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 >8mm 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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3β-HSD	3β-hydroxy-steroid dehydrogenase
A4	androstenedione
AB	avitin-biotin
AC	adenylate cyclase
ACTH	adrenocorticotropic 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_8	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
PGF2α	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