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JOURNAL TITLE: Veterinary Record

VOLUME/EDITION: 180/5

PUBLISHER: BMJ Publishing Group

PUBLICATION DATE: February 2017

DOI: 10.1136/vr.103922

Short communication

Effect of a pre-wash on footbath contamination: a randomised control trial

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Footbaths have proven effective in controlling conditions such as digital dermatitis (Bell and others 2014). Yet, there is still relatively little published data on appropriate footbathing protocols, including use of a prewash.

The term 'prewash' is used to describe a footbath that is positioned before the treatment bath in order to reduce contamination (e.g. manure, dirt and debris) entering it (Blowey 2015) as organic matter contamination can inactivate chemicals commonly used (Holzhauer and others 2004, Hartshorn and others 2013). Some authors suggest that prewashes reduce contamination in the treatment bath by either washing cows' feet or stimulating cows to defecate in the prewash rather than in the treatment bath (van Amstel and Shearer 2006, Greenough 2007, Watson 2007). By reducing contamination, it is theorised that a prewash will extend the life of the treatment bath (van Amstel and Shearer 2006, Greenough 2007, Offer and others 2006) and enable better access of the treatment chemical to foot tissues, thereby increasing treatment efficacy (Watson 2007). Other authors hypothesise that a prewash is not effective at cleaning cows' feet, and therefore makes no difference to the amount of contamination in the treatment bath (Cook 2011). It has also been suggested that a prewash may dilute the treatment chemical, thereby reducing treatment efficacy (Toussaint Raven 1989, Cook 2011) and possibly stimulates defecation, although this may be linked to the novelty or fear induced if a prewash is used infrequently (Villettaz Robichaud and others 2013).

The objective of this study was to determine whether a prewash reduces contamination in the treatment bath by measuring particulate matter contamination and ascertaining if differences were due to defecation behaviour or cleaner feet.

The study was carried out in 2014 over four weeks in July and August in the southeast of England. Eighty milking Holstein-Friesian dairy cows that were grazed during the day were given 14 footbath treatments over 28 days, half of which were randomly allocated to include a prewash footbath. Cows went through a footbath roughly every other day, after evening milking (not over weekends). They were accustomed to the footbath protocol, but the farm had not used a prewash before the study. Pastures remained dry throughout the study and gateways were managed with woodchip to avoid accumulation of mud on the feet.

The prewash footbath, when used, was located approximately 3 m from the parlour exit and the treatment bath was 8.5 m from the parlour exit (leaving a gap of 2.5 m in between). Cows were milked using a single-exit parlour. Baths were set up immediately before afternoon milking on each treatment day. The treatment bath measured 200 cm×85 cm×15 cm (180 litre footbath FB1, Paxton Agricultural, Leafield Environmental, UK) and was filled with exactly 120 litres of water and 4.8 litres of Formalin 40 solution (Strathclyde Nutrition, Scotland) to make a 4 per cent formalin treatment bath. The prewash, a 305 cm×91.5 cm×15 cm footbath (309 litre footbath FB4, Paxton Agricultural) was filled with 160 litres of water.

Samples from the treatment footbath were taken from the middle of the bath at nine intervals; the first was taken before any cows had passed through to establish a baseline level of contamination. Subsequent samples were taken immediately following every 10 cow passes, while the liquid was agitated to reduce the effect of particulate matter settling to the bottom. A sample was taken by fully submerging a 50 ml centrifuge pot (Star Lab E1450-0800, UK) into the centre of the treatment bath (100 cm along and 42.5 cm across) with the opening facing upwards. When the bottom of the pot touched the bottom of the footbath, it was tilted slightly towards the front of the race (so that the entire opening was immersed in the solution) and then raised up. Suspended particulate matter was used as a measure of organic matter and extracted by pouring over two 8 ply 12.5 cm×12.5 cm gauze napkins (UnoDent, UK) placed one upon another. The gauzes were air dried in a fume cupboard for three hours. Data on the percentage of cows that defecated into the treatment bath and the particulate matter contamination in the treatment bath were analysed using a statistical software package (SPSS Statistics V.22, IBM, USA).

A univariable assessment of the level of particulate matter contamination with and without a prewash was assessed using a Mann-Whitney U analysis, which indicated a significant difference ($P<0.001$). A generalised estimating equation was used to analyse the level of contamination in the treatment bath and indicated a significant effect of the prewash overall ($P=0.015$) and the number of cow passes ($P<0.001$).

As the number of cow passes increased, the level of contamination in the treatment bath also increased (Fig 1) with a high degree of variation due to the non-homogenous nature of the particulate contamination in the bath.

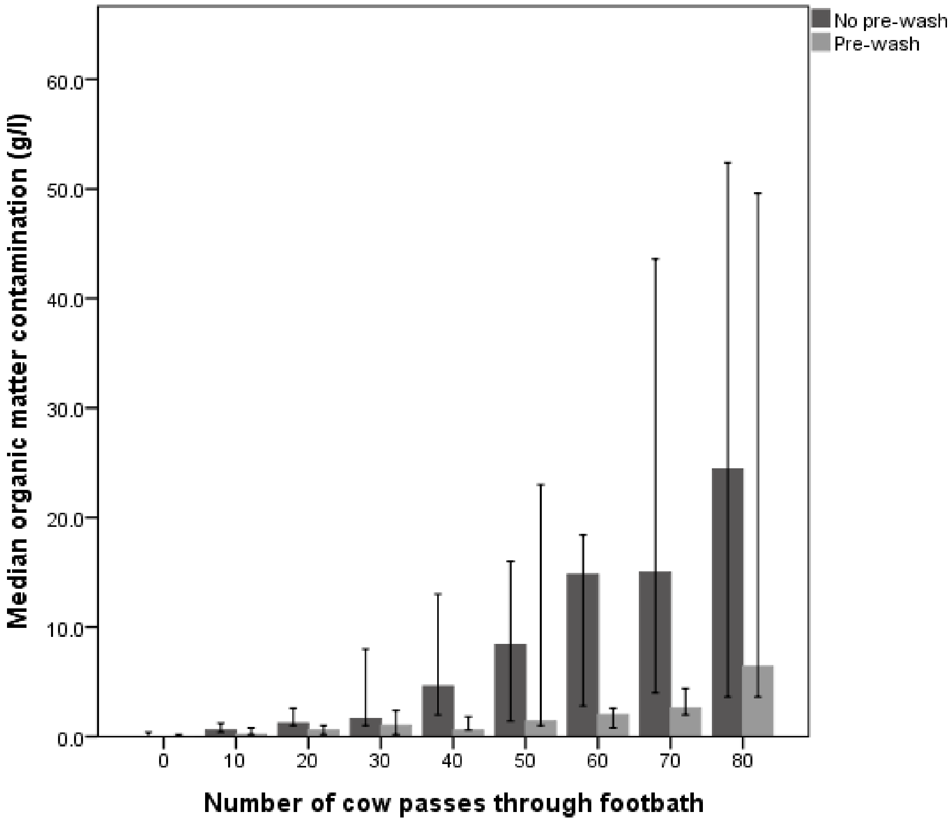

Figure 1. The median organic matter contamination (g/l) at each number of cow passes for the "pre-wash" group ( ) and the "no pre-wash" group ( ), with 95% confidence intervals.

Regardless of the presence of a prewash, cows defecated in the treatment bath at a rate of 5.4 per 100 passes. An independent t-test was used to analyse the percentage of cows that defecated into the treatment bath and indicated no significant difference (P=0.975). The effect of a prewash to reduce contamination in the treatment bath is therefore most likely due to cleaning cows' feet.

A prewash is expected (by some experts) to have two benefits on the footbath treatment. First, as organic matter contamination has been shown to inactivate chemicals commonly used in footbaths (Holzhauer and others 2004, Hartshorn and others 2013), if a prewash reduces contamination then it has been suggested that the treatment bath would not have to be changed as frequently (van Amstel and Shearer 2006, Greenough 2007). Second, if a prewash is effective at cleaning cows' feet then it is expected to increase the efficacy of the treatment by increasing exposure of the treatment chemical to foot tissues (Watson 2007).

The level of contamination reported here is relatively low compared with levels used to test disinfectant activity (Hartshorn and others 2013), and therefore, it may not adversely affect biocide activity at concentrations typically used on farm. Furthermore, the relatively small herd size and the use of one farm means that further work is needed to generalise to large herd scenarios. A single-exit parlour could affect defecation behaviour and speed of passage through the baths relative to a rapid exit system. However, the method provides a useful approach to evaluating footbath contamination in efficacy trials.

The results of this study demonstrate that the presence of a prewash does not influence the number of cows defecating into the treatment bath. Villettaz Robichaud and others (2013) also found that walking cows through a footbath does not reliably stimulate defecation behaviour.

A limitation in the sampling technique was a lack of repeated sample collections, and that sampling only took place from the centre of the treatment bath. There is no published literature on the optimum depth of footbath, but the prewash bath was filled to less than the recommended depth of 7–10 cm (Toussaint Raven 1989, Blowey 2015).

Nonetheless, the data shown here support other opinion that promotes the use of a prewash (Weaver 2000, van Amstel and Shearer 2006, Greenough 2007, Watson 2007, Blowey 2015) and provide evidence that a prewash can reduce the levels of particulate matter contamination. Further work is required to determine whether this affects biocide efficacy and digital dermatitis control.

Acknowledgements

We would like to thank Charlie Verity and Paul Christian for their assistance and Anna Riddle from the Clinical Investigation Centre for providing the lab space and equipment.

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