Final Report for Project 277-0683-18

Identification and quantification of pain caused by mastitis
and monitoring of alleviation by pain killers

Submitted to the Israel Dairy Board by:

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Abstract: This research project dealt with the identification and monitoring of pain or poor welfare caused by udder inflammation. Three types of udder inflammation were examined – induced infection with *E. coli*, simulation with LPS, and natural occurrence at a subclinical level. In terms of pain monitoring and quantification, measures included temperature, blood counts and milk tests, but also algometry and acoustic monitoring. In the first experiment, the algometric response of milking dairy cows was tested prior, during and after inoculation with *E. coli*, and after treatment with an NSAIDS anti-inflammatory. With regard to algometry, the main findings were that the test is more reliable after milking than before; inoculation and subsequent inflammation intensifies the algometric response; the infected quarter tends to a more acute algometric response than the other quarters; and inoculation increased antagonism to the test (evading and kicking). In the second experiment with cows undergoing drying, a strong acoustic signal was obtained of distress (bellowing) sounds and it was decided to focus on bellowing instead of teeth grinding. The results of the algometry measurements in the third experiment with LPS were weak and disappointing. We found that acoustic monitoring picks up a wide variety of sounds, and we focused on bellowing and rumination. In the final experiment of the study, we were able to map rumination activity over many animals, at great detail and accurately. On a systemic level, and using routine blood screening tests, we did not find any index that shows a difference between the control and subclinical treatments. In contrast, several blood indices clearly responded to the LPS challenge, but the effect faded quickly. The measure of average rumination bout length was well-conserved across treatments, and would be a poor welfare marker. In contrast, the daily total rumination time or the daily number of rumination bouts showed a response to treatment. We saw an increase in subclinical cows compared to control cows, over the entire experiment. The variation in these indices from day to day was high and there are probably cyclical patterns that operate on time scales of several days that have yet to be identified. A promising result was the frequency of vocalizations in LPS treatment: the transition from zero vocalizations to vocalizations exactly on the day of the challenge suggests that there is a real phenomenon here. At the population level, it may be possible to detect differences between groups of animals by a uniform and consistent application of algometry. In the context of precision agriculture and detecting poor welfare at the individual level, our experience does not raise hopes for algometry. On the other hand, there were promising results from the acoustic method. A unique acoustic database was created as part of this research that will serve the continued development of acoustic monitoring in the context of pain and poor welfare in dairy cows.