Inclusion of detergent in a cleaning regime and effect on microbial load in livestock housing

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Context
Cleaning and disinfection (C&D) is often an undervalued element of farm management but is vital for disease control and eradication, biosecurity and improvement of pre-harvest food safety. The aim of C&D is to remove organic matter, using physical and water-based cleaning methods, and kill remaining microorganisms via chemical disinfection and desiccation (rest). If cleaning is ineffective at removing faeces there will be pathogen persistence and decreased effectiveness of disinfection. Biofilms are also responsible for pathogen persistence; additionally, they can corrode metal, damage concrete and cause resistance to antimicrobials. Detergents can help to disrupt biofilms, assist with removal of organic matter and are bactericidal.

The primary objective of this study was to determine the effect of a detergent soaking period in a cleaning regime by monitoring total aerobic and Enterobacteriaceae counts (TAC and ENT) on different materials in livestock housing. Secondary objectives included determining the relationship, if any, between detergent treatment and subsequent disinfection and the influence of surface type on the effectiveness of C&D.

Main conclusion
Within this study, detergent reduced microbial load but the effect varied significantly according to surface and bacterial type. No synergy occurred between detergent and subsequent disinfection. The effects of disinfectant and rest were also significantly related to surface type; of particular interest was Virkon S being ineffective on metal and the lack of significant reduction in bacterial counts on concrete after five days of drying.

Approach
The study was carried out in a trial facility livestock building in August 2011. Identical pens (2.14 by 1.77m), each housing a boar for two months, were randomly allocated a treatment: control or detergent. All trial participants were blinded to treatment. Immediately after the pig vacated, each pen was scraped to remove loose faeces and bedding. The following day pens were soaked for one hour with 10 litres of water (control) or 10 litres of detergent (1:100 Blast-Off; Biolink). After soaking, each pen was pressure washed with cold mains water for 35 minutes using a consistent and repeatable method. Each pen was disinfected 24 hours later by applying five litres of 1 per cent Virkon S (DuPont). Pens were left to rest for five days.

Swab samples were taken in each pen from concrete flooring, metal (galvanised steel) floor slats and stock board walls after each stage of the regime, and enumerated for TAC and ENT. Results
When compared to control pens, after washing, detergent-treated concrete had significantly larger reductions in TAC (1.6 log cfu/cm², P<0.005) but not ENT. Detergent-treated metal had significantly larger reductions in both TAC and ENT (1.5 and 0.4 log cfu/cm², P<0.05). There was no significant difference in effect of treatment on stock board. After disinfection, and during rest, there was no significant difference in reduction, or counts, of bacteria comparing detergent-treated and control pens; therefore, data sets were combined for analysis of disinfection and rest. There were significant reductions in both TAC and ENT after disinfection of concrete (1.6 and 0.7 log cfu/cm², P<0.05) and stock board (1.1 and 0.6 log cfu/cm², P<0.05), but no significant change in counts on metal. During rest there was a significant reduction in TAC and ENT after 24 hours of rest on metal (1.8 and 1.1 log cfu/cm², P<0.05) and stock board (0.8 and 1.8 log cfu/cm², P<0.05); counts at 48 or 120 hours were not significantly lower than those at 24 hours. No significant reduction in counts occurred on concrete up to 120 hours.

Interpretation
In this study, detergent showed a varying ability to reduce counts according to surface and bacterial type. This may be due to physical surface characteristics, differing bacteria-surface interactions or bacteria-specific biocidal components of the product. Lack of detergent effect on stock board could also be explained by the surface being vertical, thus detergent contact time may have been reduced.

Like many disinfectants, Virkon S has reduced action in the presence of organic matter; hence, the hypothesis was that previous detergent soaking would significantly improve subsequent disinfection. The current study showed no such relationship, and the significant reductions in detergent-treated pens may be attributable to the biocidal action of the detergent rather than improved organic matter removal.

Virkon S caused significant reductions in bacterial counts on concrete and stock board but not on metal. This may be due to acidic components in Virkon S having a neutralising reaction with the metal, thereby impeding action of the oxidising compound which is most effective at a low pH. The differing microbial death rates during rest in this study may be attributable to the surface characteristic; concrete is rough and porous, giving it an ability to adsorb liquids whereas galvanised steel and stock board are smooth, allowing for better desiccation and significant microbial death.

Significance of findings
Despite the lack of synergy between detergent and disinfectant in this study, the authors recommend that both are incorporated in C&D for their independent significant bacterial actions, along with a minimum drying period of 24 hours. Reduction in ENT, encompassing important enteric pathogens, after product application was sometimes significant but appeared of low biological value with regards to surface contamination, suggesting that other combinations of approved C&D products need to be tested. Producers should be aware of the influence of building material on the success of C&D, both product effectiveness and ease of drying, and should consider this when designing livestock housing and C&D regimes to be implemented in them.

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