

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

ACKNOWLEDGEMENTS

I would like to start by thanking my supervisors Dr Nigel Kendall, Dr Richard Lea, Dr George Mann and Prof Bruce Campbell. Thanks also go to Dr Bob Robinson and Prof Clare Wathes for giving me the opportunity to complete this project. Thanks go to Mrs Catherine Pincott-Allen for, not only, the countless hours we spent getting those RIAs right despite sweltering temperatures in the lab, but also for your friendship and support. Thanks to Mrs Morag Hunter and to Juan Hernandez for your technical assistance, time, friendship and guidance in the lab. I would also like to thank the vets; Mark Burnell, Julian Allen and Rachel Hayton, particularly Mark, for their support in recruiting farmers onto my trials. My PhD experience would not have been the same without one whole year of early morning farm visits to Joe, Paul, Arthur and Michael who, despite the trial over running by 6 months, never complained once. I would like to thank Dawn from JF Cobb and Sons, for her diligent collection and labelling of hundreds of milk samples and her continued support and belief in my project, as well as Dawn, thanks go to all the other farmers that also participated in this study to make it a success. I would also like to thank Jaime Hughes for her support and friendship from the very beginning of my project, you never turned me away when I had a question, I enjoyed our stolen chats in the corridor and I will never stop laughing at some of things you said to me! Furthermore, thanks to Leanne Williams and Sarah Potterton for your support during these difficult last few months.

Most importantly, I would like to thank my Mum and Dad, and my brothers James and George, for their support during the last 5 years, at times it has been very difficult but you all kept me motivated and your words of positivity and encouragement kept me going. I would also like to thank Rella, not only for her ceaseless ability to make me laugh, but also for her unconditional love and support all the way through this project, thank you for believing in me. Thanks also go to Hamish for supporting me, in more ways than one, over the last 18 months, you have been instrumental in the completion of this thesis and I am very grateful, so thank you.

Last but not least I would like to thank the IDTC and Nottingham University for providing the funding that gave me the opportunity to complete this project.

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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