RADIO-IMMUNOASSAYS OF ANABOLIC HORMONES IN YOUNG RUMINANTS

A thesis presented in partial
fulfilment of the requirements for
the Degree of Doctor of Philosophy
in Animal Science at
Massey University

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1978

ABSTRACT

Four experiments with young calves and one with ewes and lambs are described, all of which involved taking blood samples via a jugular catheter. Plasma samples were all assayed for insulin and growth hormone by radio-immunoassays. In Experiments 1 - 4, prolactin assays were also carried out, and results of plasma glucose assays were presented for Experiments 2 - 4.

In Experiments 1 and 5, the effect of suckling on starved calves and lambs was investigated. Insulin rose from <1 ng/ml to 2 - 7 ng/ml after suckling. Growth hormone and prolactin did not change systematically in any way after suckling in calves, but lambs' growth hormone levels increased from <2 ng/ml to >10 ng/ml at the onset of suckling, as did the GH levels in plasma of their dams.

In Experiments 2 and 4, the effect of changing plasma energy substrate levels was investigated in calves. In Experiment 2, it was observed that a 30-second jugular infusion of either volatile fatty acids in an equimolecular mixture of acetate, propionate and butyrate, or glucose (both administered at 1.25 mM per kg body weight (bw)) resulted in a variable, but significant increase in insulin levels, but had no effect on growth hormone or prolactin. The results of 1.4 mM per kg bw glucose administration in Experiment 4, confirmed those of Experiment 2. Administration of 0.75 U per kg bw of protamine zinc insulin resulted in a prolonged hypoglycaemia, which was achieved more slowly in five-week-old calves than in week-old calves. Growth hormone and prolactin levels did not respond

immediately to insulin administration, but after hypoglycaemia had been maintained for 2 - 3 hours, growth hormone levels decreased from 4 - 8 ng/ml to <3 ng/ml in calves of both one week and five weeks of age, and prolactin levels increased slightly.

The effect of a 30-second infusion of 0.3 g per kg bw arginine on calves was tested in Experiment 3, and significant increases in all plasma measurements except growth hormone were observed. Increases of both insulin and glucose were higher in five-week-old milk-fed calves than they were in week-old calves or in five-week-old ruminant calves, and in all calves the glucose increase was quickly followed by a decrease in glucose levels to a deep hypoglycaemia. The prolactin response was smaller and more prolonged in week-old calves than in the older calves. Saline which was infused in an equi-osmolar solution to arginine, resulted in decreases in both growth hormone and prolactin. The results of Experiment 3 are contrasted with those of Experiment 5, in which a 0.5 g per kg bw arginine dose was infused over a 30-minute period into ewes and lambs. The insulin responses were smaller than those of calves, but the growth hormone levels increased significantly from <2 ng/ml to >4 ng/ml.

In addition to the experimental results described above, radio-immunoassays were described in detail, because all work utilised antibodies raised by the author during the course of study.

PREFACE

Plasma levels of insulin, growth hormone and prolactin have been measured in calves and lambs, with special reference to the change in energy substrate metabolism which occurs as a result of the transition from pre-ruminant to the ruminant mode of digestion. Whereas lambs' plasma hormone levels have been extensively studied in this respect, the literature contains very few references to those of young calves. Thus it was of interest to compare and contrast results obtained with calves and lambs, but to concentrate four out of the five experiments on calves.

Changes in plasma levels of the hormones and of glucose were measured in response to several acute stimuli, chosen for their significance either in relation to energy substrate metabolism, or the anabolic functions of the three hormones under investigation. The stimuli tested were as follows:

(i) The effect of suckling

(ii) The effect of rapid infusions of

- (a) Glucose
- (b) Volatile fatty acid mixture
- (c) Insulin
- (d) Arginine

ACKNOWLEDGEMENTS

I am indebted to my supervisors, Professor D.S. Flux and Dr. R.W. Purchas, for their invaluable guidance and encouragement.

I should also like to thank the following: Dr. D.D.S. Mackenzie for helpful discussion and advice.

Dr. J.M. Gooden for inviting and supporting my collaboration with his work with ewes and lambs.

Dr. R.M. Greenway for helpful advice and also for assistance with setting up the glucose assay.

Professor R.E. Munford, Dr. P.R. Wilson and Mr. G.C. Arnold for help with the computer analysis of radioimmunoassay data and discussion about statistical treatment of results.

The staff of the Animal Production Unit, especially Mr. L. Robertson, and also of the Small Animal Production Unit, especially Mr. J.E. Ormsby.

Finally, the staff of the Dairy Husbandry Department have all helped in countless ways, giving me advice and support throughout every stage of this study.

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