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ABSTRACT

Ovarian cysts are a cause of reproductive failure and economic loss in postpartum dairy cows. Using a unique combination of research to approach this problem, this thesis aimed to better understand mechanisms of ovarian cyst formation.

The use of progesterone as a tool in cyst diagnosis was initially examined. Results demonstrated that 13/30 (43%) cows had progesterone profiles that disagreed with veterinarian diagnosis. Furthermore treatment in 21/30 (70%) cows was ineffective within 4 weeks of administration, and no pregnancy was established earlier than 8 weeks post treatment in all cows. When veterinarian and hormonal diagnosis agreed pregnancy was achieved, on average, two weeks earlier than when they disagreed.

Effects of cow management, specifically the NEB experienced during late gestation and early lactation were investigated to determine whether these increased requirements resulted in the development of ovarian cysts. Results demonstrated that from early lactation all 85 cows were in a state of NEB. Ovarian cysts were confirmed in 31/79 cows, and these cows had significantly higher or lower peripheral concentrations of some metabolites, *vs.* no-cyst cows.

Long term down-regulation with a GnRH agonist, followed by a period of observation to monitor the recovery of reproductive function, was conducted for evaluation as a potential model for ovarian cyst formation. Results indicated that 6/12 cows exhibited an LH surge within 104 hours of luteal regression while 6 animals did not ($P < 0.001$). FSH concentrations in 6/12 cows showed divergence comparable with LH surges. 8/12 had at least 1 follicle > 8 mm and 5/12 had at least 1 follicle > 20 mm. Follicle appearance was heterogeneous, with 63% of follicles showing some degree of luteinisation. Positive immunostaining for steroidogenic enzymes was detected in 12.5% of follicles.

In conclusion, these results have important clinical significance in improving the diagnosis and management of ovarian cysts in dairy cows.

PUBLICATIONS ARISING FROM THIS THESIS

JACKSON, R.A., WILLS, J.R., KENDALL, N.R., GREEN, M.J., MURRAY, R.D., DOBSON, H. 2011. Energy metabolites in pre- and postpartum dairy cattle as predictors of reproductive disorders. *Veterinary Record*. 168: 562-567

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LIST OF ABBREVIATIONS

| | |
|----------------|--|
| 3 β -HSD | 3 β -hydroxy-steroid dehydrogenase |
| A4 | androstenedione |
| AB | avitin-biotin |
| AC | adenylate cyclase |
| ACTH | adrenocorticotrophic hormone |
| ANOVA | analysis of variance |
| AP | anterior pituitary |
| AST | aspartate transaminase |
| BCS | body condition score |
| bFGF | basic fibroblast growth factor |
| BHB | beta-hydroxy butyrate |
| BMP | bone morphogenetic protein |
| BSA | bovine serum albumin |
| cAMP | cyclic adenosine monophosphate |
| CCI | calving to conception interval |
| CL | corpus luteum/corpora lutea |
| COC | cumulus oophorus complex |
| CPM | counts per minute |
| CV | coefficient of variance |
| d | day |
| DAB | 3,3'-diaminobenzidine |
| DF | dominant follicle |
| DMI | dry matter intake |
| E2 | oestradiol |
| EDTA | ethylenediaminetetraacetic acid |
| EGF | epidermal growth factor |
| ELISA | enzyme-linked immuno-sorbent assay |
| FC | follicular cyst |
| FME | fermentable metabolisable energy |
| FSH | follicle stimulating hormone |
| FSHr | follicle stimulating hormone receptor |
| G _s | stimulatory G protein |
| GC | granulosa cell |
| GDF | growth differentiation factor |
| GGT | γ glutamyl transpeptidase |
| GnRH | gonadotropin releasing hormone |
| h | hour |
| HGF | hepatocyte growth factor |
| HPO | hypothalamo-pituitary-ovarian |
| HRP | horseradish peroxidase |
| IGF | insulin-like growth factor |

| | |
|---------------|--|
| IGFBP | insulin-like growth factor binding protein |
| IL | interleukin |
| im | intramuscular |
| IHC | immunohistochemistry |
| IU | international units |
| IVD | intra-vaginal device |
| KGF | keratinocyte growth factor |
| KL | kit ligand |
| l | litre |
| LC | luteal cyst |
| LDL | low density lipoprotein |
| LH | luteinising hormone |
| LHr | luteinising hormone receptor |
| mins | minutes |
| ml | millilitres |
| mmol | millimole |
| MMP | matrix metalloproteinase |
| mRNA | messenger ribonucleic acid |
| NEB | negative energy balance |
| NEFA | non-esterified fatty acid |
| ng | nanograms |
| NS | no-surge |
| NSB | non-specific binding |
| oFSH | ovine FSH |
| oLH | ovine LH |
| O | ovary |
| P4 | progesterone |
| PAPP-A | pregnancy associated plasma protein A |
| PBS | phosphate buffered saline |
| PEG | polyethylene glycol |
| PG | prostaglandin |
| pg | picograms |
| PGF2 α | prostaglandin F 2 alpha |
| PKA | protein kinase A |
| POF | pre-ovulatory follicle |
| QC | quality control |
| RIA | radioimmunoassay |
| RF | ruptured follicle |
| S | surge |
| SEM | standard error of the mean |
| StAR | steroidogenic acute regulatory protein |
| STD | standard |
| TC | theca cell |
| TC | total count |

| | |
|------|------------------------------|
| TB | total bound |
| TGF | transforming growth factor |
| TMB | tetramethylbenzidine |
| TNF | tumour necrosis factor |
| TP | total protein |
| VLDL | very low density lipoprotein |
| μl | microlitres |