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**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
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in Physiology
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**SUZANNE MARIE HODGKINSON
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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.

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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 |
| <i>H. contortus</i> | = | <i>Haemonchus contortus</i> |
| 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 ₂ CO ₃ | = | sodium carbonate |
| nm | = | nanometres |
| N.Z. | = | New Zealand |
| OD | = | optical density |
| <i>O. circumcincta</i> | = | <i>Ostertagia circumcincta</i> |
| / | = | 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.