Evaluation of seal meal as a protein supplement for growing steers

E. Charmley[1] and E. O'Reilly[2]

[1]Research Farm, Agriculture and Agri-Food Canada, Nappan, Nova Scotia, Canada B0L 1C0; [2]Department of Fisheries, Food and Agriculture, Provincial Agriculture Building, P.O. Box 8700, St. John's, Newfoundland, Canada A1B 4J6. Received 11 March 1997, accepted 9 July 1997.

Charmley, E. and O'Reilly, E. 1997. **Evaluation of seal meal as a protein supplement for growing steers**. Can. J. Anim. Sci. **77**: 529–531. This experiment evaluated the suitability of dried seal meal (SM) as a protein supplement for growing steers. Protein in the SM had an effective degradability of 65% and a slow degradation rate in the rumen. There was a positive quadratic growth response to replacing soybean meal (SBM) with SM ($P < 0.05$). We attribute this response to optimized concentrations of fat and metabolizable protein supplied by the SM/SBM mixtures. We conclude that SM is a beneficial protein source for growing steers when combined with SBM.

Key words: Growing steer, seal, protein supplement, silage

Charmley, E. et O'Reilly, E. 1997. **Évaluation de la farine de phoque comme complément protéique dans l'alimentation des bouvillons en croissance**. Can. J. Anim. Sci. **77**: 529–531. Nos expériences portaient sur la valeur de la farine de phoque (FPh) séchée comme complément protéique pour les bouvillons en croissance. Le taux de dégradabilité effective des protéines de la farine dans le rumen était de 65 %, mais il était de plus lent par comparaison à celui du tourteau de soja. La substitution de la FPh au tourteau de soja a généré une réponse quadratique positive ($P < 0{,}05$) pour la croissance. Cette réponse s'expliquerait par l'optimisation des concentrations de graisse et de protéines métabolisables fournies par l'association FPh/TS. La FPh apparaît donc comme une bonne source de protéines pour les bouvillons en croissance lorsqu'elle est associés au tourteau de soja.

Mots clés: Bouvillons en croissance, phoque, complément protéique, ensilage

Seal meal represents a potentially abundant protein by-product of the Newfoundland sealing industry. Research with dairy cows demonstrates that intake of DM as well as production of milk progressively decline as the proportion of SM in the diet increases to 5.7% of dry matter intake (DMI) (Robinson 1993/1994). In eastern Canada, silage is commonly fed to growing cattle. However, a diet consisting solely of silage can limit animal performance due to poor protein utilization (Veira et al. 1994). Any feeding regime that maximizes use of locally produced feeds is usually most cost-effective, provided animal performance is not compromised. Seal meal, containing approximately 65% CP and 14% fat, could become an important protein supplement for livestock in Atlantic Canada.

The objectives of this study were to compare SM with a commonly available protein source, SBM, and to determine the optimum level of SM in the diet of growing beef steers fed silage.

Seal meal was prepared from eviscerated seal carcasses with the pelt, subcutaneous fat, hind flipper and hand portion of the front flipper removed. Carcasses were ground and cooked in fat at 124°C for 3–4 h. Since seal meat contains 7 to 14% fat, it was necessary to add chicken tallow to aid cooking. Free-running fat was removed after cooking. The remaining solid material was extruded through a dye press to remove further fat and moisture, then sieved to form a dry meal. Delquin 50, an antioxidant, was added to the meal at a rate of 0.5 kg t^{-1} meal.

Forty-eight steers (initial BW 264 kg, standard error of the mean 14.9) were selected for a 10-wk growth trial. Steers were housed in tie-stalls for 4 wk prior to the start of the trial for adaptation to their housing and the silage diet. At the start of the trial, steers were blocked according to BW and six dietary treatments were randomly assigned within each block. All steers were fed the same annual ryegrass-timothy silage mixture ad libitum, which was combined in a 40:60 ratio on a DM basis. The treatments were: silage alone (Control), silage plus protein supplement comprised 300 g d^{-1} SM (SM100), 200 g d^{-1} SM + 126 g d^{-1} SBM (SM67), 100 g d^{-1} SM + 254 g d^{-1} SBM (SM33), 380 g d^{-1} SBM (SM0), or 380 g d^{-1} SBM + 60 g d^{-1} calcium salts of fatty acids derived from palm oil (SBM + CSFA). The fat concentration of the latter supplement (157 g kg^{-1} DM) was formulated to have similar fat content to that of SM100. The fat concentration of the SM 100, SM 67, SM 33, SM 0 were 195, 135 and 74 g kg^{-1} DM, respectively. All supplemented diets were formulated to be isonitrogenous at 210 g CP kg^{-1}

Abbreviations: **ADF**, acid detergent fibre; **BW**, body weight; **CP**, crude protein; **DM**, dry matter; **DMI**, dry matter intake; **NDF**, neutral detergent fibre; **SBM**, soybean meal; **SBM + CSFA,** SBM + calcium salts of fatty acids, **SM**, seal meal; **SM0**, 380 g d^{-1} SBM; **SM33**, 100 g d^{-1} SM + 254 g d^{-1} SBM; **SM67**, 200 g d^{-1} SM + 126 g d^{-1} SBM; **SM100**, 300 g d^{-1} SM

DM. A mineral supplement containing (g kg^{-1}) dicalcium phosphate, 199; magnesium sulphate, 400; cobalt-iodized salt, 199; calcium carbonate, 199; copper sulphate, 3; and (mg kg^{-1}) selenium, 8, was fed at 100 g d^{-1}. Silage was fed once daily in the morning and offered to allow 5% weighback, which was recorded and removed daily. Supplements and mineral were top-dressed on the silage shortly after silage had been given. Steers were weighed every 2 wk throughout the trial. Weighing was conducted before feeding, and water was withheld for 16 h prior to weighing. Samples of feed offered were taken daily and composited over 14 d. Samples of feed refused were taken weekly and combined into two weekly composite samples.

Two canulated cows fed timothy hay were used to determine in situ degradability of CP in the dietary supplements. Duplicate nylon bags (pore size 50 µm), containing unground samples of the dietary supplements, were inserted into the rumen and incubated for 0.1, 1, 3, 6, 8, 24 and 48 h. The method of Charmley et al. (1994) was followed. Both steers and cows were cared for in accordance with the guidelines of the Canadian Council on Animal Care.

Fresh silage was analysed as described by Charmley et al. (1996) except that DM was determined by oven drying at 50°C for 48 h and corrected by drying at 105°C. Dry matter was not corrected for volatile components.

The steer data were analysed by ANOVA using Genstat 5 (Genstat 5 Committee 1993) as a randomized complete block design with weight class as blocks and dietary supplements as treatments. The response curve, regressed on the level of SM in the protein supplement, was tested for linear and quadratic effects. In addition, orthogonal contrasts were used to assess the effects of protein supplementation per se (Control vs. SM100, SM67, SM33 and SM0) and the effect of fat source (SM100 vs. SBM + CSFA). Statistical tests were conducted at 5% significance probability.

The SM used in this study contained 35% more fat (195 g kg^{-1} DM) and 4% more CP (670 g kg^{-1} DM) than has been reported in the literature (Pound 1993/1994). This was offset by a lower ash value (153 g kg^{-1} DM). The timothy silage was well preserved with a low pH (4.80) and relatively restricted fermentation. The ryegrass silage was wetter than timothy (234 g DM kg^{-1} versus 345 g DM kg^{-1}) and had a more extensive fermentation with a high proportion of butyric acid (6.36 g kg^{-1} DM). The CP concentration of ryegrass was high at almost 24%, but the proportion of insoluble protein was low. The DM of the silage mixture fed averaged 300 g kg^{-1} and contained 172 g CP, 351 g ADF, 510 g NDF and 46 g fermentation acids per kilogram of DM. The pH averaged 4.15 and trichloroacetic acid insoluble N accounted for 237 g kg^{-1} total N.

Seal meal was fed at levels up to 300 g d^{-1} which represented about 5% of DM intake, and was readily consumed without adversely affecting silage intake.

Degradability characteristics of SM DM differed from that of SBM in that the slowly degraded fraction was only 26.5% compared with 60% for SBM. Fractional degradation rate of DM was much slower for SM (0.08 h^{-1}) than SBM (0.18 h^{-1}). The nitrogen in SM had a higher rapidly degraded fraction (45 vs. 23%), a lower slowly degraded fraction (31 vs. 73%) and a lower degradation rate (0.09 vs. 0.27 h^{-1}) than SBM. Effective degradability of SM (outflow rate of 5% h^{-1}) was 65% as compared with 85% for SBM. The cooking conditions used for the preparation of SM may have contributed to the lower effective degradability as a consequence of Maillard-type reactions. Twenty-five percent of N in SM remained undegraded after 48 h incubation in nylon bags. These protein degradability characteristics indicate that SM is an intermediary source of undegraded protein similar to heat-treated plant proteins, although the degraded fraction has a markedly different degradation pattern. Seal meal should have been an excellent supplement to a silage-based diet, supplying not only ruminally available amino acids for microbial metabolism over a sustained period, but also contributing to the undegraded protein supply. Both protein types are limiting in silages and thus a response to CP supplements is seen even with high CP silages (Veira et al. 1994).

A positive quadratic response in rate of gain as the proportion of SM in the supplement increased was observed (Table 1). As a consequence of numerically lower intakes and higher gains in steers fed diets containing mixtures of both protein supplements, there was a trend towards a negative quadratic effect on feed to gain ratio ($P = 0.09$).

Dry matter intake when silage was fed alone was 20.8 g kg^{-1} BW and was not influenced when supplements were added to the diet nor was there an effect on BW gain (Table 1). When silage was fed without supplements, steers gained 0.69 kg d^{-1}. Rates of gain were similar for steers fed SM100 and those fed SBM + CSFA, a supplement formulated to be similar in CP and fat concentration. Performance from both diets containing fat was poor, relative to other treatments.

The response to supplemental protein was less than expected according to Agricultural and Food Research Council (1993), especially for diets containing the highest inclusion of fat (SM100 and SBM + CSFA), where the gain was only 84% of predicted. Thus we conclude that the dietary fat probably reduced apparent digestibility of diets containing these supplements. Ample evidence exists to support this theory (Palmquist and Jenkins 1980). Since the fat was added to the seal meat in processing, it is probable that SM could be prepared with less added fat.

The quadratic response in gain and feed:gain ratio to SM inclusion may be attributed to an antagonistic action between fat and protein supply. As SBM replaced SM there was a linear decline in metabolizable protein (Agricultural and Food Research Council 1993) calculated from the degradability characteristics of the two protein sources. However, at the higher rates of SM inclusion, the high concentration of fat may have reduced digestibility and therefore negated any benefits due to the additional metabolizable protein from these diets. At intermediate inclusion rates of SM, we speculate that the effect of fat was minimized and a response to protein was observed. At the lowest rate of SM inclusion, fat clearly had no negative impact; however, growth was restricted by reduced metabolizable protein supply. We conclude that SM has good

Table 1. Effect of substituting SM for SBM or SBM + CSFA on growth and intake of steers

Dietary supplement	DM intake (kg d^{-1})	DM intake (g kg^{-1} BW)	BW gain (kg d^{-1})	Feed:gain
Control (silage alone)	6.30	20.8	0.69	8.56
SBM + CSFA	6.47	21.5	0.67	9.38
SM (100%) + SBM (0%)	6.63	21.9	0.69	8.93
SM (67%) + SBM 33%)	6.59	21.7	0.77	8.33
SM (33%) + SBM (67%)	6.12	20.2	0.76	7.37
SM (0%) + SBM (100%)	6.61	22.4	0.73	8.56
SEM	0.19	0.71	0.03	0.40
Contrasts	*Significance probability of contrast*			
Control vs. suppl.	0.37	0.40	0.27	0.95
SBM + CSFA vs. SM100	0.53	0.89	0.17	0.05
SM – linear	0.53	0.99	0.35	0.34
SM – quadratic	0.18	0.12	0.02	0.086

degradability characteristics; however, the high fat concentration may have reduced any response to protein possibly because of a depressing effect on diet digestibility.

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