Table 1. Variance components of percent labeled cells for bead and bacteria phagocytosis assays.

Source of variation	Variance[z]		P-value[y]	
	Bead	Bacteria	Bead	Bacteria
Day	1.5±5.3	13.2±25.1	0.3902	0.2999
Calf	23.2±10.4	96.4±32.2	0.0130	0.0014
Sampling	41.8±7.6	63.5±11.6	0.0001	0.0001

[z]Each value is the variance estimate ± standard error.
[y]P-value of the Z-test of the hypothesis that the variance=0 .

We conclude from this study that the labeled bacteria assay is more representative of the physiologic response of the animal, and therefore a more sensitive indicator of phagocytic cell activity in the animal. Applications of this technique versus the bead assay would include animal selection based on cell function as a predictor of performance or nutrient or drug studies to measure cell response during an inflammatory process.

Evaluation of Nitric Oxide Production by Bovine Alveolar Macrophages

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Introduction

Expression of inducible nitric oxide synthase (iNOS) and production of nitric oxide (NO·) is a key defensive response of rodent macrophages against taxonomically diverse infectious agents *in vitro* and *in vivo*.[1,4] Bovine alveolar macrophages (bAM) express iNOS in response to stimuli known to be present in pneumonic lung, but the role of NO· production in infectious pneumonia of cattle remains unknown.[2,3,4] This work was designed to: i) evaluate the microbicidal activity of NO· against *P. haemolytica* A1, ii) determine if virus infection of bAM alters subsequent NO· production, and iii) determine if activation of bAM for NO· production alters macrophage permissiveness for subsequent viral infection.

Materials and Methods

IFN-γ and endotoxin were used to activate bAM. NO· production and cell viability were measured by the Greiss reaction and MTT assays, respectively. Bacterial killing and viral titers were measured by limiting dilutional analysis. Killing of *P. haemolytica* was measured after exposure to reactive nitrogen oxides (RNO) generated by S-Nitroso-N-acetyl-D,L-penicillamine (SNAP) and 3-mopholinosydnonimine (SIN-1) or activated macrophages. NO· production and cell viability was measured in macrophages infected with cytopathic bovine virus diarrhea virus (BVD), bovine herpes virus type 1 (BHV) and parainfluenza type 3 (PI3). Macrophages activated for NO· production were subsequently infected with these viruses, and viral titers measured after an additional 48 hours in culture.

Results and Conclusions

Chemically-generated RNO kill *P. haemolytica* in a dose-dependent fashion. bAM kill leukotoxin-deficient *P. haemolytica*, but prior stimulation for NO· production abrogates this effect. BHV and BVD infection depresses NO· by affecting bAM viability. PI3 depresses NO· production, apparently by altering bAM function. Prior stimulation of bAM for NO· production did not affect the

replicative ability of these viruses. The role and significance of NO· production by bovine alveolar macrophages in infectious pneumonia remains speculative.

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Association Between Ration Protein and Economic Efficiency of Milk Production on Ontario Dairy Farms

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Introduction

An investigation of the association between the protein content of the ration and the economic efficiency of milk production indicates that increasing forage protein on Ontario dairy farms increases the daily milk income minus feed costs (IMFC).

Materials and Methods

Milk production data were collected monthly on 59 Ontario dairy farms, from August 1995 to December 1996. Total amounts of forage (corn silage, haylage, hay and pasture) and concentrate (grains, mineral and protein supplements) fed to lactating cows, and forage analyses, were recorded. Milk production and daily milk income minus feed costs (IMFC) were initially analyzed by herd-month, and then at the herd level by averaging variables across months within herd.

Mean herd size was 58 (±35) milking cows. On average, each cow was fed 4 kgs of protein daily, with 60% coming from protein supplements. Monthly ration composition remained fairly constant, with a slight decrease in the dry matter intake (DMI) and protein intake during the months of June through September.

Results, Discussion and Conclusion

In analyzing the herd-month data, a repeated measures approach was used to adjust for the correlation within herd, with milk production (MILKPROD) and IMFC as outcomes. In the final model, protein from haylage, grain and supplements all had a significant curvilinear relationship with IMFC. An increase in haylage protein, however, would have to be accompanied by a decrease in the supplemental protein to achieve a higher IMFC. Herd effect accounted for 60% of variation in the model. If total protein intake was held constant at the optimal average of 4 kgs, the maximum for IMFC was achieved with a lower level of forage protein than was required to maximize MILKPROD.

Because of the large herd effect, a herd-level model was created. Protein from haylage and corn silage were the two significant (linear) factors in modeling both IMFC and MILKPROD. An increase in haylage and/or corn silage served to increase both IMFC and MILKPROD, with subsequent decreases in feed costs per cow.

Since there are obvious herd-level as well as within herd associations between protein source and economic efficiency, the results from both levels of analyses must be considered when making recommendations to dairy producers.