5. **Using decision-tree algorithms to classify diet, dry period length and lactation weeks in dairy cows**

Xiaodan Wang[1, 2*], Edoardo Saccenti[2], Sanjeevan Jahagirdar[2], Bas Kemp[1], Ariette van Knegsel[1]

[1] Adaptation Physiology Group, Wageningen University & Research, The Netherlands

[2] Laboratory of Systems and Synthetic Biology, Wageningen University & Research, The Netherlands

* Corresponding author. E-mail: xiaodan.wang@wur.nl

The aim of this study was to classify diet, dry period (DP) length, and week of dairy cows based on milk characteristics and plasma variables measured in early lactation. Holstein-Friesian cows (N=95) were randomly assigned to DP lengths (n=31, n=34, and n=30 for 0, 30, and 60d dry, respectively) and early lactation diets (n=47 and n=48 for lipogenic and glucogenic, respectively), resulting in a 3 × 2 factorial design. Cows were fed with two diets from 10 day before the expected calving date and till week8 postcalving. Body weight of cows, milk yield, milk composition, and somatic cell count in milk were measured weekly. Blood was sampled weekly and analyzed for glucose, insulin, urea, non-esterified fatty acids, β-Hydroxybutyric, and Insulin-like growth factor-1 concentration. The Xgboost algorithms model was used for classification in this study. This classification had high sensitivity (100%) and specificity (100%). For the two diets, the comparison from week2 to week8 and week1 of 3 DPs had similar and high AUC (>0.89). For lipogenic ration, the top feature in the comparison of week2 and week1 and the comparison of week3 and week1 of cows with 0d DP was glucose in plasma rather than milk-related indicators. For glucogenic ration, the top features were milk-related indicators in weekly comparison of cows with 3 DPs. In conclusion, cows with different DPs and diets can be accurately classified through weeks. With the influences of different DPs, the responses of early-lactation cows to lipogenic ration and glucogenic ration showed different characteristic.

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