afternoon and morning curves showed that feeding behaviour was quite repeatable within a day for a given animal. On the first PC axis, there was an opposition between on the right of the figure, the parameters characterising total intake and rate of intake, and on the left one, number of eating bouts and residual mean square error of the exponential model. This means that it has a better ability to fit meal kinetic with high intake and rate of intake and low number of bouts. On the second PC axis, there was an opposition between intake (upper part) and rate of intake (lower part). Animals with the highest intakes ate a lot during their first eating bout (or main meal) which was also of longer length (Dur1steb) what agrees with the literature.

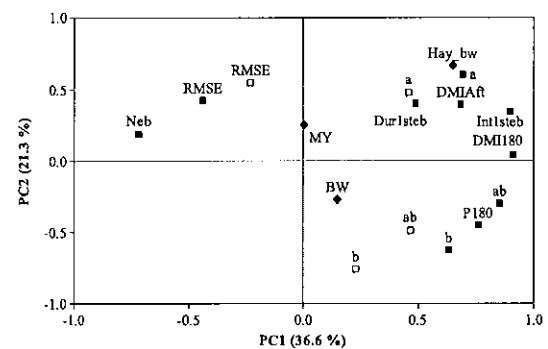


Figure 1 Projection of the variates on the first two principal components or PC (dark squares for afternoon data and open squares for morning ones).

The opposition between rate of intake and RMSE of the models and Neb pointed out that when the animals had a lot of eating bouts, the exponential model cannot characterize DMIh evolution between two distributions. At the opposite, the segmentation-clustering method is useful to better interpret data with the output of a vector of parameters which can explain, for example, the results of the exponential model: when the animals have a lot of eating bouts, the exponential model is of poor accuracy. Score plots of the individuals (not shown) pointed out that they were disseminated in the whole first two loading vectors plan what means that there was a high inter-individuals variability in feeding behaviour.

Conclusion. The segmentation-clustering method is a promising method to characterise individual pattern of feeding behaviour with cumulative dry matter intake obtained in the context of precision livestock farming in dairy ruminants.

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References

- Dado RG and Allen MS 1994. *Journal of Dairy Science* 77, 132-144.
 Giger-Reverdin S, Lebarbier E, Duvaux-Ponter C and Desnoyers M 2012. *Computers and Electronics in Agriculture* 83, 109-116.
 Sauvant D and Giger-Reverdin S 2018. In INRA, 2018. INRA feeding system for ruminants, 339-374.