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Director's Digest

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ROLE OF TALLOW AS A RUMEN INERT FAT FOR DAIRY COWS

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NOTE: *This article appeared in the August 9, 1993 issue of Feedstuffs Magazine. It covers data from some Fats and Proteins Research Foundation sponsored studies. This is excellent information when visiting with your customers about utilizing high levels of tallow in dairy cattle rations.*

Tallow, a very economical source of energy for high-producing dairy cows, is generally considered to have excellent digestibility and high palatability, but to be limited in extent of use because of problems in rumen fermentation. When fats for the dairy cow are stratified as illustrated in Table 1, tallow is generally placed in the second category, along with fats from oilseeds.

This indicates a concern is given relative to negative associative rumen action of tallow.

Recently, our attention has been called to several papers demonstrating a relatively high degree of rumen inertness for tallow, even when fed in combination with significant quantities of fat originating from oilseeds. It should be noted, however, that even

though rumen fermentation characteristics were not noted supporting detrimental actions of tallow, the partial digestibility of the fat was seriously questioned, especially when total dietary fat intakes exceeded 1,000 g. The purpose of this note is to call attention to the relatively high degree of rumen inertness associated with tallow, but, at the same time, to reinforce the fact that fat digestibility declines significantly as a function of total dietary fat intake.

Research Reviewed Recently, three studies have been published that investigated the addition of tallow to diets that were relatively high in fat from oilseeds or high corn oil. Two of these studies from the University of Illinois provided information on fat digestibility as well as measurements relating to rumen function. A third study from the University of Wisconsin provided a rather complete description of the action on rumen function.

It has generally been accepted that fat is relatively rumen inert if fiber digestion is not altered and if there is no appreciable change in feed intake and production. All three of these studies provided a rather close evaluation of these parameters, and for the most part, tallow would be considered relatively rumen inert even at total fat intakes exceeding 1,000 g per day.

The first study from the University of Illinois[4] utilized four diets in a Latin square design. Diets were control, control plus a 10% addition of raw whole soybeans (WSB) and the WSB diet with a 2.5 and 4.0% addition of tallow. All diets contained 45% of dry matter (DM) from alfalfa haylage and 5% from corn silage. The 10% WSB diet was substituted for soybean meal and soybean hulls. The tallow diets were achieved by substitution of corn grain.

All diets were adequate in protein (19.7-20.6% crude protein [CP]) and fiber (21-30% acid detergent fiber [ADF] and 33-36% neutral detergent fiber [NDF]]). The total fatty acid content of the control diet was 3.1% with the substitution of WSB increasing the fatty acid content to 5.2%. Tallow additions of 2.5 and 4.0% increased fatty acids to 7.1 and 7.9%, respectively. Calcium was maintained relatively high for all diets (1.1-1.3%).

Cows utilized in the study were mature Holsteins at mid-lactation. The periods for the Latin square were of 21 days in duration with the final 7 days used for sample collection.

In a second study,[1] the Illinois workers utilized a similar experimental design to investigate tallow additions to a moderately high-fat diet, achieved by using high-oil corn (conventional corn replaced with high oil corn, containing ether extract of 8.1%) and the high-oil corn diet with tallow added at 2.5 and 5.0%. Tallow replaced DM from the high-oil corn.

Alfalfa haylage, soybean hulls, soybean meal and blood meal DM contents were equalized in all four diets at 37, 5, 8 and 3%, respectively. This resulted in diets with protein from 17.3 to 17.7, ADF from 20.8 to 22.0 and NDF from 32.0 to 33.8. The total fatty acids content was 2.7% for the control, 4.2% with the high-oil corn and 6.1 and 8.6% for the 2.5 and 5.0% tallow additions.

The cows in this second study were early in lactation (average of 49 days in milk) and exhibited much higher feed intakes as well as production.

The third report reviewed was conducted by Wisconsin workers[2] using an experimental design similar to those described earlier. The

Wisconsin effort involved 16 Holstein cows, averaging 47 days in milk in a 4X4 Latin square experimental design.

Diets studied consisted of a control and the control with tallow additions of 1, 2 and 3%. The forage base was alfalfa silage and corn silage of 33 and 12%, respectively. Ground corn, soybean meal, roasted soybeans and tallow additions dominantly for corn. Since 14% of the control diet was roasted soybeans, the fatty acid content was quite high (5.5%). Tallow additions resulted in fatty acid contents of 6.3, 6.9 and 7.6%, respectively, for the three additions.

Rumen Inertness As mentioned previously, all tallow diets showed a great degree of rumen inertness when evaluated by the dietary intake and fermentation parameters. This resulted even with total fatty acid intakes approaching 2,000 g.

The Wisconsin study[2] utilized dacron bags containing forage DM suspended in the rumen and found no differences in DM disappearance over 48 hours of incubation. In fact, the study showed lower pH with the tallow additions and a greater molar quantity of total volatile fatty acids, suggesting that rumen function was actually enhanced. The authors provided no explanation for these observations.

Fat Digestion It was of interest to evaluate the fat digestibility from the Illinois studies using a calculation for partial digestion. Tables 2 and 3 present threse results.

The addition of tallow to the WSB is illustrated in Table 2. Total fatty acid intakes were from 688 g (control diet) to 1,691 g for the diet with 4% tallow addition. Total tract apparent digestibility of the fatty acids declined from 76.7% for the control to 57.6% at the highest tallow addition.

Calculation of a partial coefficient for the added fat increment showed fatty acid digestibilities of 50% for the WSB increment and 54 to 46% for the 2.5 and 4% tallow additions, respectively.

In the second Illinois study where high-oil corn was used (Table 3), total fatty acid intake exceeded 2,000 g for the 5% tallow diet. Partial digestion coefficients indicated excellent utilization of the fatty acids from the high-oil corn (81%) with somewhat lower values for the tallow increment at 2.5% addition. However, this value is comparable to that of the control diet and is achieved with a total fatty acid intake in excess of 1,600 g. At the highest tallow addition where total fat intake is exceeding 2,000 g, it is obvious that fat digestibility is reduced and DM intake declines.

The Bottom Line Results of these studies suggest that tallow is relatively rumen inert, even when introduced into diets containing up to 5.5% fatty acids from other sources. It must, however, be recognized that all diets were from a forage base of alfalfa. Field observations from our experiences, as well as that of others[3] suggest that alfalfa forage base diets are more tolerant to fat additions.

The law of diminishing returns with respect to fat utilization and total amounts fed exists just as strong in these studies as found from studies of other fat products reviewed by this author and reported in earlier columns. Until methods are established where more efficient digestibility occurs, it is doubtful if fat digestibility results in additional fat providing net energy values no greater than that from carbohydrate.

Additional research is needed to establish the most effective means of fat incorporation into diets for achievement of maximum

digestibility. Also, it is essential to evaluate fat introductions under varied forage conditiions to establish the role of forage source with respect to tolerants of a fat load.

REFERENCES

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[3] Lunquist, Rick. 1993. Personal communication.

[4] Schauff, D.J., J.P. Elliot, J.H. Clark, J.K. Drackley. 1992. Effects of feeding lactating dairy cows diets containing whole soybeans and tallow. J. Dairy Sci., 75:1923-1935.

TABLES

1. Stratification of fats for dairy cows

Type	Amount	Description
I	3%	Background fats in conventional feeds.
II	2%	High-fat feeds such as oilseeds, tallow and animal-vegetable blends.
III	1-2%	Rumen inert sources such as Megalac, Energy Booster, Alifet, Booster Fat and Carolac.

2. Effects of adding tallow to high soybean-containing ration soybeans and tallow

		Soybeans and tallow		
	Control	Control +WSB	Control +WSB +2.5% tallow	Control +WSB +4.0% tallow
DM intake, kg	22.2	21.8	21.7	21.4
% Fatty acid	3.1	5.2	7.1	7.9
Fatty acid intake, g	688	1,134	1,541	1,691
Basal fatty acid intake, g	688	608	1,100	1,068
Supplemental fatty acid intake, g	0	525	441	622
Dig. %	76.7	64.5	61.5	57.6
Fatty acid dig., g	528	731	948	974
Basal fatty acid dig.	528	467	710	689
Supplemental fatty acid dig.	0	265	238	285
% Dig.	—	50.4	54.0	45.8

Schauffer et al., 1992

3. Adding tallow to rations high in background level of fat

		High-oil corn and tallow		
	Control	HOC	HOC + 2.5% tallow	HOC + 5% tallow
Diet intake, kg DM	27.2	27.1	26.8	23.8
Fatty acid, % DM	2.7	4.2	6.1	8.6
Intake, g	734	1,138	1,635	2,047
Basal	734	721	1,097	950
Test	0	417	537	1,097
Fatty acid dig. %	64.1	70.3	68.4	61.9
Fatty acid dig., g	471	800	1,118	1,267
Basal	471	462	772	668
Test	0	338	347	599
Partial dig. %	—	81.0	64.5	54.6

Elliott et al., 1993