Research Proposal for COST DairyCare Short Term Scientific Mission

January – March 2015 in collaboration with INRA

Background;

Traditional disease detection is becoming more challenging as herd size and labour cost increase and a lack of skilled labour continues (LeBlanc, 2010). These trends are fuelling an interest in automated systems of disease detection aimed at efficiently monitoring health in larger herds (Wathes et al., 2008).

Despite Ingvartsen et al. (2003) predicting that tools which allow the automatic detection of disease becoming important tools on modern dairy farms there has been little progress made in detection and monitoring aids, particularly for metabolic disorders. Firstly, uncertainty exists as to which indicators best reflect metabolic status and allow for the prediction of disease (de Vries et al., 2011). Secondly, although technological advances have meant that high frequency data for a number of production parameters is now available, a lack of suitable analysis means that this is often not converted into biologically meaningful information.

Scope:

This project seeks to address some of these issues by identifying potential indicators of production disease (metabolic disorders, metritis and retained placenta) in the dry period – so as to allow the ranking of cows based on risk of developing disease in the transition period.

This study will focus entirely on the dry and transition periods as, due to the physiologically overwhelming nature of this period, the majority of disease occurs during this time and can have lactation and life-time effects on health and productivity. A means of identifying at risk cows during this period would therefore offer most value to producers.

Aims & Objectives:

Aim: Identify biologically relevant non-invasive disease indicators which can be acquired and extracted from dry period data in order that cows at risk of transition disease can be identified early and thereby assist good animal husbandry.

Objectives:

- To identify and quantify the effect of production disease on body energy change in the dry period by monitoring such in diseased and healthy animals
- To develop a data handling system to filter, extract and combine body condition score and live weight data collected on farm
- To identify features of body energy data (total change, slope of change etc.) which are significantly different in diseased and health animals
- To construct a statistical model which is able to calculate risk of production disease based on body energy data collected in the dry period

Experimental Design

All data for this project will be sourced from the extensive database at SRUC Dairy Research Centre, UK during the period of 2003 – 2011. During this time, animals were in a long term 2 x 2 genotype by feeding study.

Approach/Proposed Methodology

This study will involve the retrospective analysis of 542 cow lactations, collected from cows transitioning to second and third lactation. Dry period data for each of these cows will be extracted – key information from this period is weekly body condition score and weekly live weights. This data will be used to calculate weekly body energy content for each cow based on standard equations (Banos et al., 2006). Based on disease incidence in the first thirty days in milk, cows will be classified into one of four groups – healthy, metritis, retained placenta or metabolic disorder.

A combination of literature searching and preliminary analysis of the data will be used to identify potential "features" to be extracted from the body condition score, live weight data and body energy content data – which will be analysed in latter stages of this project.

Analysis of variance will be used to determine differences in the proposed indicators across the dry period for cows in the 4 different disease groups. Genetic line and feeding system of cows will be accounted for at all stages. Principal component analysis and logistic regression will be used to explore the relationship between body energy at the start of the dry and the rate of change across the dry period. The aim of this work is to establish whether an "ideal" or "target" trajectory of BCS change can be constructed for individual cows. The fit between the ideal and actual trajectory would then be used to identify cows at risk of transition disease.

The final stage of analysis will be to consolidate knowledge and produce a predictive model to rank cows based on disease risk using features of body energy data as inputs. SAS will be used throughout all stages of this analysis, with supplementary use of R.

Outcomes;

- A scientific research paper (Working Title: Exploring the Characteristics of Dry Period Body Energy Content in Individual Cows) publishable in a reputable journal

- Development of an algorithm/model which uses features extracted from body energy status as an input to rank cows based on risk of developing transition disease.

References

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