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TechBulletin

# Soapstock in Ruminant Diets

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Net energy (NE) intake by feedlot cattle is one of the most important, if not the most important, dietary factors influencing weight gain. increasing the energy content of the diet by adding fat (1-4% DM basis) results in increased NE intake and rate of gain provided DM intake, fat digestibility, and fiber digestibility are not substantially depressed. Tallow supplementation often results in reduced DMI but with minimal effects oil fiber digestibility, resulting in a net increase in energy intake and dietary NE content. The degree to which fat may influence DM intake and nutrient digestibility varies with supplementation level, degree of saturation, and whether or not the fat is protected from the rumen. Unsaturated fats arc highly subject to saturation by rumen bacteria through the process of biohydrogenation. This is the primary reason why beef fat and muscle have a higher saturated fat content compared with pork and poultry. Protecting dietary unsaturated fats from biohydrogenation has resulted in increased DM intake, NDF, ADF, and fat digestibility, and higher unsaturated fat levels in blood and tissue when compared with cattle fed diets containing tallow or unprotected vegetable oils (Trenkle et al., 1995; Rule et al., 1994; Pantoja et al, 1994; Doreau et al., 1993; Brandt and Anderson, 1990).

Ruminal availability, and thus biohydrogenation of unsaturated fat may be influenced by grain processing (if oil is in the seed) or by saponification of supplemental fat (i.e. soapstock).'Soapstocks (SS) are saponified fatty acids (FA) formed when free fatty acids and divalent cations (usually

calcium) are combined to form a protected fat that is relatively inert in the rumen (Grummer, 1988) but dissociates In the acidic environment of the duodenum (first part of small intestine) during digestion. Dissociation of fat and Ca is important for proper digestion and absorption of soapstocks. Soapstocks can be formed from most fats and oils including (in general order of increasing maturation) tallow, palm oil, cottonseed oil, corn oil, soybean oil, rapeseed oil, and canola oil. Dissociation and digestibility of SS in the rumen and total tract can vary with degree of FA saturation and pH (Sukhija and Palmquist, I990).

Recent research showed unsaturated soaps were generally more digestible (Enjalbert et al. 1997) and tended to dissociate at a higher pH compared with those that were more saturated. The unique properties of unsaturated SS allowed for DM intake that was similar to tallow supplemented diets but did not negatively influence digestion and metabolism as would be expected with diets containing unprotected fats (Pantoja et al, 1994; Wu et al., 1991). Studies generally agreed that digestibility of major nutrients such as organic matter, starch, nitrogen, and energy were similar while NDF and ADF digestion was improved when unsaturated SS was supplemented (2-6% of diet DM) compared with tallow and vegetable fat supplemented at the same level (Doreau et al , 1993; Zinn, 1992; Ngidi et al., 1990). These findings were consistent with those by White (1958) who observed low fiber digestion was completely reversed when dietary Ca was increased from .3 to .9% in diets supplemented with 5% corn oil. This also suggests when supplying supplemental fat as SS additional dietary Ca may not be needed for improved fiber digestion to occur (Zinn and Shen, 1996). In agreement with this are the trials reviewed here where improved fiber digestion occurred with unsaturated SS supplementation but with no additional Ca provided.

Even though feeding SS has been associated with improved lilt and fiber digestion, improvements in feedlot performance by steers fed SS compared with those fed tallow or yellow-grease have nut been demonstrated (Fluharty and Loerch, 1997; Bock et al., 1991; Ngidi et al., 1990). Nonetheless, higher NE content and improved feedlot performance occurred when diets containing 2-4% SS was led compared with control diets containing no added lat. Compared with unprotected fat, SS appears to support similar levels of feedlot performance but without the tendency to depress DM intake and fiber digestion. When SS from tallow (i.e. saturated SS) was fed (Jenkins and Palmquist, 1984) ruminal fiber digestibility readied normal levels (e.g. control level) but total fat digestion was reduced. This would be expected since SS is inert in the rumen

and digestibility of saturated fat is lower than that for unsaturated. Unsaturated SS appears to be of benefit since it is relatively inert in the rumen compared with unprotected oils, and is mole digestible in the small intestine than is saturated fat and saturated SS. Lastly, if SS is led as the sole fat source it should probably be supplemented at a level of less than 6% of the total diet DM.

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