



Interactions between metabolic load and dairy cow welfare in grass dominated feeding systems

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Key words

Welfare, wellbeing, high yielding dairy cow, metabolism, stress physiology, herbage-based feeding systems

Aim of the study

Evaluation whether high yielding dairy cows can cope with a sole fresh herbage diet in early lactation or not (develop metabolic and infectious diseases or not); assessment and quantification of the welfare related stress response towards the metabolic load; identification and evaluation of relationships between metabolic and well-being/stress-related physiological, biochemical and behavioral parameters; evaluation whether the level of milk production aggravates the metabolic load and stress response and therefore compromises the level of well-being or not.

Material and methods

Twenty-five multiparous dairy cows (lactation yield: 4679-10808 kg) were classified according to the cortisol response following an ACTH challenge before the experiment and allocated to two groups: Whereas the treatment group (CON-) received only fresh herbage ad lib. plus mineral supplements, the control group additionally was fed with concentrate (CON+) according to the requirements. Within treatment groups, animals were divided in high and low yielding animals. The trial lasted from week 3 ante partum until week 8 post partum. Two animals of the high performing CON- group were excluded from the study in week 1 and 3 post partum, resp., due to clinical ketosis and downer cow syndrome, resp. Feed intake and milk yield was recorded daily. Blood samples were taken once weekly and analyzed for metabolites (glucose, NEFA, BHBA), endocrine factors (IGF-1) and welfare associated parameters (beta-endorphine, SAA, haptoglobin). Milk samples were obtained 3x weekly and resumption of ovarian cyclicity derived thereof. Heart rate variability, rumination and locomotion behavior and ruminal fermentation were evaluated over 24-h periods weekly and bi-weekly. Saliva cortisol was determined bi-weekly.

Results and significance

In particular, cows of the high performing CON- group experienced a severe metabolic stress far beyond the thresholds for diagnosis of clinical ketosis, however without obvious signs of health problems. Despite free access to herbage, animals of CON- had a lower feed intake compared to CON+ and a longer lasting negative energy balance. Milk yield in CON- was lower compared to CON+. Data on saliva cortisol, welfare-related parameters, heart rate, locomotion and rumination behavior did not show treatment effects. However, high-yielding dairy cows without supplementary concentrate needed to cope with enhanced metabolic stress having a negative impact on fertility, milk yield and body condition. Not being able to achieve genetic potential and inducing metabolic imbalances with further negative implications on health and fertility due to inadequate feeding is a crucial welfare issue in animal husbandry.

Publications, posters and presentations (Formatvorlage Überschrift 2)

One veterinary thesis in preparation; one thesis finished and accepted in 2016 (Zbinden R.S., Vetsuisse Faculty University of Bern)

Zbinden RS, Falk M, Münger A, Dohme-Meier F, van Dorland HA, Bruckmaier RM, Gross JJ. 2016. Metabolic load in dairy cows kept in herbage-based feeding systems and suitability of potential markers for compromised well-being. *J Anim Physiol Anim Nutr (Berl)*. 2016 Mar 9. doi: 10.1111/jpn.12498. [Epub ahead of print]

Falk M, Münger A, Dohme-Meier F. 2016. Technical note: A comparison of reticular and ruminal pH monitored continuously with 2 measurement systems at different weeks of early lactation. *J Dairy Sci*. 2016 Mar;99(3):1951-5. doi: 10.3168/jds.2015-9725.

Falk, M.; Münger, A.; Zbinden, R. S.; Gross, J. J.; Bruckmaier, R. M.; Hess, H. D.; Dohme-Meier, F. (2018) Effects of concentrate supplementation in early lactation on nutrient efficiency, ruminal fermentation and reticular pH of zero-grazing dairy cows with differing milk production potentials. *J Anim Physiol Anim Nutr*. 2018;00:1–12.

Further peer-reviewed publications in *Journal of Dairy Science*, *Livestock Science* and *Schweizer Archiv für Tierheilkunde* in preparation.

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