1480T Supplementation of rumen-protected sugar decreases blood β-hydroxy butyric acid concentration and improves reproduction in fresh lactating dairy cows. C. Brock*[1], V. N. Long[2], and A. Robinson[3], [1]*Berg + Schmidt GmbH & Co. KG, Hamburg, Germany,* [2]*Innochems, Gia Lai Province, Central Highlands, Vietnam,* [3]*Berg + Schmidt Asia Pte Ltd., Singapore.*

The objective of the study was to supplement rumen-protected sugar (RPS) to transition cows to decrease blood β-hydroxy butyric acid (BHB) concentration in early lactation. Sixty-two Holstein cows were separated into either control (CON), or on-top supplementation of RPS (LipoAktiv Glu 60, Berg + Schmidt GmbH & Co. KG, Hamburg). Supplementation started - 3 wk before estimated calving date with 150 g/cow/d RPS, after calving until 21 d in milk (DIM) RPS was fed at 200 g/cow/d. Blood glucose level was measured at calving, 7 and 14 DIM. Blood BHB level was measured at 7 DIM. Daily milk yield was measured until 63 DIM. Reproduction data were measured. Daily milk yield and blood glucose concentration were analyzed using statistical program R version 4.1.1 (2021). Treatment, time, interaction of treatment and time were included as independent variables, cow nested within treatment as random effect in a linear mixed model. Reproduction data and blood BHB level were compared by *t*-test statistics. Supplementation of RPS during transition period had no effect on blood glucose level ($P = 0.88$). Cows fed RPS tended to have lower blood BHB concentration compared with CON at 7 DIM (0.72 m*M* CON vs. 0.62 m*M* RPS; $P < 0.1$). Subclinical ketosis (SCK) was detected 12.5% in CON and 0% in RPS ($P < 0.05$), where SCK was defined as blood BHB concentration ≥1.2 m*M*. Blood BHB level ≤0.8 m*M* are associated with higher migration of circulating polymorphonuclear leucocytes (PMN). The rate of animals with blood BHB level ≤0.8 m*M* was higher in RPS (90.9%) than in CON (77.5%) ($P < 0.1$). There was no difference in milk yield by treatment ($P = 0.98$). Average days from calving to estrus tended to be reduced in RPS compared with CON (52.4 CON vs. 45.4 RPS; $P < 0.1$). Average days to first insemination were 129 for CON and 120 for RPS ($P < 0.1$). In conclusion, supplementation of RPS in transition dairy cows decreased blood BHB concentration which can be associated with reduced subclinical ketosis and improved migration of circulating PMN.

Key Words: rumen-protected sugar, subclinical ketosis, reproduction

1481T Interaction of digestible fiber and acetate supplementation on milk fat yield in dairy cows. M. Husnain*, R. Bomberger, and K. Harvatine, *The Pennsylvania State University, University Park, PA.*

Milk fat is an important and desirable component of milk because of its economic value and the demand for processed dairy products. Milk fat is sensitive to nutritional changes and acetate supplementation has been reported to increase milk fat in lactating cows. The objective of this experiment was to test the interaction of sodium acetate and diet digestible fiber level. Our hypothesis was that acetate would increase milk fat more in diets with lower digestible fiber as they are expected to also have lower acetate yield. Twelve multiparous Holstein cows were arranged in 4 × 4 Latin square design with 21 d period and a 2 × 2 factorial arrangement of treatments. Treatments were lower digestible fiber with a diet based mainly on forage fiber and high digestible fiber diet that substituted soyhulls and citrus pulp for corn silage (13.1% diet DM) with or without acetate (ACET) supplementation. The soyhull and citrus pulp substitution was balanced to decrease dietary starch 4 percentage units and forage NDF 1.3 percentage units with only a 0.4 percentage unit increase in total NDF. Sodium acetate was mixed in the TMR targeting 600 g/d. Data were analyzed by using JMP Pro 16 with a model that included the random effect of cow and period and the fixed effect of fiber digestibility, acetate, and their interaction. There was no effect of fiber digestibility, acetate, or interactions of fiber digestibility and acetate on milk yield. Acetate increased milk fat yield 103 g/d ($P < 0.02$) but there was no interaction of fiber digestibility and acetate ($P > 0.36$). There was no effect of fiber digestibility or interaction of digestibility and acetate on milk fat percentage but acetate tended to increase fat concentration 0.14 percentage units ($P = 0.08$). There also was no interaction of fiber digestibility and ACET for milk protein yield and concentration, but acetate tended to increase milk protein concentration ($P = 0.06$). There were no effects on milk urea nitrogen. In conclusion, acetate increased milk fat yield regardless of fiber digestibility of the basal diet.

Key Words: milk fat, sodium acetate, fiber digestibility

1482T Effect of organic solvent emulsifiers on *in vitro* rumen fermentation and gas production. X. Sun[1], Y. Li*[1], K. Giller[1], C. Kunz[1], M. Terranova[2], and M. Niu[1], [1]*Department of Environmental Systems Science, Institute of Agricultural Sciences, ETH Zürich, Zürich, Switzerland,* [2]*Agrovet-Strickhof, ETH Zürich, Lindau, Switzerland.*

Performing in vitro incubations of lipophilic supplements in rumen fluid requires the utilization of emulsifiers. When selecting an emulsifier, it is important to ensure the absence or at least minimization of emulsifier effects on fermentation parameters to minimize potential biases to the lipophilic treatments in the in vitro experiments. This study aimed to evaluate the effect of 7 emulsifiers, 2 concentrations each, on in vitro gas production and rumen fermentation, to identify the most inert emulsifier. In vitro incubations of emulsifiers were performed using the Hohenheim Gas Test. Individual rumen fluids were collected immediately before the morning feeding from 3 nonlactating cannulated Original Brown-Swiss cows and incubated for 24 h with TMR (40% grass silage, 40% maize silage, 15% hay and 5% concentrate, dry matter). Ethanol (E), ethyl acetate (EA), propylene glycol (PG), glycerol (G), ethylene glycol (EG), soy lecithin (SL), and Tween 80 (T80) were added in dosages of 0.5% or 1% vol/vol. The untreated diet served as control (CON). Compared with CON, the 24-h methane production was higher ($P < 0.05$) for E (36.9, 40.8%), EG (47.5, 48.2%), and G (63.8, 90.1%) for 0.5 and 1% dosage respectively. The acetate was 20.6 m*M* and 48.9 m*M* higher for EA in 0.5 and 1% respectively, and 13.5 m*M* higher ($P < 0.05$) in 0.5% EG compared with the CON. The propionate was 13.2 m*M* and 20.6 m*M* higher for 0.5 and 1% G, respectively, and 10.7 m*M* and 10.8 m*M* higher for 0.5 and 1% PG respectively, when compared with the CON. In comparison to the CON, the in vitro organic matter digestibility increased ($P < 0.05$) by EA (30.7, 41.5%), EG (18.4, 18.0%), G (42.5, 50.1%) and SL (17.7, 24.0%) at 0.5 and 1% dosage respectively. In summary, T80 was the only emulsifier that did not significantly affect in vitro rumen fermentation parameters and can therefore be considered most suitable for in vitro incubations of lipophilic substances in rumen fluid.

Key Words: Tween 80, methane, volatile fatty acid

1483T Relationship between pre-trial milk fat concentration and milk fat response to marine oil diets that caused milk fat depression in sheep. A. Della Badia[1,2], P. G. Toral*[1], G. Hervás[1], C. Matamoros[2], P. Frutos[1], and K. J. Harvatine[2], [1]*Instituto de Ganadería de Montaña (IGM), CSIC-University of León, Grulleros, León, Spain,* [2]*Pennsylvania State University, University Park, PA.*

Biohydrogenation (BH)-induced milk fat depression (MFD) results from ruminal alterations when sheep are fed marine oils. However, there is no available information on the relationship between pre-trial milk fat concentration and response to the MFD diet. The objective of this

study was to conduct a meta-analysis to characterize whether pre-trial milk fat concentration may determine subsequent changes in milk fat synthesis when ewes were fed diets containing marine lipids. Data was used from 10 experiments in which 160 Assaf ewes were fed 16 MFD diets (including fish oil or marine algae, alone or in combination with sunflower oil) for 3 to 5 wks. The decrease in milk fat concentration was calculated using 3 different methods: the absolute change (final − initial), change as a percent of pre-trial value, and potential change relative to the maximal expected MFD (assuming a maximal decrease to 3% milk fat). The statistical model included the random effect of the experiment and interaction of experiment and pre-trial milk fat concentration, and the linear and quadratic effect of this latter variable. There was a linear relationship between initial milk fat content and the absolute ($P < 0.001$; $R^2 = 0.46$; partial R^2 of 0.08), relative ($P < 0.01$; $R^2 = 0.39$; partial R^2 of 0.06), and "potential" change in milk fat concentration ($P = 0.04$, $R^2 = 0.17$; partial $R^2 = 0.03$), with higher milk fat ewes experiencing greater reductions. It can be hypothesized that MFD severity in more responsive ewes may be related to some rumen function alterations (which in turn, might result in higher concentrations of certain antilipogenic metabolites). Overall, there is a linear inverse relationship between pre-trial milk fat concentration and the magnitude of MFD when sheep are fed marine oils, with higher reductions in ewes with higher milk fat percentage. Supported by PID2020–113441RB-I00 (MCIN/AEI) and PRE2018–086174 (MCIU/AEI/FSE, UE).

Key Words: ewe, biohydrogenation, marine lipid

1484T Do dairy sheep display Δ^{13}-desaturase activity? An in vivo study using ^{13}C-labeled fatty acids. P. G. Toral*, P. Frutos, and G. Hervás, *Instituto de Ganadería de Montaña (IGM), CSIC-University of León, Grulleros, León, Spain.*

The fatty acid desaturase 3 (FADS3) enzyme introduces a Δ^{13} double bond in fatty acids (FA). Using isotopic tracers, the activity of FADS3 has been identified in the mammary tissue of goats, catalyzing the desaturation of *trans*-11 18:1 to *trans*-11 *cis*-13 CLA. However, we have not found any similar research on other ruminant species in the literature. Neither does there seem to be any publication on the possible Δ^{13} desaturation of 18:0 in dairy animals. Thus, this study was conducted to examine the presence of FADS3 products in ewe milk, using ^{13}C-labeled FA. In a first trial, 5 Assaf sheep received an intravenous injection of 200 mg of [1-^{13}C]*trans*-11 18:1, and milk samples were collected at −24, −15, 0, 9, 24, 33, 48, 57, 72, 81, and 96 h postinjection (p.i.). In a second trial, 6 ewes received an intravenous injection of 2 g of [1-^{13}C]18:0, and milk samplings were conducted at −24, −15, 0, 4, 8, 12, 16, 20, 24, 36, 48, 60 and 72 h p.i. Compound-specific isotope analysis of milk FA were conducted by gas chromatography-combustion isotope ratio mass spectrometry. Despite this methodology offers high accuracy and precision to quantity isotope distribution at low abundance levels, in trial 1 we failed to detect increases in the ^{13}C % of *trans*-11 *cis*-13 CLA above basal levels. However, the presence of [1-^{13}C]*cis*-13 18:1 was detected in trial 2, with a maximum ^{13}C enrichment of 0.36% at 24 p.i. On average, the proportion of *cis*-13 18:1 being synthesized endogenously represented 51.4% of the amount secreted in milk, which corresponded to Δ^{13}-desaturation of 0.35% of the 18:0. These results would confirm the activity of FADS3 in sheep, but the question remains as to whether the lack of *trans*-11 18:1 desaturation was due to a specificity in this ruminant species or to the low concentration of its putative product (*trans*-11 *cis*-13 CLA) in trial 1 (on average, 0.007% of milk FA). Further research would be advisable using diets that favor the presence of this CLA isomer in sheep milk (e. g., linseed oil).

Key Words: conjugated linoleic acid, desaturation, isotopic tracer

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Relationship between pre-trial milk fat concentration and milk fat response to marine oil diets that caused milk fat depression in sheep

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1. INTRODUCTION

Biohydrogenation (BH)-induced **milk fat depression (MFD)** results from ruminal alterations when sheep are fed marine oils.

However, there is **no available information** on the relationship between pre-trial characteristics (e.g., milk fat concentration) and response to the MFD diet.

Objective: To conduct a **meta-analysis** to characterize whether pre-trial milk fat concentration may determine subsequent changes in milk fat synthesis when ewes were fed diets containing marine lipids.

2. MATERIAL AND METHODS

Data base

160 Assaf sheep (10 trials conducted at the IGM)

16 MFD-inducing diets (supplemented with fish oil or marine algae, alone or in combination with sunflower oil) fed for 3-5 weeks

Changes in milk fat concentration (g/kg) and **yield** (g/d)

Expressed as:

Absolute change (final fat – initial fat)

Relative change (as a percent of pre-trial value)

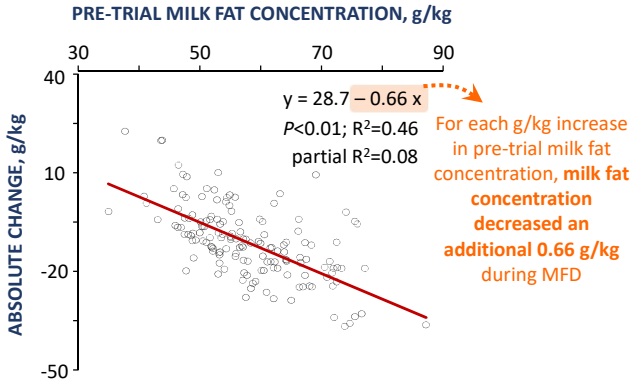
Potential change (relative to the maximal expected MFD, assuming a maximal decrease to 3% milk fat)

Statistic analysis (bivariate) JMP v. Pro 16

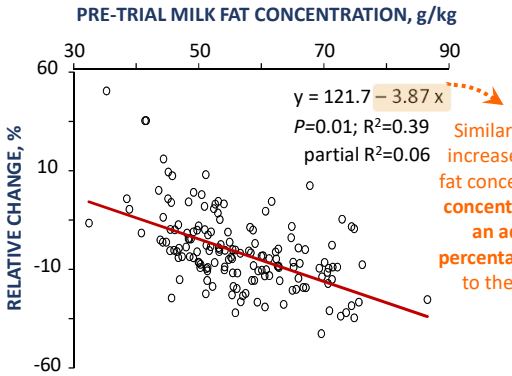
Fixed effect of pre-trial milk fat concentration (linear and quadratic), random effect of the trial and their interaction.

Fit statistics: root mean squared error (RMSE) and determination coefficient (R^2 and partial R^2).

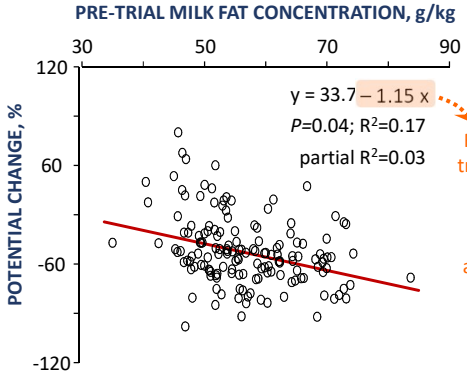
3. RESULTS



For each g/kg increase in pre-trial milk fat concentration, **milk fat concentration decreased an additional 0.66 g/kg** during MFD



Similarly, for each g/kg increase in pre-trial milk fat concentration, **milk fat concentration decreased an additional 3.87 percentage points** relative to the pretrial values



For each g/kg increase in pre-trial milk fat concentration, **the potential change in milk fat concentration was 1.15 percentage points greater,** assuming a maximal potential decrease to 3%

PRE-TRIAL MILK FAT YIELD, g/d

There was also an **inverse linear relationship** between pre-trial milk fat concentration and the absolute and relative change in milk fat yield. No significant relationship was found for the potential decrease in milk fat yield.

The higher the initial milk fat content, the greater the extent of MFD. It can be speculated that MFD in more responsive ewes may be related to **rumen function alterations** that increase concentrations of candidate antilipogenic metabolites.

4. CONCLUSION

Overall, there is a **linear inverse relationship** between **pre-trial milk fat concentration** and the **magnitude of MFD** when sheep are fed **marine oils**, with higher reductions in ewes with higher milk fat percentage.

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