Sickness behaviour induced with low doses of lipopolysaccharides in dairy calves

Borderas, T.F.[1,2], A.M.B de Passillé[1], and J. Rushen[1]
[1]Pacific Agri-Food Research Centre, Agassiz, BC, Canada
[2]DPAA. Universidad Autonoma Metropolitana – Xochimilco, Mexico

Introduction: Rates of illness remain high among dairy calves Treatment is more effective if done early and so there is a need for better early detection of illness. A better understanding of which behaviors change as illness develops may help improve the early detection of illness. The effect of low doses of LPS might be more typical of the early onset of illness.

Our question: **Can behaviour be used to identify prodromal period in dairy calves?**

1. Calves showed reduced duration of rumination and hay eating.

2. The frequency of grooming was reduced and the time spent lying inactive increased.

3. Low LPS doses seem promising to understand early sickness behaviour but short effect of LPS and differences in calf sensitivity must be taken into account.

Methods:

Fifteen dairy calves of 2 ages (3 wk and 20 wk), housed in individual pens and fed milk and concentrates with free access to hay and water, were injected i.v. with 1 of 2 low doses (0.025 or 0.05 μg/kg) of LPS before feed delivery with saline injections as a control using a cross-over design.

Fifteen calves showed an increased body temperature (> 39.5 °C) lasting 2 to 8 h with a maximum temperature of 40.59 ± 0.52 °C attained 4.62 ± 0.96 h after the LPS injection.

Video recordings were used to measure durations of behaviors during a 4 h period when body temperatures were elevated.

Table 1. Mean (± SE) values of rectal temperature (RT), heart rate (HR) and respiratory frequency (RF) on control (SAL) and treatment (LPS) days for the 24 h period

		Mean ± SE		
		4 h Fever		
Variable	Treatment	Peak	20 h	24 h
RT °C	LPS	40.03 ± 0.07*	39.30 ± 0.04	39.58 ± 0.05*
	SAL	39.10 ± 0.03*	39.14 ± 0.03	39.12 ± 0.02*
RF bouts/min	LPS	46.50 ± 2.45*	42.86 ± 1.31	44.34 ± 1.26*
	SAL	36.11 ± 0.98*	39.91 ± 0.89	38.36 ± 0.68*
HR beats/min	LPS	111.56 ± 1.86	112.35 ± 1.95	112.01 ± 1.38
	SAL	106.25 ± 1.98	110.89 ± 1.84	109.00 ± 1.37

* indicates a significant difference ($P < 0.05$) between LPS and SAL.

Figure 1. Rectal temperature of calves at each sampling time following injections of either LPS or saline (SAL)

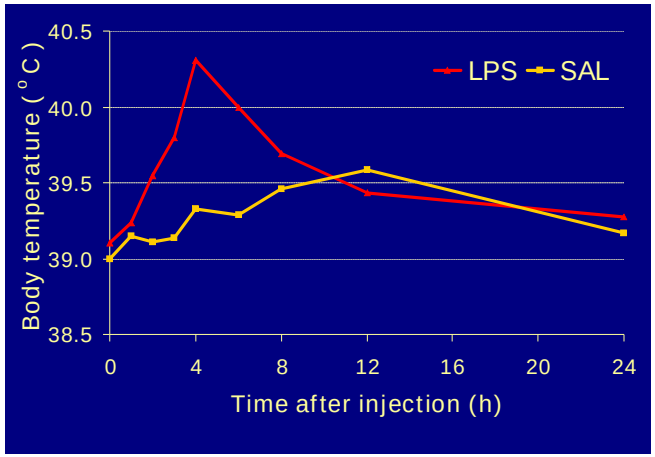

Table 2. Total duration of time (min) spent performing behaviors during the 2 h before and after peak rectal temperature.

Behavior	Treatment	Duration (min)	*P*-value
Lying inactive	LPS	132.63 ± 10.60	0.02
	SAL	104.39 ± 12.63	
Eating concentrate	LPS	2.03 ± 1.32	0.28
	SAL	4.83 ± 2.02	
Eating hay	LPS	23.11 ± 6.93	0.04
	SAL	31.52 ± 7.54	
Ruminating	LPS	6.42 ± 3.69	0.001
	SAL	24.57 ± 6.64	
Self-grooming (Frequency)	LPS	13.47 ± 1.75	0.008
	SAL	24.07 ± 3.12	

Discussion

These behavioral changes may indicate the beginning of illness (prodromal period). Time spent lying down and amount of concentrate and milk consumed were not affected. There were no differences between doses or due to the age of the calves. Very low doses of LPS seem promising to understand early development of sickness behaviors in dairy calves. However, the effectiveness of this model has some limitations like the short duration of the effect and the individual differences in sensitivity to LPS.

Agriculture and Agri-Food Canada | Agriculture et Agroalimentaire Canada

Special thanks to Marjolaine StLouis, Isabelle Blanchet and staff at Dairy and Swine Research Centre, Agri-food Canada at Lennoxville, Qc