EFFECTS OF *OSTERTAGIA CIRCUMCINCTA* LARVAE AND ADULT PARASITES ON ABOMASAL AND INTESTINAL TISSUES IN SHEEP

A thesis presented in partial fulfilment of the
requirements for the degree of
MASTER OF SCIENCE
in Physiology
at Massey University

SUZANNE MARIE HODGKINSON
1994

ABSTRACT

Ostertagia circumcincta parasites infect the abomasum of sheep causing damage to the abomasal tissues and significant production losses to the sheep farming industry. Ingested larvae enter the gastric glands and emerge as adults which live in the abomasal lumen. The effect of adult parasites on the abomasum has not been systematically investigated. In the present study, sheep raised to be free of helminth parasites were given either adult *O. circumcincta* parasites *via* an abomasal cannula or larvae *per os*.

Adult as well as larval *O. circumcincta* parasites stimulate hypergastrinaemia, a decreased abomasal pH and elevated serum pepsinogen concentrations. While the concentration of G cells did not change in the larval parasite infected sheep compared with the non-infected control sheep, the total number of G cells was increased due to an increase in mucosal thickness. There appeared to be fewer G cells present in the adult parasite infected sheep compared with the non-infected control sheep, which was most likely due to a depletion of their gastrin content due to overstimulation. The hypergastrinaemia observed during ostertagiasis is not due to a change in the ratio of G:D cells.

The lumen dwelling adult *O. circumcincta* affect the mucosa of the abomasum resulting in an apparent inflammatory reaction, demonstrated by the presence of eosinophils and neutrophils in the lamina propria. Mucous production and/or secretion is also affected, shown by the presence of large mucus-secreting cells in the mucosa.

The total wet weight of the abomasum/kg body weight is increased in sheep infected with *O. circumcincta*, with an increase in the total size of the abomasum. The larval parasites evoke a hyperplasia in both the antral and body mucosae with little change in cell size. In sheep infected with adult parasites, the thickness of the abomasal mucosa is increased in the body, but not the antrum. This increase is most likely due to hypertrophy.

Either the larval *O. circumcincta* or the hypergastrinaemia have trophic effects on the upper duodenum, with an increased mucosal thickness which did not occur more

distally. This did not occur in the adult parasite infected sheep.

The larval parasites or hypergastrinaemia provoked a hyperplasia in the jejunal mucosa. This did not occur in the adult infected sheep.

The larvae and adult parasites did not appear to exert a hypertrophic or hyperplastic effect on the ileum, caecum or colon.

These results indicate that adult *O. circumcincta* parasites have substantial effects on the ovine abomasum.

ACKNOWLEDGEMENTS

I am especially grateful to my supervisor Dr G.W. Reynolds for his continued support, guidance and help throughout this project.

I also wish to thank Dr H.V. Simpson for many helpful discussions, and the entire staff of the Department of Physiology and Anatomy for all their help.

Thanks also to Mr D.E.B. Lawton for help with the sheep and for providing the parasitology, gastrin and pepsinogen data, and to Ms N. Schwarzer for doing the immunocytochemical staining with the gastrin and somatostatin antisera.

Thanks to Mr M.J. Birtles, Mr W.E. Pomroy and Dr W.A.G. Charleston for expert advice, Ms D.J. Anthony for technical assistance with the sheep and Mr R.I. Sparksman for help with histological techniques and the photomicrographs.

I am very grateful to the C. Alma Baker Trust who provided the funding for this project.

Finally, special gratitude to my family, fellow postgraduates and friends for all of their support and encouragement, particularly Natalie Petrie, Mark Foreman, Andrew Dinness and John Williamson.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

LIST OF ABBREVIATIONS

Abbreviation		
@	=	at
A cell	=	glucagon containing cells
API	=	adult parasite infected
BSA	=	bovine serum albumen
°C	=	degrees Celcius
CCK	=	cholecystokinin
D cell	=	somatostatin containing cell
DAB	=	diaminobenzidine
DNA	=	deoxyribonucleic acid
EC cell	=	enterochromaffin cell
ECL cell	=	enterochromaffin-like cell
EGF	=	epidermal growth factor
ED	=	external diameter
e.p.g.	=	eggs per gramme
g	=	grammes
g	=	gravity
G cell	=	gastrin containing cell
GRP	=	gastrin releasing peptide
H. contortus	=	*Haemonchus contortus*
hr	=	hour
HCl	=	hydrochloric acid
ID	=	internal diameter
IGF	=	insulin growth factor
kg	=	kilogramme
L	=	litre
LPI	=	larval parasite infected
m	=	metres
min	=	minute
mm	=	millimetres
mm^2	=	square millimetres
mmol	=	millimoles
mol	=	moles
mRNA	=	messenger RNA
n	=	number
N	=	normality
Na_2CO_3	=	sodium carbonate
nm	=	nanometres
N.Z.	=	New Zealand
OD	=	optical density
O. circumcincta	=	*Ostertagia circumcincta*
/	=	per
%	=	percent
P	=	probability
PLP	=	phosphate-lysine-periodate
pmol	=	picamoles
RNA	=	ribonucleic acid

rRNA	=	ribosomal RNA
PBS	=	phosphate buffered saline
PLSD	=	probability of least significant difference
tRNA	=	transfer RNA
s.e.	=	standard error
SE	=	secretory-excretory
SOD	=	super oxide dismutase
µg	=	microgrammes
µm	=	micromoles
VFAs	=	volatile fatty acids

ANIMAL ETHICS

The protocols for the experiments described in this thesis have been approved by the Massey University Animal Ethics Committee.