Production of Microbial Long Chain Fatty Acids in the Rumen of Defaunated and Refaunated Sheep

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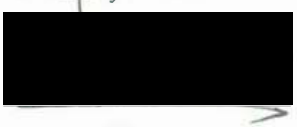
Preface

The study presented in this thesis was completed by the author whilst a postgraduate student in the Department of Animal Science at the University of New England, Armidale, NSW, Australia. Any assistance received is acknowledged in the acknowledgements. All references cited are included in the bibliography. The work is otherwise original.

I certify that the substance of this thesis has not already been submitted for any degree and is not currently being submitted for any other degree.

I certify that, to the best of my knowledge, any help received in preparing this thesis, and all sources used, have been acknowledged in this thesis.

February, 1997



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Summary

Little is known of the synthesis of long chain fatty acids (LCFA) in the rumen, so this study sought to establish benchmark data on the rumen environments and LCFA outflow from the rumen of defaunated and refaunated sheep.

- The percentages of dietary dry matter apparently and truly digested in the rumen were higher in defaunated animals than in refaunated animals ($P < 0.05$ and < 0.1, respectively). This was in spite of defaunated sheep tending to have a lower ruminal ammonia concentration than refaunated sheep ($P = 0.07$), indicating that the concentration of ruminal ammonia was not a limiting factor in terms of dry matter digestion in defaunated sheep in this study. The higher ammonia concentration in refaunated animals probably reflects extensive degradation of dietary protein and bacteria by protozoa and the fact that protozoa do not utilise ammonia. The increased digestibility in the rumen of defaunated sheep might be a result of higher numbers and activities of bacteria and fungi.

- The ruminal volume of defaunated sheep was significantly larger ($P < 0.05$) than that of refaunated sheep, but there was no significant difference in rumen liquid outflow (l/d) or $t_{1/2}$ (min) between defaunated and refaunated sheep.

- The concentration of total VFA in ruminal fluid was not significantly altered by defaunation status. This suggested that total VFA production was unaffected by protozoa and this was confirmed by infusion of 1-^{14}C-acetate. There was no difference in pH between the two groups of sheep.

- The difference in molar proportion of individual VFA observed between defaunated and faunated animals can not solely be attributed to the effect of protozoa *per se*, but also to the composition of microbes present. In this study, the proportion of acetate and acetate:propionate ratio were significantly higher in defaunated animals than in refaunated ones. The molar proportion of propionate, however, was lower in defaunated animals.

- Methionine supplementation and the presence or absence of protozoa did not affect the calculated flow of microbia to the abomasum based on the urinary allantoin excretion or the efficiency of microbial growth expressed as g cells/kg dry matter apparently digested in the rumen.

- The daily flow of dry matter through the abomasum was higher in refaunated animals, despite the lower liquid outflow rate in these sheep. It may be that the higher dry matter flow flow in refaunated sheep is was associated with a greater population of particle-phase bacteria.

- The concentration of LCFA in total abomasal digesta dry matter was not affected by the presence or absence of protozoa in the rumen. However, the concentration of LCFA in particle-digesta dry matter, the ruminal production and daily flow of LCFA, were significantly higher in refaunated than in defaunated animals. This suggested that the protozoal contribution to post ruminal digesta concentration and flow of LCFA was important. The greater flow and greater concentration of LCFA in particle-digesta dry matter of refaunated animals may partly be attributed to the contribution of particle-phase bacteria.

- Methionine supplementation did not alter the concentration of LCFA in digesta, but significantly reduced the flow of LCFA to the abomasum.