DairyCare COST ACTION

Preliminary Report for Short Term Scientific Mission (STSM)

April 19th, 2016

COST ACTION: FA1308.
STSM title: Milk production and feeding behavior databases to assess welfare and productivity of dairy cows.
Reference number: ECOST-STSM-FA1308-040416-071876.
Type: Regular (from Spain to Italy).
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Dates: from April 4th to April 17th (14 days). *Actually, the STSM was held from April 13th to April 27th (14 days) due to a travel of the host to the U.S.*

STSM objective and tasks:

The main purpose of this STSM was to evaluate the possibilities of using milking records and feed intake data obtained in several trials with different purposes for the assessment of welfare and productivity of dairy cows.
The following tasks were planned:

- Data cleaning, standardization and integration.
- Definition of metadata necessary for proper data integration.
- Characterization of the individual variability of feed intake, feeding rate, number of visits, number of meals, milk production, feed efficiency, etc.
- Study of the relationship between intake and production (quantity and quality).
- Study of social behaviors related to the access to the trough.
- Identification of possible indicators of cow welfare.

Description of the work carried out (to the date of the preliminary report):

The very first task of the STSM was the collection of the available datasets about feed intake and feeding behavior. Initially, two datasets were collected: the first one had 8281 records from a trial involving 14 dairy cows during 10 days of January 1999; the second one had 5260 records from 12 dairy cows (divided in two groups) during 10 days (divided in two periods) of February 1999. This was a 2x2 experimental design where each group received the same TMR with a different chopping level. Both datasets were obtained in the same facility and had the following data for each record: cow number, cow group, feeding gate number, date and hour of the beginning of each feeding visit, duration of each feeding visit, feed intake in each feeding visit and remaining feed weight after each feeding visit. For the second dataset, milking records (kg per day, protein, fat, etc) and behavior data (time spent eating, drinking, ruminating, etc) were also available. We expect to have more datasets obtained in the Italian facility and one dataset of a trial carried out in U.S. by the end of the STSM. In the U.S. trial, the diet composition was changed in order to measure changes in milking records.
As expected, data cleaning has been the first step of the knowledge discovery process. We have calculated the mean and the standard deviation for the recorded variables and for the

derived ones, e.g. feeding rate (feed intake during a visit/duration of the visit). On the other hand, we have evaluated the correspondence between the weight and time at the end of each visit and the starting weight and time of the following visit.
In order to have a better understanding of the records, we have reviewed different methods for defining "meals" from feeding visits. A meal is a more relevant unit than an individual visit for describing feeding behavior. We have tested both graphical methods and those based on the distribution of the interval between feeding visits (Tolkamp et al., 2000; von Keyserlingk and Weary, 2009).
Moreover, we have calculated descriptive statistics per cow for some variables, e.g. feeding time, feeding rate… and we have reviewed papers about metadata needed for a reliable integration of data coming from different sources.

Description of the main results obtained (to the date of the preliminary report):

Data cleaning:
We observed that feeding rate is a good starting point when looking for univariate outliers, as it has a limited range from a physiological point of view (no more than 10 grams per second). On the other hand, the study of data consistency described before was useful for the detection of multivariate outliers. We observed errors in the recording system at the end of the day, when feed in the trough is scarce. We also found a large number of feeding visits (approx. 30%) where the intake is very low (< 100 g) and the interval with the previous or the next visit is short (< 5 min). these have been tagged as non-feeding visits.

Definition of meals:
We have observed that results from graphical and mathematical methods to define meals from feeding visits are similar when non-feeding visits are excluded. On the other hand, the "meal criterion" (the longest non-feeding interval that is still accepted as interval within a meal) is better defined when using the data of each cow separately.

Metadata:
The review of metadata for the integration of datasets is not completed, but, by now, we have identified: characteristics of each cow (number of lactation, days in milk, etc), agro-climatic data and characteristics of the diet (ingredients, composition, etc).

Final outcomes:
This STSM has begun a few days ago. We will continue working until the scheduled date. The final outcomes are expected to be:

- Catalogue of recommended metadata for feed intake and feeding behavior trials.
- Study on the individual variability of feed intake, feeding time, number of meals, etc.
- Study on the relationships among those data and the characteristics of cows, diet, etc.
- Study on the ability to estimate feed intake from feeding time.
- Study on the identification of sick cows based on feed intake and feeding behavior data.

- Study on the social interactions of dairy cows at the feed bunk.
- A scientific research paper publishable in a SCI journal.

Confirmation of the host institution:

A letter of the host institution confirming that the STSM has been carried out as planned is attached to this preliminary report.

References:

Tolkamp BJ, Schweitzer DP and Kyriazakis I (2000) The biologically relevant unit for the analysis of short-term feeding behavior of dairy cows. Journal of Dairy Science 83: 2057-2068.

Von Keyserlingk MA and Weary DM (2009) Review: feeding behavior of dairy cattle, measures and applications. Joint Annual Meeting of the Canadian Society of Animal Science. Montreal.