FATS AND PROTEINS RESEARCH FOUNDATION, INC.

Director's Digest

WERNER R. BOEHME
Technical Director

2720 DES PLAINES AVENUE
DES PLAINES, ILLINOIS 60018
AREA CODE 312-827-0139

November, 1977 No. 133

Improving the Food Value of Fats and Proteins in Rations for Ruminants

David S. Kronfeld, University of Pennsylvania, School of Veterinary Medicine, New Bolton Center, Kennett Square, PA

The ruminant dream is to feed ruminants on materials which are unacceptable to man and have these transformed into high quality food products, meat and milk. The dream is made possible by fermentative digestion in the rumen. This process utilizes substances which cannot be digested by hydrolysis, the predominant process in humans. There is another side of the dream which usually remains unseen: fermentation is energetically far less efficient than hydrolysis. The difference in efficiency between hydrolytic and fermentative digestion is especially important in regard to the utilization of fat and protein.

Two research workers at the University of Pennsylvania, William Chalupa and David Kronfeld, have been emphasizing that further advances in rations for ruminants will involve processing the food and manipulating enzymatic processes in the rumen so that any feed which can be digested hydrolytically is not fermented in the rumen, and that only feeds which cannot be digested hydrolytically are fermented in the rumen. The next step is to provide these materials in optimal proportions to maximize the animal's health and productivity (see Chalupa, J. Dairy Sci. 58, 1198-1218, 1975; Kronfeld, Zeitschr. Tierphysiol. Tierernaehr. Futtermitt. 7, 7-26, 1976).

The Fats and Proteins Research Foundation is supporting a study by Dr. Kronfeld which has tested an hypothesis advanced in the above articles. This proposes that dairy cows produce milk in an amount depending mainly on the amount of glucose taken up by the mammary gland. That in turn is influenced by the composition of the diet; high protein and high grain diets generate more glucose and promote milk production. The secretion of milk creates a demand for precursors of milk fat.

of metabolizable energy as fat. The control ration was corn silage supplemented to meet National Research Council recommendations with a corn and soy bean meal concentrate. The test ration had 1/3rd of this concentrate replaced by HE.

The cows fed HE showed the following advantages: milk fat production was 12% higher, metabolic efficiency of lactation was 8 or 13% higher (depending on certain assumptions in calculations) and plasma concentrations of glucose were higher while ketones were lower. No differences between groups were indicated in 11 other tests on blood, or in calving to conception intervals. Milk protein content declined during the first 14 weeks of HE feeding and then rose above controls.

The original plan was to feed HE for only the first 4 months of lactation. A second study for 4 months yielded results which confirmed the most important features of the first trials: milk fat production was increased by 28%, and milk protein content declined for 14 weeks then exceeded controls at 16 weeks. A comparable 15 week study in California (Smith, personal communication) showed a 29% gain in milk fat production through feeding protected tallow as 30% of the ration. There seems to be no doubt about the effectiveness of feeding protected fat for the first four months of lactation.

As reviewed in Kronfeld's article cited above, the potential metabolic advantages of feeding protected fat to dairy cows should lie in the rising and peak phases of lactation. The "fat cow syndrome" is a hazard in feeding a high energy diet during the declining phase of lactation, especially the final 3 months. After 16 weeks, the cows were moved from individual stanchions to group feeding. Daily milk production dropped below 20 lbs. in individual cows from 1 to 17 weeks after this changeover. This shortening of lactation occurred in the control cows as well as those fed HE. There were several experimental conditions which could have contributed to the shortening of lactation: the psychic stress of competitive feeding following 16 weeks of individual feeding, a heat wave which struck just at the time the change was made, and a restriction of feed intake which reduced protein to just below the NRC-recommended minimum. So the shortening of lactation was not attributed to HE feeding.

In a California study, cows fed a protected oil supplement also had shortened lactations. The authors (Yang & Baldwin, paper in press) compared this shortened lactation with the duration of previous lactation of each cow, then concluded that feeding