

Direct adverse effects of persistent BVDv infection in dairy heifers – a retrospective case control study

by Hinrich Voges, Suzanne Young and Margaret Nash, Livestock Improvement

The illthrift, persistently infected (PI) calf is easily recognised and the impact of mucosal disease well understood. The consequences of transient infections during pregnancy – especially with PI introduction into a naïve herd – can also be very dramatic. However, direct consequences of BVD on the health and productivity of ‘healthy’ PI cattle are more difficult to appreciate. These data from a well controlled trial dairy herd seek to address this shortfall.

The trial involved 904 Friesian-Jersey heifer calves with confirmed parentage that were sourced shortly after birth from 323 herds over two seasons and reared together. Cohort 1 (C1): 389 calves in 2000; Cohort 2 (C2): 515 calves in 2001.

Stored sera, collected at six or nine months (C1 and C2, respectively), were retrospectively screened using the IDEXX BVD serum antigen ELISA. Twelve heifers tested BVD antigen (Ag) positive, verified by Pourquier Ag ELISA. All 12 samples – diluted in BVD antibody-positive serum at 1:100 – tested positive for BVDv using Genemark's BVD PCR. A second sample at 15 months confirmed their PI status on BVD PCR and BVD Ag ELISA.

Overall PI prevalence was 1.33%. Amongst the first cohort, eight calves (2.1%) were persistently infected with BVDv, while only four C2 calves (0.8%) were PIs. Five PIs originated from a single herd (4 in 2000; 1 in 2001). In total, 18 calves came from this herd, including three pairs of ‘PI – non-PI’ full siblings, suggesting their dams were not PI but transiently infected during pregnancy. A second herd supplied two PI calves. The remaining five PIs originated from five different herds.

BVD PI status impairs health

All trial animals were inspected on purchase and closely monitored throughout the trial. Interestingly, none of the young PI calves appeared to be typical illthrift BVD PI cattle, although overall they weighed 3.6 kg less than their compatriots (nonPI) at three weeks ($p=0.036$).

Two PIs died at 15-16 months – one of bloat complications, the other of septicaemia (possibly mucosal disease). Another PI heifer was culled after aborting (and illthrift) at 20 months, so that 75% of the PIs entered the milking herd. One PI with pneumonia was euthanased at 38 months and several were culled after ongoing infections – two with mastitis and one with an infected claw. Three PIs were treated for pneumonia, including the single surviving PI cow, which has suffered two bouts of pneumonia as an adult. Five of the nine lactating PIs suffered clinical mastitis – in some cases multiple bouts.

BVD PI status impedes growth

The growth curves for all C1 and C2 PI calves to ~21 months (91 weeks) are shown in Figures 1a and 1b, respectively.

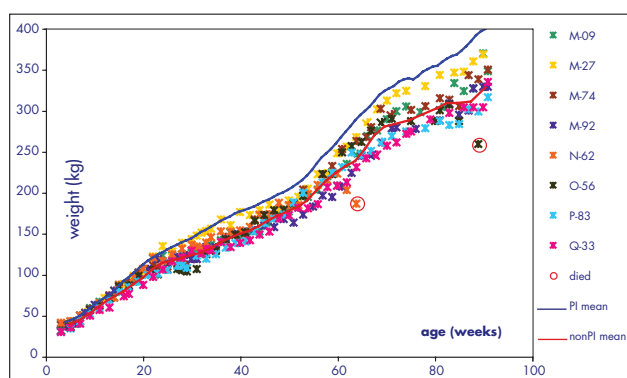


Figure 1a: Individual liveweights of 8 cohort 1 PI calves, 3-91 weeks old with means for PI and nonPI calves

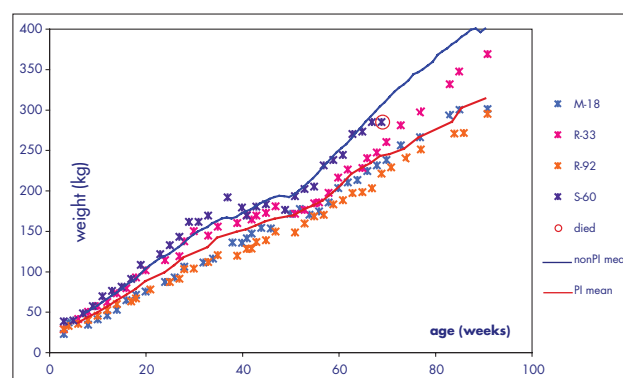


Figure 1b: Individual liveweights of 4 cohort 2 PI calves, 3-91 weeks old with means for PI and nonPI calves

PIs had slightly higher mean ancestry liveweight breeding values¹ than nonPIs. Yet the mean PI weight generally tracked near the lowest 2.5% of the remaining herd. By 91 weeks, the surviving PI heifers weighed on average 68kg (17%) less than their nonPI herd mates (Table 1).

	PI	nonPI	PI / nonPI	PI - nonPI	
Number of heifers	12 (1.33%)	892			
Ancestry LW BV	8.4	2.6			
Week 3 weight	30.2 kg	33.7 kg	89%	- 3.6 kg	p=0.04
Week 91 weight	335 kg	403 kg	83%	- 68 kg	p<0.001
Growth / week	3.4 kg	4.2 kg	82%	- 0.7 kg	
Survival to w91	75%	93%			

Table 1: Mean liveweight statistics for all heifers by BVD PI status

BVD PI status reduces survival

A single PI cow remains alive (8%), having survived two bouts of pneumonia. This contrasts with 75% (3/4) nonPI full siblings currently still in the herd, and 71% survival overall. Figure 2 clearly illustrates the dramatically reduced survival time of BVD PI cattle in the herd (p<0.001).

Nine PIs did survive to adulthood, producing 19 calves in total. The majority were bull calves; one was stillborn and

only two heifers have been reared. As expected, the two replacement heifers were recently confirmed PI by PCR and Ag ELISA.

Because of the trial design, no cows were culled for production-related reasons. Significantly more PIs were culled for mastitis-related reasons than nonPIs (see Table 2). Severe illness and sudden death also claimed a disproportionate number of PIs. The culling data do not suggest compromised fertility associated with PI status.

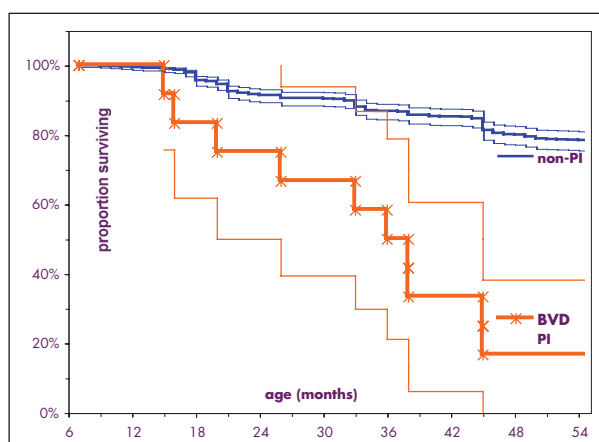


Figure 2: Survival curves for 904 crossbreed cattle by BVD PI status with 95% confidence intervals

Cull reason	PI	nonPI	Odds ratio	
Sub-fertility (including empty)	2	164	0.89	not sig
Abortion, calving or metabolic	1	21	3.77	not sig
Mastitis related	3	17	17.16	p<0.001
Severe illness or sudden death	3	23	12.59	p<0.001
Miscellaneous	2	36	4.76	not sig
Alive at 4 ¹ / ₂ years	1	631	0.04	p<0.001

Table 2: Cumulative culling incidence to 4¹/₂ years by BVD PI status classed by cull reason with odds ratios for PI versus nonPI

¹ Ancestry breeding value (liveweight or production): Based on parentage information, expected difference in live weight (kg) or milk production (kg per lactation) compared to an average mature 'base' cow born in 1985

BVD PI status depresses milk production

Based on ancestry breeding values, average milk production from the PI individuals should be equivalent to the nonPI herd mates (Table 3). Yet analysis of first lactation milk-fat, protein and volume production

highlights massive production losses ($p < 0.001$) associated with PI status. Milk solids production was essentially halved. The Animal Evaluation Unit's lactation yield deviations² confirm that these losses were not simply due to later calving and/or earlier culling of PIs.

Lactation 1	Breeding or production index	BVD PI	nonPI	PI / nonPI	PI - nonPI	
	Number of cows	9	824			
	Mean days in milk	197	234	84%	- 37	not sig
Milk fat	Ancestry BV	29	26		3	$p=0.02$
	Total production	79	164	48%	- 85	$p < 0.001$
	Yield deviation	- 65	3	- 68	$p < 0.001$	
Milk protein	Ancestry BV	20	18		2	$p=0.07$
	Total production	57	11	49%	- 59	$p < 0.001$
	Yield deviation	- 47	1	- 48	$p < 0.001$	
Milk volume	Ancestry BV	252	259		- 8	not sig
	Total production	1375	2878	48%	- 1503	$p=0.03$
	Yield deviation	- 1232	44	- 1276	$p < 0.001$	

Table 3: Production data (in kg) for first lactation only, with respective ancestry breeding values

Conclusion

Full siblings to four PIs tested BVDv negative – evidence that these PIs resulted from transient infections of their dams during pregnancy. At least one herd of origin appears to have suffered a 'BVD outbreak' in 1999/2000 due to exposure of the naïve herd or cohorts to a BVDv shedder (possibly a PI bull) during pregnancy. However, at least one cow in that herd remained susceptible until the following season – as demonstrated by birth of a nonPI in 2000 with a PI sibling in 2001.

In spite of the number of PIs in the herd, there was no evidence of a mucosal disease outbreak and the majority

of PI heifers survived long enough to calve and join the milking herd. However, both PI growth rates and general health were clearly compromised. First lactation milk production was halved as a result of persistent BVDv infection. As expected, the PI animals apparently lack efficient immune function, suffering multiple infection episodes including pneumonia. The lifespan of PIs is short with high losses from infectious causes.

The direct impact of non-cytopathic BVD virus on the health and welfare of PI individuals is substantial.

To contact the author: hvoges@lic.co.nz

² Lactation yield deviations: Performance of cows' production as deviation from their contemporaries in the herd, with adjustment for calving date and standard lactation length

Animal welfare in emergencies

Recent severe floods in New Zealand have highlighted the animal welfare consequences of natural disasters. The National Animal Welfare Emergency Management Group has been formed recently to address management of animal welfare in emergencies.

The group includes representatives from a number of organisations involved with animals and civil defence – the Ministry of Agriculture, Ministry of Civil Defence and Emergency Management, Federated Farmers, SPCA, World Society for the Protection of Animals (WSPA) and NZVA.

The group will, through their combined resources, advise on coordinating responses to animal welfare issues during emergencies by clarifying roles and responsibilities, identifying resources and gaps in emergency planning and providing training on animal welfare matters. Appropriate people will be nominated for the regional Welfare Advisory Groups to ensure that animal welfare is properly addressed in regional emergency management planning.