DRY MATTER INTAKE FOR MID-LACTATING COWS FED BY BIOACTIVE COMPOUNDS

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1. INTRODUCTION

The continuous narrowing gap between feed costs and milk prices in the dairy industry underscores the need to improve and maintain milk efficiency (i.e., amount of milk produced per kg of feed provided) in dairy farms (POTTS et al., 2017). Dietary protein or crude protein is an essential nutrient in dairy cow rations and plays a significant role in the improvement of milk efficiency (HUHTANEN AND HRISTOV, 2009). Therefore, the optimization of crude protein and particularly metabolizable protein can significantly improve the economic return in a dairy farm operation (SCHWAB AND BRODERICK, 2017).

Plant-derived bioactive compounds (i.e., phytochemicals) have shown a variety of antimicrobial properties in ruminants as well as a great potential to modify rumen characteristics (CALSAMIGLIA et al., 2007; OH et al., 2017). Naturally occurring tannins are plant polyphenols classified as hydrolyzable or condensed and by hydrogen bonds can bind dietary protein, forming a tannin-protein complex. This complex is stable at ruminal pH (5-7) and consequently decreases the degradation of proteins by the rumen microbiota, and this complex is dissociated in the abomasum which has a low pH (FRUTOS et al., 2004).

Capsicum species are flowering plants that contain capsaicinoids as their active compound, has been observed, that such compound can increase feed intake also affect some changes on the rumen fermentation characteristics rates (CALSAMIGLIA ET AL., 2007; RODRIGUEZ-PRADO et al., 2012).

The aim of the study was to compare the effects of dietary phytochemicals including tannins and *Capsicum* on dry matter intake against a known source of dietary rumen undegraded protein (RUP) as expeller soybean meal (ESBM) fed to mid-lactation dairy cows.

2. METHODOLOGY

All experimental procedures were approved by the Institutional Animal Care and Use Committee at the South Dakota State University (Protocol no. 17-010A). Cows were housed in a ventilated enclosed barn with access to mattress freestalls during the entire experiment. Cows were fed once daily at 0530 h using electronic admission gates with individual transponders (American Calan, Northwood, NH). Feed offered was adjusted daily to achieve 5 to 10% refusal.

Twenty-four multiparous Holstein cows (96 ± 16 DIM; mean ± SD) were used in a 3 × 3 replicated Latin Square experimental design with a covariate period. Cows were blocked according to milk production, and BW and randomly assigned eight by treatment sequence.

Diets were formulated using the Spartan Dairy Ration Evaluator 3.0 (Michigan State University, East Lansing; http://spartandairy.msu.edu/spartandairy/home) to meet requirements of the average cow in the group according to the NRC (2001). Daily dry matter intake were recorded throughout the experiment.

Data were analyzed using the mixed model procedure of SAS 9.4 (SAS Institute Inc., Cary, NC) to account for the carryover effect. If the carryover effects were not detected ($P > 0.05$), this term was removed from the model.

3. RESULTS AND DISCUSSION

Table 1. Effects of supplementing dairy cows with soybean meal (SB), phytochemicals (RUM), and expeller soybean meal (ESBM) during mid-lactation on DMI.

Item	Treatment			SEM [1]	*P*-value[2]		
	SB	RUM	ESBM		TRT	P	Seq
DMI (kg/d)	25.9	25.5	25.9	0.66	0.65	<0.01	0.25
DMI (% of BW)	3.64	3.61	3.60	0.12	0.85	<0.01	0.58

[1]Largest standard error of the mean.
[2]TRT= Treatment effect; P = Period effect; Seq=Sequence effect.

Dry matter intake, DMI as % of BW were not affected by dietary treatments. There was a period effect ($P < 0.01$) for the variable (Table 1). However, this effect cannot be associated to a single period being significantly different across all these parameters. The DMI and DMI as % BW decreased linearly throughout the periods.

Commonly tannins have been associated with low feed intake in ruminants due to decreases in palatability (COOPER AND OWEN-SMITH, 1985) or astringency (LANDAU et al., 2000), and these consequences have been associated with high concentrations (> 5% of diet on DM) of tannins in the diet (McNABB et al., 1996).

However, some studies have observed decreses in feed intake when the inclusion tannins rates were at 1.8% (AGUERRE et al., 2016) and 3% (DSCHAAK et al., 2011) in the diet. In the current study, the RUM pellet was made to contain 1.5% phytochemicals, including tannins and Capsicum. The RUM pellet was offered at 4.16% of the diet on DM basis, indicating that the feed rate of the phytochemicals in the diet represented 0.06% of the diet on DM basis.

Therefore, this little inclusion rate in comparison to previous studies can be linked to the lack of negative effects on DMI. In contrast to tannins, Capsicum species have been combined with increased DMI in ruminants (CARDOZO et al., 2006; RODRIGUEZ-PRADO et al., 2012). However, the lack of response in DMI in the current trial, probably indicate that a low inclusion rate of Capsicum within the RUM pellet, or the effect in DMI observed by CARDOZO et al. (2006) and RODRIGUEZ-PRADO et al. (2012) in beef heifers is more challenging to be translated into adult lactating dairy cows.

4. CONCLUSIONS

Our data described the responses on dry matter intake parameters when dairy cows were fed a combination of tannins mixture (i.e., condense and hydrolyzable) and *Capsicum* in comparison to expellers soybean meal and soybean meal. These data suggest that phytochemicals doesn't affect the DMI when fed to mid-lactation cows, on the rates used, in the trial. Other studies are required, to elucidate the ideal supplemented rate of phytochemical, to feed dairy cows

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