On-farm udder health monitoring

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Summary
In this article an on-farm monitoring approach on udder health is presented. Monitoring of udder health consists of regular collection and analysis of data and of the regular evaluation of management practices. The ultimate goal is to manage critical control points in udder health management, such as hygiene, body condition, teat ends and treatments, in such a way that results (udder health parameters) are always optimal. Mastitis, however, is a multifactorial disease, and in real life it is not possible to fully prevent all mastitis problems. Therefore udder health data are also monitored with the goal to pick up deviations before they lead to (clinical) problems. By quantifying udder health data and management, a farm is approached as a business, with much attention for efficiency, thought over processes, clear agreements and goals, and including evaluation of processes and results. The whole approach starts with setting SMART (Specific, Measurable, Acceptable, Realistic, Time-bound) goals, followed by an action plan to realize these goals.

Introduction
Management of udder health is one of the critical processes in a dairy farm. Udder health management influences the mastitis situation in a herd, which can have huge economic consequences (2, 4), influences dairy cow welfare (14) as well as work satisfaction of farmers (6). Farmers consider mastitis a complicated disease. They know that udder health often can be improved, but they often do not take action and keep on doing what they always have been doing. Dairy farmers who do want to improve udder health, often do not know where to start and how to approach the disease (6). Although many farmers are aware that mastitis is a multifactorial disease that needs a long-term multifactorial approach in order to improve the situation, they do not act likewise. Many tools for on-farm application are available, but many farmers are waiting for ‘the golden bullet’, the simple, efficacious and cheap solution that solves all mastitis problems (7).

This paper will approach udder health in a business-like approach, taking the current udder health situation on a farm as a starting point. Monitoring udder health basically has two aspects. The first aspect is related to mastitis data, goal setting and checking results at regular intervals. The second aspect is directed towards the management itself, trying to monitor critical control points in the daily work in order to influence the management before it leads...
to complaints or suboptimal results. This paper intends to give some insight in monitoring data as well as management processes, and will provide examples of tools used for these purposes in the Netherlands. More details on these tools can be found on the website of the Dutch Udder Health Centre (www.ugcn.nl).

**Monitoring udder health data**

Farmers are not used to approach mastitis quantitatively, while there is a lot to gain in that field. Mastitis is the most expensive disease in a dairy herd (2) and over 70% of farmers underestimate the economic costs related to udder health (4). Only approximately 2% of farmers has a quantitative goal for mastitis, generally not taking rational decisions on whether or not to put extra energy into the subject. If a dairy farm, and more specifically, udder health management in a dairy farm, is approached as a business, decisions have to be made at several levels (Fig. 1).

![Pyramid of business](image1)

In order to make rational decisions, it is necessary to set goals and to have reliable data to compare to these goals. In a business-like approach of udder health a standard management circle can be used in which it has to be decided whether or not one is satisfied with the udder health situation. If parameters are sufficient, business can go on as usual. If, however, parameters are insufficient, if they do not meet the goals set, data have to be analyzed to find the cause. Based on the findings, the management may need to be analyzed in more or less detail, and may have to be changed in order to improve the results (Fig. 2).

Implementing a management circle starts with setting goals. To do that, it is important to first quantify the current mastitis situation. Preferably a one year period is used for that, because shorter periods may be influenced by seasonal variability (18). Even if herd health programs implementing tools such as the management circle are not used by veterinary practitioners, goal setting may be a very simple and rewarding approach. Simply asking clients what their goal is on udder health can tell you a lot. Literally do not take “No” for an answer. Asking further is not in the nature of the veterinary practitioner (8) but it can give a lot of information on the motivation and goals of the farmer and the advisory work you as a practitioner can do on that farm (12).

Quantifying the most important udder health parameters over the previous year helps to visualize the current situation. This is the starting point of any herd health program, trying to take rational decisions on whether or not to try to improve that situation. This type of schemes can be software based and is available in many herd management programs. If these are not available on a farm, a start can be made with a very simple basic approach to quantify mastitis: what is the situation now, am I satisfied or do I want to improve it? A simple scheme is shown in Table 1, where examples of parameters are presented, that can be replaced by others.

![Management circle](image2)

Generally the most important **udder health parameters** to evaluate consist of bulk milk and individual somatic cell count (SCC) and clinical mastitis data. In specific herd situations it may be advisable to add parameters focusing on e. g. cows culled or heifers with mastitis. Based on a review of the udder health status of a herd and on all relevant aspects, goals may be set. These goals ought to be SMART:

- **Specific** (clear and unambiguous)
- **Measurable** (quantitative)
- **Achievable** (meets the goals)
- **Realistic** (achivable)
- **Time-bound** (timeframe for achieving the goal)
Specific: Not “as little mastitis as possible”, rather “15 cases of clinical mastitis in 2011.”
Measurable: Data should be available to measure outcomes. If, for instance, no reliable documentation of clinical mastitis is in place, start with SCC data.
Acceptable: All involved should be convinced that the goal is worthwhile, especially the farmer. He or she has to do the work. Motivation issues are crucial.
Realistic: When a bulk milk somatic cell count (BMSCC) has been around 350,000 cells/ml for a number of years, it may be unrealistic to set < 100,000 cells/ml for the forthcoming year.
Time-bound: Decide when results are evaluated and the goal has to be met.

Obviously, SMART goals are very herd specific. They depend on the current situation, the currently available data and on the ambitions of the farmer. Given welfare, antibiotic use and economic consequences, however, our opinion is that it is worthwhile for dairy farmers to be ambitious on udder health. Ambitious udder health goals are presented in Table 2. Some farmers may be more ambitious, for others it may take some years to realize them, but basically it should be reachable on every dairy farm.

Based on the data described above it is possible to quantify the current mastitis situation and to set realistic goals for the forthcoming year. This can be further optimized by calculating the economic costs associated with these parameters. In many countries tools are available to calculate these costs (e. g. Huijps et al. [4]). Subsequently, the costs of management factors associated with improving udder health can be weighted against potential profit, leading to a business-wise cost-benefit analysis of udder health, ignoring other motivating aspects that are important in relation to mastitis (3).

Additionally, bacteriological results from across the year ought to be reviewed. Often these data of individual cows are available, but they are rarely organized and analyzed at the herd level. Ideally all clinical mastitis cases are cultured to optimize treatment of individual cows. Alternatively, collect samples of all cases of clinical mastitis, label and freeze them. Samples can then be cultured as required. The distribution of bacterial pathogens should be assessed at least annually and as a minimum, quarter samples from at least 10 high SCC cows and 10 clinical mastitis cows should be cultured (10). More details on microbiological monitoring on the dairy farm have been described earlier (11) and are presented in another article in this issue of Tierärztliche Praxis by Zoche et al. (29).

**Monitoring udder health management**

Monitoring udder health data as described above, basically is curative work at the herd level. Results are reviewed on a regular base, and when deviating occurs action is taken. The larger the herd is, the more data are available, the smaller standard variation in data will be and the more reliable this approach is. In herd health this approach is crucial in order to pick up (herd level) problems at an early stage to prevent serious problems.

In addition to this, there is the real preventive approach. Independent of the results at a point in time, one tries to optimize management according to the best knowledge available in order to prevent problems. This approach is called Hazard Analysis of Critical Control Points (HACCP) and has been described for the dairy farm by Noordhuizen et al. (16). HACCP adds value to the management circle approach as presented in Figure 2, but can not fully replace it. Monitoring preventive udder health management can be done on several aspects. Which ones are actually implemented, partly depends on the herd situation and history.

The standard preventive udder health management program, called the 5-point plan, was introduced in the sixties in the United Kingdom and focused mainly on contagious pathogens such as *Streptococcus agalactiae* and *Staphylococcus aureus* (15). The five issues were: milking technique and milking machine; treatment of clinical mastitis; dry cow treatment; post-milking teat disinfection; and culling of chronically infected cows. Over the years, the prevalence of contagious pathogens has changed, leading to a (relative) increase of the importance of other pathogens (26). The increasing role of environmental pathogens and the increased knowledge on different subjects related to mastitis led to an extension of the standard mastitis prevention plan by the National Mastitis Council to a 10-point plan (www.nmconline.org). In this plan attention is also given to maintenance of a clean, dry and comfortable environment; record keeping; maintenance of biosecurity; and also on...
regular monitoring of udder health status. It is impossible to discuss all possible preventive management measures related to udder health in detail in this paper. A few examples, in which monitoring preventive management plays an important role are presented here.

Hygiene

The effect of housing hygiene on udder health has been shown in several reports. In a study on herds with a low BMSCC, the frequency of cleaning straw yards was found to be correlated with clinical mastitis (19). A monitoring approach on hygiene scoring of leg and udder was described by Schreiner and Ruegg (27), using a four-point scale ranging from 1 (very clean) to 4 (very dirty). Their analysis showed a significant relation between subclinical mastitis and leg and udder hygiene scores: the dirtier the cows are, the higher the SCC is and the more major pathogens are cultured from milk samples. In a study on 23 dairy herds in the Netherlands a significant relation between the percent of cows with hygiene score 3 or 4 and BMSCC was found (y = 0.124 x – 5.501; adjusted R² = 0.30; P < 0.01) as is presented in Figure 3.

Scoring udder and leg hygiene is a way to visualize the infectious pressure from the environment. Even if udder health parameters are up to standards, dirty cows indicate the management can be optimized in order to prevent problems. The manure may be too watery, or cows may have problems to stand up before defecating, indicating nutrition or cubicles may need to be improved (5).

Body condition

One of the goals in nutrition advice related to udder health is to prevent negative energy balance. Negative energy balance (NEB) has a detrimental effect on host resistance, due to either an effect on migration capacity or viability of leucocytes, or to the consequences of a high blood β-hydroxybutyrate concentration (9).

First test day milk yield and the fat to protein ratio as well body condition score (BCS) are important indicators of disease (24). In a study in 52 UK herds, routine BCS at drying off and the associated managerial changes based on the results of BCS, were found to be associated with a reduced rate of clinical mastitis (1). They described that both, milk yield and BCS ought to be monitored on a regular base.

In order to prevent NEB, nutritional composition, feeding regimen, and BCS are factors of importance. The energy balance of cows on the top of their lactation is hardly influenced by nutrition at that point in time. On the contrary, trying to correct a NEB by giving extra concentrate then, may easily lead to rumen acidosis. To prevent NEB, it is of importance to try and limit the reduction of dry matter intake around calving as much as possible. Reduction of dry matter intake may lead to mobilization of bodyfat, and thus to increased levels of non-esterified fatty acids, which may accumulate in the liver and ultimately lead to fatty liver syndrome (23). Dry matter intake in the period around calving is influenced by BMSCC at calving. An optimum of BMSCC at calving is 3.0 to 3.25 on a 5-point scale. Calving BMSCC ≥ 3.5 is associated with a reduction of early lactation dry matter intake and increased risk of metabolic disorders and mastitis (24).

Teat ends

Milking machines and milking routines have a huge influence on udder health. Milking machines should be mechanically checked at least once every year, preferably during milking. The frequency of training milkers was found to be related to efficiency of milking and the rate of clinical mastitis (25). Trying to keep the machine-on time as short as possible, it is important to allow cows time for milk letdown, 60–90 seconds should elapse between the beginning of pre-treatment and cluster attachment. The milking routine should be quiet, careful and consistent.

Scoring teat condition gives a good impression of the functionality of the milking machine and procedure, and many articles have been published on this subject, summarized by Ohnstad et al. (17). Teats ought to be scored just after removing the milking cluster. When more than 10% of cows have pronounced teat rings or other teat deviations, milking machine or milking routines need further attention. Teat ends should be scored every three months (5).

Treatment

Counting the numbers of mastitis treatments is part of monitoring udder health data, rather than monitoring udder health management. Monitoring treatment results, however, can give important information on optimizing treatment in the future. Suboptimal therapy may result in disappointing cure-rates, can be a source of new infections, and may lead to increased antibiotic resistance (22). To optimize treatments, rational decisions on therapeutics and on which cows need to be treated have to be made. Each herd
should have a standard herd-level treatment protocol for clinical mastitis, subclinical mastitis and dry cow treatment. These on-farm protocols use clinical signs such as general impression of the cow, fever, colour and texture of the milk, to categorize cases and select case-specific therapy. If available, SCC history of cows can also be included. The specific treatments recommended depend on available products, price and quality of these products, and earlier culture results. If a herd-level treatment plan is followed, the outcome can be monitored, and it can be determined whether treatment can be improved. This evaluation should take place at least annually (10). In this evaluation the farmers’ satisfaction should be included. SCC patterns after treatments and after calving should be evaluated and results of bacteriological cultures (before and after treatment) may be evaluated. Be aware of cow effects, it is not only the therapy that is being evaluated (28). The bacteriological status of a herd ought to be evaluated on a regular base (29). It may be useful to also audit the farmers’ medicine stock. This may help in optimal medicine use and in minimising the costs due to expired medicines (10).

On-farm application

Mastitis is a multifactorial disease, and is an important issue in all dairy herds. Improving udder health should start with goal-setting, including economic cost-benefit analysis. In some herds mastitis data as well as preventive management is up to standards, and attention can be given to other aspects of the dairy farm. Even in those herds, it is important to monitor the mastitis situation, and preferably also a number of critical control points in the management. The primary parameters on udder health to monitor are BMSCC and clinical and subclinical mastitis. Bulk milk SCC is a good first approach because it is available in every herd and can be compared to other herds easily. The limitations of the parameter, however, ought to be recognized (13). Data on individual SCC and clinical mastitis are of much more importance to monitor and analyze the mastitis situation in a herd. Several other methods are available for monitoring udder health on farm, such as bacteriological culturing, molecular methods, electrical conductivity and enzyme measurements (11).

Critical control points in preventive mastitis management are in the fields of infectious pressure, host resistance, milking and treatment (5). In this paper methods to monitor hygiene, body condition, teat end condition and treatment outcomes have been presented, as examples of these four attention fields. There is no “golden bullet” that solves or prevents all mastitis problems. A more or less extended check-list is required to manage the disease. In such a check-list both, monitoring of udder health data and of critical control points are integrated. An example of such a list is presented in Table 3. This example is not meant to be complete, it can be extended or shortened, dependent on the local situation. Although it contains closed questions, each question can be the start of a discussion on a certain subject itself.

Table 3 An example of an on-farm check-list on udder health

<table>
<thead>
<tr>
<th>Udder health check-list</th>
<th>Date:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mastitis data</td>
<td>Goal</td>
</tr>
<tr>
<td>BMSCC</td>
<td></td>
</tr>
<tr>
<td>Number of clinical cases / 100 cows / year</td>
<td>Yes / No</td>
</tr>
<tr>
<td>% of cows with SCC &gt; 200,000 cells/ml</td>
<td>Yes / No</td>
</tr>
<tr>
<td>Milking</td>
<td></td>
</tr>
<tr>
<td>Do you use one cloth per cow?</td>
<td>Yes / No</td>
</tr>
<tr>
<td>Do you prestrip?</td>
<td></td>
</tr>
<tr>
<td>Do you use milking gloves?</td>
<td>Yes / No</td>
</tr>
<tr>
<td>Are teats dipped with a disinfectant after milking?</td>
<td>Yes / No</td>
</tr>
<tr>
<td>Are liners replaced after 2500 milkings?</td>
<td>Yes / No</td>
</tr>
<tr>
<td>Treatment</td>
<td></td>
</tr>
<tr>
<td>Are all cows dried off with antibiotics?</td>
<td>Yes / No</td>
</tr>
<tr>
<td>Is Body Condition Score at calving ≥ 3.5?</td>
<td>Yes / No</td>
</tr>
<tr>
<td>Host resistance</td>
<td></td>
</tr>
<tr>
<td>Are all cows dried off with antibiotics?</td>
<td>Yes / No</td>
</tr>
<tr>
<td>Infectious pressure</td>
<td></td>
</tr>
<tr>
<td>Are cubicles of lactating and dry cows mucked out twice a day?</td>
<td>Yes / No</td>
</tr>
<tr>
<td>Is hygiene scoring of lactating cows up to standards?</td>
<td>Yes / No</td>
</tr>
<tr>
<td>Does the barn smell fresh?</td>
<td>Yes / No</td>
</tr>
</tbody>
</table>

Dependent on the situation subsequent steps can be taken. In all cases mastitis data, evaluating milking procedures, treatment results, infectious pressure, and host resistance should be part of regular on-farm monitoring of udder health.

Conflict of interest

The authors confirm that they do not have any conflict of interest.

References

Rezension

Ganzjährige Freilandhaltung von Mutterkühen – tier- und standortgerecht


Den neun Autoren gelingt es, einen aktuell, gut verständlichen Überblick über die ganzjährige Freilandhaltung von Mutterkühen zu geben. Jedem, der sich mit dieser Thematik beschäftigt, sollte sich den Inhalt des Buches zu eigen machen.

Axel Wehrend, Gießen