Harnessing technology for lameness control in sheep

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Lameness is a significant production limiting health issue, thought to account for £24 to £84 million worth of lost income per year in the UK sheep industry [1]. It is also considered to substantially impair animal welfare in affected animals [2,3]. In 2004, the estimated incidence of lameness in the UK national flock was approximately 10% [4], 90% of which were attributable to footrot (FR). In the 2011 Opinion on Lameness in Sheep, the Farm Animal Welfare Council set targets to reduce lameness in sheep to 5% by 2016 and to 2% by 2021 [5]. Subsequently recommended on-farm control measures for FR were revised [6], based on expanding knowledge of the aetiology and epidemiology of FR in sheep, with *Dichelobacter Nodosus* now recognised as the initiating agent of disease [7]. Among the solutions advocated to address this widespread problem, the identification and management of environmental risk factors was deemed of high importance for the control of lameness in flocks.

On page … of this week's issue of the Veterinary Record, Vittis and Kaler have presented a study in which data was collected by farmers using their smartphone and an online app and correlated with data from the Meteorological Office and the British Geological Survey. In this study increasing soil selenium concentrations appear to provide a protective effect and complements findings of trials carried out in the USA, where FR recovery rates appeared to increase with selenium supplementation [8,9]. This factor is particularly relevant, as globally, large areas of agricultural land have suboptimal and potentially decreasing levels of selenium in soil, and high rainfall can impact on pasture selenium content [10]. The reduction in lameness on farms with 'mudstone, siltstone and sandstone' however contrasts with previous data showing that clay (mudstone equivalent) soils favour the survival of *D. nodosus* [11]. Also, this is a more difficult risk factor to address within farms, as soil improvement or adjustment is possible but limited within the constraints of the geological

setting. They conclude that further investigation is needed to determine what degree of soil improvements and what specific materials would have a significant and positive effect on reducing lameness levels.

Other environmental factors investigated by Vittis and Kaler include temperature and precipitation, showing that rising temperature increased the risk of lameness, while precipitation did not show a statistically significant impact on lameness. For temperature, this is in agreement with Smith et al., 2014, but not for precipitation where there was an association demonstrated [12]. Furthermore, *D. nodosus* survival has been shown to be prolonged at 5°C compared with either 15°C [13] or 25°C [11]. Therefore the impact of climate on lameness and FR appears not as straightforward as one could assume. Nevertheless, the geographical location of the farms in Vittis and Kaler's study must be taken into account when interpreting this data, as the majority of the farms were located in Wales and central England, areas renowned for high humidity and temperate climate.

As well as environmental factors, some management factors were also assessed. Grass length has been proposed for many years as a potential risk factor for lameness in sheep. Vittis and Kaler [14], as well as Angel et al., 2018 before them, [15] have provided evidence of an association between longer grass length (over 10cm) and increased lameness. Their data also suggests that larger flock size has lower levels of lameness, which they attribute to potentially better management strategies and density dependent factors. Finally, lambs had lower level of lameness when compared to sheep over 1 year of age.

At the same time, the study by Vittis and Kaler has also shown the potential for on-farm application of technology and data recording to provide practical solutions to animal diseases. There is increasing emphasis on the application of precision livestock farming (PLF), where continuous, machine-based monitoring of health parameters could maximise animal welfare and productivity [16]. The central core to achieving such ambitious aspirations, is to combine the latest technology with the power of data gathering and analysis. The innovative approach used in the study reported

on page …., combines data already available from the British Geological Survey on soil types and composition and from the Meteorological Office on climate (precipitation and temperature) with grass length measurements using a sward stick and epidemiological data, collected by farmers via a purposely built smartphone app.

Smartphones are currently owned by 3.5billion people around the world (almost half of the world's population) [17] and their power is apparently greater than the computer which landed the first rocket on the Moon [18]. Traditional farm monitoring (pen and paper) is highly prone to human error and extremely time-consuming, while the combination of electronic ear tags for accurate animal identification and the speed offered by app technology for immediate recording and sharing of data, have significantly changed our perception and the application of on-farm data gathering and subsequent analysis.

In conclusion, the insight of this work into the impact of environmental and management factors on lameness in sheep allows us to expand the potential control strategies available to vets and farmers to efficiently tackle lameness, and FR in particular, in flocks. Vittis and Kaler have set the scene for further research to determine the extent to which these factors influence lameness levels on farms and how that knowledge can be harnessed to produce real differences in lameness levels. This will be particularly relevant in areas where the climate and soil type support the maintenance of infectious causes of lameness in sheep flocks. They have also shown the potential benefit that technology can bring to data collection and disease monitoring, an area unfortunately still lacking in many sheep farms and a practical application (smartphone app) of such technologies.

WHAT YOU NEED TO KNOW

- Increased soil selenium levels appears to have a protective effect against lameness in sheep
- High pasture sward length (over 10cm) increases the incidence of lameness in sheep
- Climate impacts on lameness, although within the constraints of the UK environment the true impact is not yet clear

- Sheep have increased risk of lameness over 1 year old
- Smartphone technology can be harnessed to improve data collection, disease monitoring and decision making

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