

## A Generalized Linear Mixed Regression Model of BHB to Early Detection of Nutritional and Management Problems in Dairy Herds

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The interpretation of milk metabolites from milk recording, can be a possible nutritional and management tool for dairy farmers. The nutrient imbalances, as the relationship between carbohydrates fermentability and protein degradability in the rumen, can be diagnosed by the urea and protein concentration in milk. The metabolic imbalances, as the negative energy balance (NEB), hyperketonemia and ketosis, can be diagnosed by the Beta-hydroxybutyrate (BHB) concentration and the relation of fat/protein (F/P) in milk. A generalized linear mixed regression model (GLMM) was constructed to determine non- nutritional factors associated with a BHB greater than 0.2 mmol/L. The model included the cow as a random effect within the herd. The adjustment of the models was made using the R Project program. This study analysed 110,461 individual milk samples of 9,523 lactating dairy cows collected monthly from January 2015 to March 2017 from 27 herds of South of Portugal, with an official milk recording (Association for the Development of the Dairy Cattle- EABL). The model shows that milk production, the stage and number of lactation, somatic cells count (SCC), milk fat and the relation F/P in milk influenced the BHB concentration. A cow with 20 kg of milk production have 13 times more possibilities to have a BHB higher than 0.2 mmol/L, than a cow with a production of 40 kg (figure 1). Primiparous at 41 days after calving (0-41 Days in milk(DIM)) have the double of possibilities (IC95%(OR)=(1,48;2,69)) of having BHB over 0,2mmol/L, than primiparous at 42 to 55 DIM (peak of milk production). Multiparous with SCC between 200 and 400x10<sup>3</sup>cells/mL have 66% (IC95%(OR)=(1,44;1,92)) more possibilities to have the BHB over 2.0mmol/L than other multiparous with SCC below 200x10<sup>3</sup>cells/mL. Cows with F/P equal or over 1.4 have 2.3 more possibilities (IC95%(OR)=(2,12;2,51)) of having a BHB over 0.2mmol/L than cows with F/P below 1.4.. In conclusion, the GLMM application optimize the potential using of milk recording to advise dairy farmers. Nevertheless, non-nutritional factors, should be considered in order to use milk metabolites as a tool to monitor milk farmers.

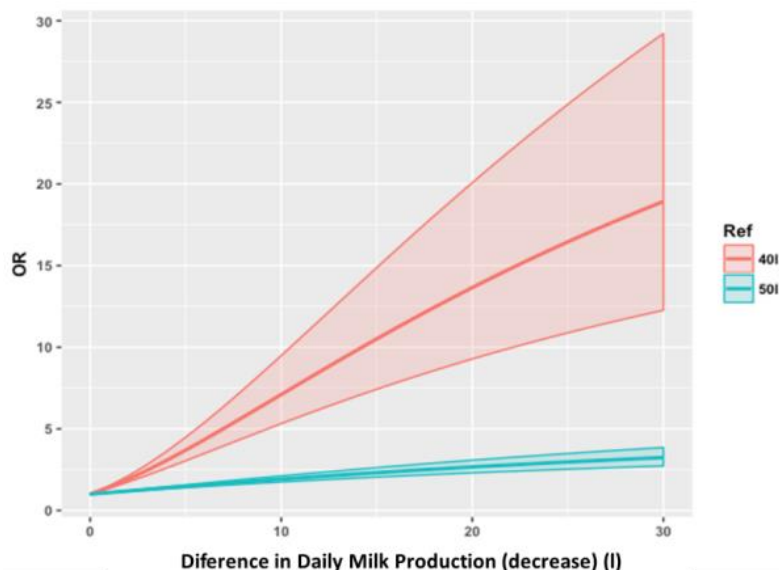


Figure 1 - The possibility of a cow having a BHB concentration greater than 0.2 with different milk production, and 95% confidence bands, taking as reference cows with daily milk production of 40 and 50 kg.

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