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Review

# Computerised claw trimming database programs as the basis for monitoring hoof health in dairy herds

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ABSTRACT

Regular documentation and recording of udder health, reproduction and metabolic status are common practices on dairy farms. However, recording of claw health is less commonly undertaken. Computerised claw trimming documentation and analysis programs have been developed in Germany, Denmark, The Netherlands, United Kingdom, Spain, United States, and Austria. Such programs enable automatic analysis of recorded data including the presence/absence of claw lesions, their severity, and exact location (lateral, medial, fore and hind claws, interdigital or in predetermined claw zones) as well as the overall incidence and prevalence of lameness.

Analysis of such data, particularly of numerical values, allows comparisons to be made between consecutive visits within one herd as well as between herds. Additionally, computerised programs can include interfaces that link to other herd health management programs or to data available from national breeding associations. Greater use of computerised claw trimming database programs would provide a valuable basis for monitoring and improving claw health and lameness in dairy herds.



## Introduction

The recording of udder health, reproduction and metabolic status, as well as dairy cow feeding practices are all used as routine herd health management procedures on many dairy farms (Khaitsa et al., 2000; Heuwieser, 2007; Hoedemaker et al., 2007; Martin et al., 2007; Thorup et al., 2012). In addition, the evaluation of monthly milk records, for example using somatic cell counts in milk and milk solids (Emanuelson and Funke, 1991; Khaitsa et al., 2000; Van Asseldonk et al., 2010), the regular documentation of body condition score (Roche et al., 2009; Thorup et al., 2012), ultrasonographic measurement of back fat thickness (Schwager-Suter et al., 2000; Schröder and Staufenbiel, 2006), and continuous documentation of reproduction performance (Heuwieser, 2007; Hoedemaker et al., 2007; Mansfeld et al., 2007; Roche et al., 2009; Wenz and Giebel, 2012) are all well-established and routinely used by many farmers and veterinarians.

However, although lameness is recognised as an important animal welfare issue (Whay et al., 1997; EFSA, 2009; Shearer et al., 2013), and is ranked as the third most important cause of economic loss on dairy farms (Green et al., 2002; Bruijnis et al., 2010; Cha et al., 2010), continuous claw health monitoring and assessment of claw health status is still in the early stages (Shearer et al., 2004; Fiedler and Maierl, 2004; Landmann et al., 2004; Pijl, 2004; Feldmann et al., 2007; Bell et al., 2009; Kofler, 2012; Wenz and Giebel, 2012).

One key reason for this could be that, until now, programs capable of digitally recording and documenting claw data digitally were not readily accessible. The availability of computerised data analysis is recognised as a precondition for efficient herd health monitoring (Etherington et al., 1995), as only computerised data analysis enables a rapid and simple comparison of health data, either within or between herds (Etherington et al., 1995; Mansfeld et al., 2007; Wenz and Giebel, 2012). Such programs are already routinely used on dairy farms for monitoring reproductive performance, energy balance and udder health status of cows (Khaitsa et al., 2000; Heuwieser, 2007; Hoedemaker et al., 2007; Martin et al., 2007; Thorup et al., 2012; Wenz and Giebel, 2012), and this approach needs to be more commonly used to monitor claw health.

## Historic documentation of hoof data

Prior to the introduction of computerised records, scientific studies evaluating claw data used paper recording (Murray et al., 1996; Greenough et al., 1997; Whay et al., 1997; Manske et al., 2002; Pesenhofer et al., 2006) or a combination of photographs and paper-based protocols (Leach et al., 1998; Smilie et al., 1999; Capion et al., 2008). Recording during claw trimming has also been carried out using paper-based systems, if at all (Manske et al., 2002; Koenig et al., 2005; Pesenhofer et al., 2006). However, this

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**Table 1**
List of currently available computerised claw trimming database programs worldwide.

| Name of program | Manufacturer/operating company | Country | References |
|---|---|---|---|
| KLP/KLP mobil | dsp-Agrosoft GmbH, Ketzin | Germany | http://www.portal-rind.de, Feucker et al. (2004), and Feucker (2009)[a] |
| DLBR Klovregistrering | Dansk Landbrugs-radgivning, Landscentret, Aarhus | Denmark | http://www.clawhealthregistration.dk/DK/, http://video.dlbr.dk/tag/klovregistrering, DLBR Klovregistrering (2012), and Capion (2010) |
| Digiklauw | CRV, Arnhem | The Netherlands | https://www.crv4all.nl/downloads/van-kalf-tot-koe/BvKtK_NED_DEEL2_HS4.pdf |
| Hooftec | SKS Foot Trimming Service Ltd, Willowhurst Farm, Golden Cross, East Sussex | UK | http://www.sksfoottrimmingservice.co.uk/ |
| I-SAP (Salud podal) recording system | CONAFE – Confederación de Asociaciones de Frisona Española; Valdemoro | Spain | http://www.conafe.com and http://vimeo.com/51048148 |
| Hoof Supervisor System | Supervisor Systems, KS Dairy Consulting Inc., Dresser, WI | USA | http://www.supervisorsystems.com,Murray (2010), and Shearer and Van Amstel (2013) |
| Accu-Trac Hoof Analyzer | University of Wisconsin, WI | USA | http://www.comforthoofcare.com/ and Döpfer (2012) |
| Pocket Trimmer System Dairy Comp 305 | VAS Valley Agricultural Software, Tulare, CA | USA | http://www.vas.com/products.jsp and Wenz and Giebel (2012) |
| Klauenmanager | SEG Informationstechnik GmbH, Bad Ischl | Austria | http://www.klauenmanager.eu/, Kofler et al. (2010, 2011, 2013), Kofler (2012), and Keplinger et al. (2013) |

[a] See: Managementsystem Klauengesundheit. dsp-Agrosoft GmbH; http://www.portal-rind.de/index.php?name=News&file=article&sid=144.Produktbeschreibungen (accessed 29 November 2012).

is no longer acceptable as the additional processing needed for data analysis is too time consuming.

## Computerised claw trimming database programs

The key objective driving the development of computerised claw trimming database programs has been to enable the instant documentation of claw lesions during trimming and treatment. Such recording means that data can be provided for the client and immediately analysed once the trimming and treatment have finished, and also means that the data can be accessed at any later time point (Shearer et al., 2004; Wenz and Giebel, 2012; Keplinger et al., 2013; Kofler et al., 2011, 2013).

In recent years, claw-trimming professionals in Europe and North America have developed and introduced several different programs that are capable of digitally documenting and recording claw data. Table 1 lists the trade names, manufactures or operating companies of the currently available programs globally.

The application of digital programs for documentation of claw lesions has been reported in several countries including Germany (Feucker et al., 2004; Landmann and Koenig, 2006), Denmark (Capion, 2010), The Netherlands,[1] United Kingdom,[2] Spain,[3] United States (Shearer et al., 2004; Döpfer, 2012; Shearer and Van Amstel, 2013), Canada (Murray, 2010) and Austria (Kofler et al., 2011, 2013; Kofler, 2012). Documentation in practice is carried out using pocket PCs (Shearer et al., 2004), shockproof and water-resistant touchscreens connected to a laptop, or using laptops only (Kofler et al., 2010, 2011, 2013).

Currently, there are approximately 1400 herds in Denmark for which computerised claw data are being recorded by 50 claw trimmers (N. Capion, personal communication). Computerised claw trimming database programs are routinely used by 73 claw trimmers in Germany (W. Feucker, personal communication), by 70 claw trimmers in The Netherlands (M. Holzhauer, personal communication), by 40 claw trimmers in the UK (J. Clarke, personal communication), by 20 claw trimmers in Spain (A. Adrián González Sagüés, personal communication), by 16 claw trimmers in Austria and by 10 claw trimmers in Wisconsin, USA (N.B. Cook and K. Burgi, personal communication).

## Applications of digital programs

The computerised claw trimming database programs listed in Table 1 have a wide range of applications. They document client and farm details, cow identification, a pre-determined number of claw lesions, severity scores for those lesions, and additional comments made by the claw trimmer. Furthermore, previous trimming records are available instantly and cows can be marked for re-checks or for presentation to the veterinarian. These programs can record the use of blocks, bandages and other treatments, and invoices can be calculated and printed instantly after completion of the claw trimming visit on the farm (Kofler et al., 2011; Wenz and Giebel, 2012).

All of the programs listed in Table 1 are suitable for automatic analysis of some or all of the following parameters: prevalence of different claw lesions, proportion of lesions in each severity score category, lesion location – lateral vs. medial, fore vs. hind, interdigital vs. digital skin, and the lameness prevalence noted during claw trimming sessions. Additionally, most of the programs include interfaces to link in with other herd health management programs (Capion, 2010; Kofler et al., 2011; Wenz and Giebel, 2012; Shearer and Van Amstel, 2013).

Both the American Hoof Supervisor System (Shearer and Van Amstel, 2013) and the Austrian Klauenmanager program are able to record the exact location of the lesion using the International Hoof Map which divides the claw into zones (Greenough and Vermunt, 1991; Greenough et al., 1997) and locomotion scores (Sprecher et al., 1997).

The Klauenmanager program, developed for the claw trimming practice, offers 12 defined claw lesions, and three severity scores of each lesion (Kofler et al., 2011), according to recommendations from the scientific literature for the assessment of claw lesions and of their severity (Leach et al., 1998; Smilie et al., 1999). Those authors had calculated severity scores for claw lesions using a geometrical calculation and these were then used to calculate Cow-Claw-Score (CCS), Farm-Claw-Score (FCS) (Greenough and Vermunt, 1991; Leach et al., 1998; Smilie et al., 1999; Huber et al., 2004) and Farm-Zone-Score (FZS) (Kofler et al., 2010, 2011).

The CCS is the sum of the geometrically calculated severity scores of the lesions in all 10 zones of all eight claws in one cow (Greenough and Vermunt, 1991; Leach et al., 1998; Smilie et al.,

[1] Digiklauw, 2012. https://www.crv4all.nl/downloads/van-kalf-tot-koe/BvKtK_NED_DEEL2_HS4.pdf (accessed 29 November 2012).
[2] Hooftec, 2012. http://www.sksfoottrimmingservice.co.uk/ (accessed 29 November 2012).
[3] I-SAP, 2013. http://www.conafe.com/; http://vimeo.com/51048148 Accessed 4 June 2013.

1999). The FCS is the median of all CCS of a herd (Huber et al., 2004). These numerical claw health parameters reflect the type and severity of claw lesions of one single cow (CCS), of all the cows in one herd (FCS) and of the most severely and most frequently affected claw zones in one herd (FZS) with one single number for each (Kofler et al., 2010, 2011, 2013; Keplinger et al., 2013). Lower CCS and FCS scores indicate better claw health. A good CCS and FCS value for both heifers and cows is <35 (Kofler et al., 2011).

The FZS is the total of all CCS of all cows in a herd for each particular claw zone. This parameter is useful for identifying the most severely and most frequently affected claw zones in a herd, and thus identify the key potential risk factors for those lesions (Kofler et al., 2011, 2013).

## Benefits of computerised claw trimming database programs

Why should professional claw trimmers spend large sums of money for an electronic documentation system and why should they spend additional time during claw trimming (about 15 s per cow) recording all the lesions? In most countries where such programs have been established, the software and its accompanying hardware are paid for by the professional as an investment for his modern service (Döpfer, 2012; Kofler et al., 2013; J. Clarke, personal communication; G. Cramer, personal communication; J.K. Shearer, personal communication). A different approach exists in Denmark, where the Danish Cattle Breeding Association supports claw trimmers financially by purchasing the software tool and reimbursing a large part of the cost of the hardware purchased. In exchange, the Danish Cattle Breeding Association has access to all the documented computerised claw data collected by the claw trimmers (Capion, 2010), giving them a large pool of claw data for heritability calculations. A similar arrangement is used in The Netherlands, where all recorded data are transferred to a breeding association, which analyses the data and returns the information back to the farmers (Digiklauw, 2012; M. Holzhauer, personal communication).

Irrespective of the financial investment, the benefits of computerised claw trimming database programs for claw trimmers are many; undoubtedly, one benefit is the creation of a big step towards modern customer service through instant data analysis and invoicing. Another benefit is the transfer of regularly documented claw data to the farmers, veterinarians and breeding associations. As the claw trimmer who is equipped with such a digital system has claw data for all trimmed cows, including those trimmed in the past, and this information available at any point he can keep a comprehensive data set of claw health. For the farmer and veterinarian, computerised records provide quick, easy access to prevalence of diagnosed claw lesions, their severity scores, the exact location of claw lesions, and the lameness prevalence (Shearer et al., 2004; Kofler et al., 2011, 2013; Wenz and Giebel, 2012; Shearer and Van Amstel, 2013).

Computerised database programs that record cow and farm level scores (numerical calculated parameters) allow for an easy comparison of claw data at subsequent visits (Kofler et al., 2013) or a comparison of claw data from different herds (Keplinger et al., 2013; Kofler et al., 2013). The FCS expresses the claw health of the herd in one number (Kofler et al., 2011) in a similar manner to the somatic cell count for the bulk milk of a farm (Emanuelson and Funke, 1991) and can be used by the farmer, claw trimmer and veterinarian as a claw health management tool. Progress in improving claw health can be easily followed by creating a boxplot graph of CCS values.

## Outlook

Digital documentation of claw data recorded at regular claw trimming visits and immediate computed analysis of those data with automatic calculations and graphical presentation of a wide range of parameters (Etherington et al., 1995) provides all the prerequisites for veterinarians to establish a modern claw health monitoring program.

All programs detailed in Table 1 come with a preselected range of diagnoses; however, the quality of such diagnoses is dependent on the level of education of the claw trimmer and their ability to recognise lesions accurately and to score lesion severity correctly. The Danish, Dutch and Austrian programs offer an integrated photo chart showing all claw lesions, their various severity scores and a photo chart of the various locomotion scores, in order to help claw trimmers to identify the lesions correctly and score locomotion effectively. In addition, regular training sessions are essential for all users of these programs; the operating companies could offer such sessions, as could national claw trimming or breeding associations.

Locomotion assessment during trimming sessions does have some limitations caused by the cows stress reaction during claw trimming procedures (Pesenhofer et al., 2006) and possibly non-representative movements to the trimming crush. Nevertheless, locomotion scoring at the claw trimming visit can provide a useful overview and allows a concurrent comparison of prevalences of claw lesions and lameness (Manske et al., 2002; Wenz and Giebel, 2012; Kofler et al., 2013).

All of the computerised claw trimming database programs listed in Table 1 are integrated with interfaces linked to other herd health management programs. This allows claw data to be integrated with other performance parameters such as milk yield, somatic cell counts and reproduction data. Accordingly, analysis of production groups, such as pregnant heifers and cows within defined stages of lactation, becomes more comprehensive (Shearer et al., 2004; Wenz and Giebel, 2012; Kofler et al., 2013). Moreover, nationwide collection of computerised claw data recorded by a large number of claw trimmers and other professionals represents a highly valuable data pool for estimation of genetic heritabilities of claw disorders and for genetic evaluations of sires (Koenig et al., 2005; Van der Waaij et al., 2005; Aamand, 2006; Eriksson, 2006).

## Conclusions

Computerised documentation of claw data recorded during the claw trimming procedure followed by immediate computerised analysis will raise the standard of claw health monitoring program in dairy herds within the next decade, supporting farmers, claw trimming professionals and veterinarians worldwide.

## Conflict of interest

The author of this paper has no financial or personal relationship with other people or organisations that could inappropriately influence or bias the content of the paper.

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