Polysaturated fatty acids (PUFA) feeding often decreases protozoal numbers in the rumen. Animal-vegetable fat (AM) FA, a by-product of the food industry, is readily available to provide PUFA in dairy diets. However, the response to AV supplementation on protozoal numbers is not consistent, possibly due to biohydrogenation (BH) of PUFA in the rumen. Long chain saturated FA are less toxic to protozoa, therefore, the BH of PUFA removes their potential inhibitory effects. In contrast, evidence from OSU supports the contention that protozoa are a vehicle for passage of PUFA or other intermediates of BH that do not promote MFD.

AV supplementation in combination with Rumensin® (R), an ionophore improving feed efficiency, occasionally spontaneously decreases milk fat yield and percentage. This milk fat depression (MFD) is likely due to the partial BH of PUFA, which favors FA intermediates that are inhibitory to milk fat synthesis.

Feeding coconut oil (CO) rich in medium chain fatty acids (MCFAs), and therefore low in PUFA, has decreased the abundance of ruminal protozoa in sheep. We hypothesized that, while lowering protozoal populations, diets supplemented with CO in combination with R would not cause MFD as would AV diets combined with R. PUFA or MCFA in combination with R could shift ruminal fermentation and potentially depress fiber degradation, reducing fed intake.

Therefore our objectives were to determine the effects of feeding AV or CO in combination with R on protozoal abundance, ruminal fermentation, total tract digestibility, feed intake, milk and milk fat production. This interaction between R and fat source on MFD is reported here with a 2x3 factorial arrangement of treatments with +/- R and either no fat, AV, or CO.

### Material and methods

Six primiparous rumen-cannulated Holstein cows (79 DIM) were fed six diets in a 6x6 Latin square design. The diets were supplemented with 260 mg of R (+R), and with control (no fat added), 5% AV, or 5% CO or a 2x3 factorial arrangement. Periods were 3 wk except the 4-week initial period to allow adequate adaptation of ruminal populations to R; in subsequent periods, ruminal contents were transferred to hasten adaptation. Diets were prepared once daily as a TMR and fed every 2 h.

All diets contained 16.2% alfalfa hay and 32.8% corn silage on a DM basis. The diet composition averaged 16.8% CP, 5.5% ash and 41.5% NFC, similar for all diets. Diets averaged 2.4, 5.8, and 6.4% for粗for control, AV, and CO, respectively, and the FA profile of CO is similar to that of R.

The mixed model included fixed (diet) and random (period, cow) effects. Contrasts were the main effects of: 1) R, 2) Fat supplementation (control vs. AV+CO), and 3) Source of fat (AV vs. CO); and 4-5) the interactions of R with contrasts 2 (RxF) and 3 (RxS). Significance was 0.05 for main effects and P>0.10 for interactions.

### Discussion

Feeding CO drastically decreased protozoal cell counts and shifted ruminal fermentation toward propionate at the expense of acetate and butyrate. Although total protozoal counts were not affected by the interaction RxS, the counts of Epidinium were lower when both R and AV+R. Because this diet also caused MFD, Epidinium likely contributed to MFD. Against our hypothesis, diets supplemented with CO also induced MFD, possibly through another mechanism than AV diets. Indeed, feeding CO differentially affected protozoal genera with no toxic effects on Epidinium.

The changes in VFA were associated with a decreased total tract digestibility of NDF for CO from inhibition of fiber degradation in the rumen. This inhibition is associated with the lower DMI with CO from rumen 18. Total tract digestibility of FA was higher with CO due to higher duodenal digestibility of MCFAs. Higher C16 digestibility with CO could result from more UFA from incomplete BH, causing the MFD observed when AV+R was fed.

Although the inhibition of fiber degradation might have limited energy for milk fat synthesis, further analysis of omasal and milk FA will help elucidate the mechanism of MFD with CO supplementation.

### Materials

Feeding animal-vegetable (AV) or medium chain FA to dairy cows can decrease rumen protozoal count. In contrast, AV+R drastically decreased protozoal cell counts and shifted ruminal fermentation toward increased propionate at the expense of acetate and butyrate. Although total protozoal counts were not affected by the interaction RxS, the counts of Epidinium were lower when both R and AV+R. Because this diet also caused MFD, Epidinium likely contributed to MFD. Against our hypothesis, diets supplemented with CO also induced MFD, possibly through another mechanism than AV diets. Indeed, feeding CO differentially affected protozoal genera with no toxic effects on Epidinium.

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