

Dichelobacter nodosus metapopulations and the epidemiology of footrot in an endemically infected flock

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Interdigital dermatitis & severe footrot

Interdigital dermatitis (ID)

... inflammation and/or lesions of the interdigital skin

Severe footrot (SFR)

... separation of the hoof horn from underlying tissue



ID and SFR account for ~70% of foot lesions in UK sheep.

Dichelobacter nodosus

... the main causal agent of ID and severe footrot

Costs the industry between **£24 and £80 million** per annum.

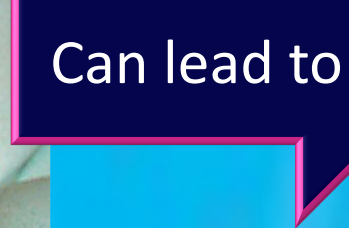
Virulence factors of *D. nodosus* include fimbriae, serogroups and proteases. These have been investigated but not in relation to disease severity. In addition, their role in the *D. nodosus* strain community remains unclear.



Interdigital dermatitis



Severe footrot



Aims

To investigate strain types of *Dichelobacter nodosus* on feet:

- One/several dominant strains?
- Are strains in the same serogroup or different serogroups?
- Do certain *D. nodosus* strain communities explain disease severity?

To identify virulence factors of *Dichelobacter nodosus* and to determine what the association is between these and the severity of ID and SFR.

Samples

The *D. nodosus* strain community and virulence factors are being investigated in 25 ewes from one farm studied previously (Smith *et al.*, 2016 *Vet J.*).

Ewes' feet were swabbed and scored in 4x 4-week sampling periods over 10 months plus outside those periods if a locomotion score >2 was recorded.

Results from *D. nodosus* load data

DNA has been extracted from all 923 swabs and run through quantitative PCR to detect and quantify *D. nodosus*.

➔ **68%** of interdigital swabs were positive for *D. nodosus* (*rpoD* gene)

For each swab Log(*D. nodosus* load) per swab was calculated.

Log(*D. nodosus* load) significantly increased ($p < 0.01$) with each ID score (Figure 1). However, there was no significant difference in Log(*D. nodosus* load) between SFR 0 and 1.

Both treatment methods significantly reduced the external load of *D. nodosus* (Figure 2).

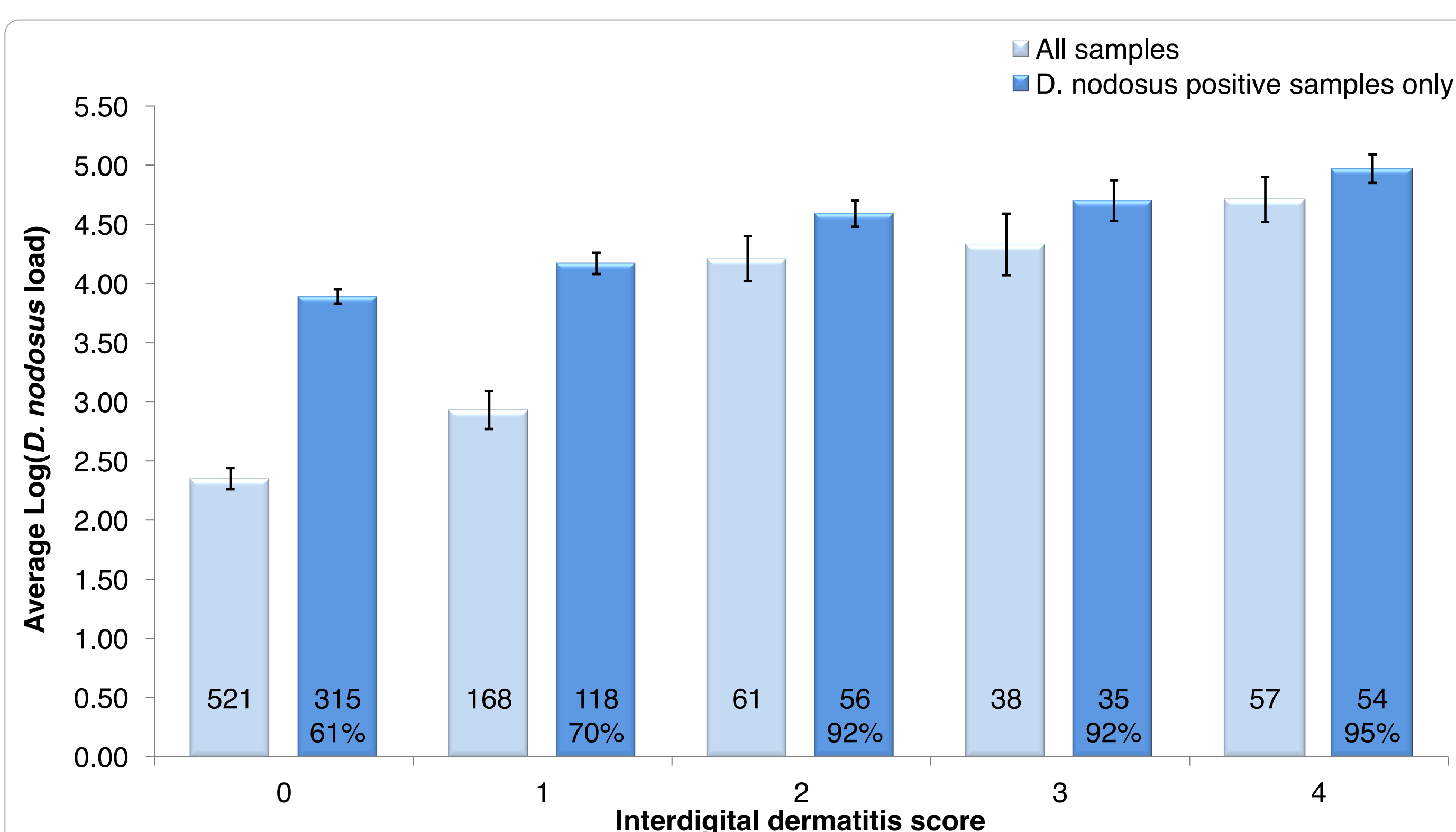
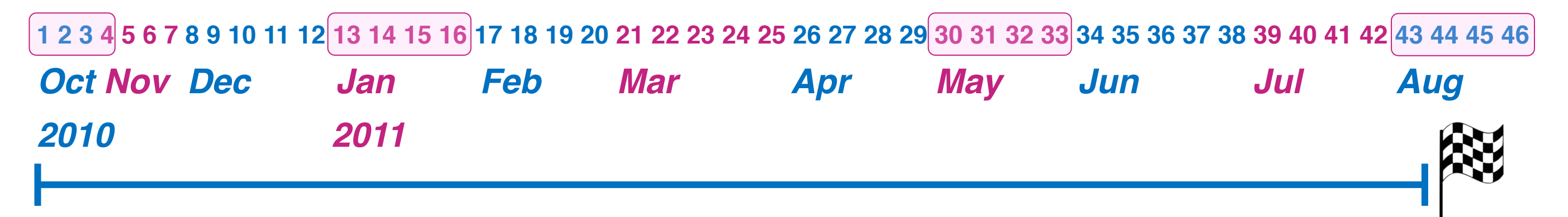


Figure 1: Number of samples, % of positive samples and average Log(*D. nodosus* load) ± standard error per interdigital dermatitis score.

Samples with a higher load were more likely to be culturable (Table 1). This indicates that isolates are not from foot samples that are randomly representative.

1/47 (2%) just *D. nodosus* positive samples with isolates (all of which were *D. nodosus* positive) with <1450 *rpoD* gene copies/sample
 109/531 (21%) just *D. nodosus* positive samples without isolates (67% were *D. nodosus* positive) with <1450 *rpoD* gene copies/sample

➔ Quantitative PCR is able to detect *D. nodosus* at lower loads more frequently than culture – more representative method



On any occasion where a locomotion score >2 was recorded, treatment was given as per their allocated treatment group; either foot trim and antibiotic spray or antibiotic injection and antibiotic spray.

Samples from **two feet of each sheep** from Oct 2010 to Aug 2011 were selected for analysis – in total **923** samples; 845 interdigital skin samples and 78 non-interdigital lesion samples.

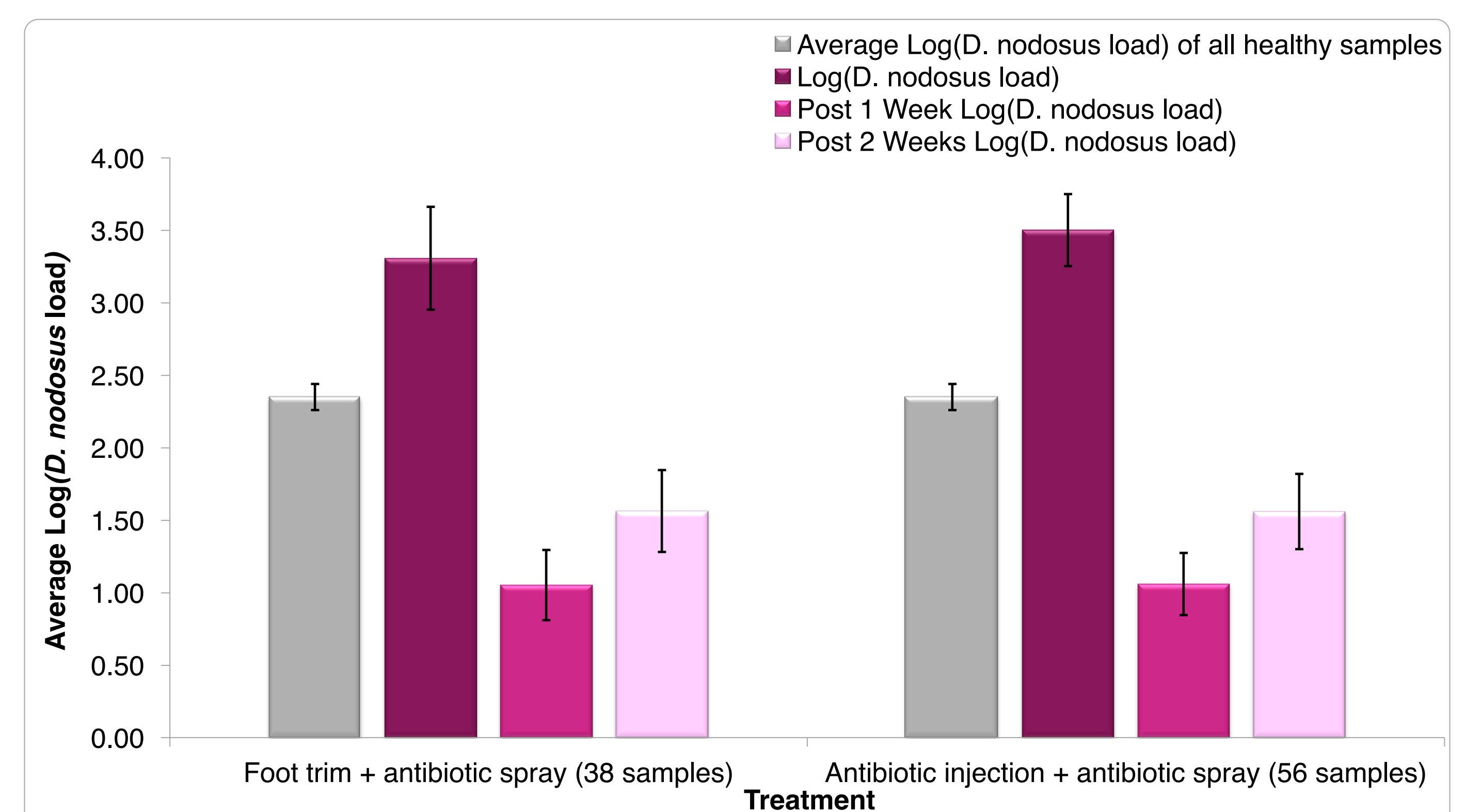


Figure 2: Average Log(*D. nodosus* load) ± standard error for healthy samples, samples on the day a treatment was given and one and two weeks post treatment being given.

Table 1: Number and % of samples and average Log(*D. nodosus* load) ± standard error for samples with isolates obtained from culture that were positive for *D. nodosus* (100%) and for samples without isolates obtained that were positive for *D. nodosus* (67%).

Samples with isolates		Samples without isolates	
No. (%) of samples	Average ± standard error Log(<i>D. nodosus</i> load)	No. (%) of samples	Average ± standard error Log(<i>D. nodosus</i> load)
47 (8)	4.63 ± 0.11	531 (92)	4.12 ± 0.05

Next...

PCR and isolate results (collected previously) will be compared with disease development.

A sub group of samples will be selected for MLVA (strain profile) and virulence factor analysis.



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