



# IDF ANIMAL HEALTH REPORT

Research progress | Global insights | Expert opinion



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# PREFACE

## MESSAGE FROM THE IDF DIRECTOR GENERAL

Milk and dairy products are one of the most nutrient-rich foods for diets worldwide, and healthy and well-cared for animals produce safe and quality milk. Included in this report are examples of how the sector is working towards ensuring the highest quality animal care practices including information relating to environment, husbandry, nutrition, water, disease prevention, veterinary care and protection from extreme conditions.

The report offers an opportunity for those involved in the field to present their findings through innovative research and provides an update on progress achieved and lessons learned. IDF's work on animal health and welfare aligns with the efforts of international organizations (the World Health Organization, the Food and Agriculture Organization of the United Nations, the World Organisation for Animal Health and Codex), stakeholders and consumers.

We extend our thanks to the authors, whose contributions have helped to add value to this scientific report through their insights and analysis.

**Caroline Emond**  
IDF Director General



## MESSAGE FROM THE CHAIR OF THE IDF STANDING COMMITTEE ON ANIMAL HEALTH AND WELFARE

First, I would like to congratulate the Scientific Editors with another new IDF Animal Health Report of 2019. This report is dedicated to animal welfare cases and is a follow up of the IDF Guide to Good Animal Welfare in Dairy Production 2.0, adapted to the OIE and ISO standards.

Good animal welfare is first of benefit to animals, but also benefits farmers, resulting in increased trust from consumers and increased sustainability in dairy production. Animal welfare focus areas differ from country to country according to history, tradition and culture, as reflected in this report. It is vital to share expertise, documentation, and systematic approaches on how to improve animal welfare. Only by sharing knowledge between countries can we improve practices globally.

With 17 contributions from 9 different countries this report is a good example of how we can share best practice on animal welfare within the sector. In particular, we would like to thank Sweden for the numerous inspiring case studies shared on this report.

I hope you find the report an informative read.

**Dr Olav Østerås**

*Chair of the IDF Standing Committee  
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## MESSAGE FROM THE SCIENTIFIC EDITORS

Welcome to the 13th edition of the IDF Animal Health Report! In this issue we focus especially on animal welfare. Authors shared interesting research results ranging from reproduction to stockmanship and welfare assessments. Important preventive work is also presented, with special focus on healthy udders and hooves. One of the most important consumer concerns in the dairy production is early cow and calf separation. Therefore, you can find the latest research on both alleviating stress at separation and on investigating possibilities for keeping cow and calf together. Lameness is another of the main issues of consumers concern. Economic incentives for regular hoof trimming is one cornerstone in the preventive work for healthy hooves in Sweden.

Welfare assessments are mainly performed to reduce the risk of poor welfare by assessing absence or presence of negative welfare indicators. In this issue, the assessment of positive welfare indicators on research is presented. New technology is also of great importance in welfare assessments. Examples presented here in this report includes cow body scanning technology and automatic behavioural analysis.

Read about these and many more inspiring examples for improving global animal welfare.

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# ANIMAL WELFARE INITIATIVES

## ASSESSMENTS OF POSITIVE WELFARE

### Welfare Certification System

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#### UN SDGs



#### SUMMARY

- **Location:** Nationwide, South Korea
- **IDF Welfare Action Area:** Husbandry practices
- **Resource based measure:** Responsible production
- **Animal based measure:** Ensure freedom of animals, animal health and welfare and pleasant environment for animals
- **Group demographics:** Both male and female are making contributions to this system.

#### MATERIAL AND METHODS

Any farms wishing to be certified prepare a required application form and submit it to the Animal and Plant Quarantine Agency, which is in charge of the certification system. If the application is approved, the Agency will notify the result to the applicant within 30 days. Then at least two inspectors will visit the farm to scrutinize in order to ensure it accords with the standards of animal welfare.



Figure 2 – Signboard at Certified Farm.



Figure 3 – Animal welfare logo on the products.

#### INTRODUCTION

Healthy animals provide us with safe products when they benefit from improved animal welfare through a pleasant breeding environment with minimal stress and pain. To ensure animal welfare during responsible production and consumption and with an amendment to the Animal Protection Act, the animal welfare farm certification has been implemented since 2012. The certification originally applied to laying hens and was then extended to the dairy sector in 2015. The Animal and Plant Quarantine Agency certifies a livestock farm which breeds humanely in accordance with high standards of animal welfare with the purpose of improving animal well-being and the quality and safety of livestock products.

For dairy farms for example, there are five areas to scrutinize with 32 items, including management of the dairy cow facility and health conditions plus an additional standard with regard to free-grazing. A dairy farm should have an area with an area of over 337 square metres per head. It must also include a dairy barn with non-slippery floor and an aisle with less than a 26-degree slope and over eight square metres of bed space per head.

Once approved, the Agency will issue a Ministry of Agriculture, Food and Rural Affairs approved certificate. Once a farm is qualified as an animal welfare livestock farm, the Agency and the local government departments will work together on the follow-up management of the production process and labelling requirements. This inspection regimen will take place at least once a year.

#### RESULTS AND DISCUSSION

Not only does Korea certify farms and products with regard to animal health, but it also has extended this to transportation vehicles and slaughterhouses that practice animal health in order to improve the level of welfare. This demonstrates that all the stages from breeding to slaughtering are managed systematically to produce safe and sustainable livestock products including dairy.

However, this certification system is not fully known to consumers yet. Raising consumers' awareness is crucial to the success of the system. It is important that, alongside promotion of the certification process to farms and products, the end user is also made aware of the system and its benefits for animal welfare. Moreover, educational programmes



Figure 1 – Certification Process.

# Body language – what can it tell us about positive welfare in dairy cattle?

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## UN SDGs



”Not only does Korea certify farms or products with regard to animal health, but it also has extended this to transportation vehicles and slaughterhouses that practice animal health in order to improve the level of welfare.”

## Byung Gab Son

targeting farmers are also needed so that they adopt the farming methods that improve animal welfare. Both farmers and consumers are responsible for improving the circumstances of animals in farming for safe and sustainable products.

## CONCLUSIONS

Recently, the government has announced that it will revise the animal welfare certification system. Farmers often feel the burden of applying for the certificate because of the initial investment. The government has responded by preparing a direct payment programme to solve the burden of income decrease. It will also develop and disseminate a standardized animal welfare manual for livestock in order to attract more farmers who wish to receive the animal welfare certificate.

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## SUMMARY

- **Location:** Sweden
- **IDF Welfare Action Area:** Health management
- **Group demographics:** Both men and women contribute to this system

## INTRODUCTION

Welfare assessment schemes have long been a part of dairy production. In almost all cases, the focus is on reducing the risk of poor welfare through recommendations related to housing design and management, or on indicators of poor welfare, such as lameness. Of course, this is important, but indicators of good welfare are also needed. This article summarises some of the work carried out at the Swedish University of Agricultural Sciences (SLU) to investigate indicators of positive welfare in dairy cattle. (See de Oliveira and Keeling, 2018 for the full publication).

There is growing evidence that some behaviours are likely to be associated with positive states in animals. These include play, exploration and grooming, but they are influenced by the age of the animals and by the possibilities in the environment to perform these behaviours [1]. Another area which is receiving increased attention is that of body language (a combination of body postures and small body movements) and this is already widely used to detect pain and other negative states in animals. Indeed, it is an animal's body language which could first attract and lead the farmer to examine that individual more closely for problems. But it is only very recently that body language associated with 'feeling good' rather than 'feeling bad' has been studied. Work in

pigs has focussed on tail posture [2] and in sheep and cattle it is mainly ear position which has received most attention [3, 4]. In the SLU study we focussed on ear, neck and tail positions in dairy cattle.

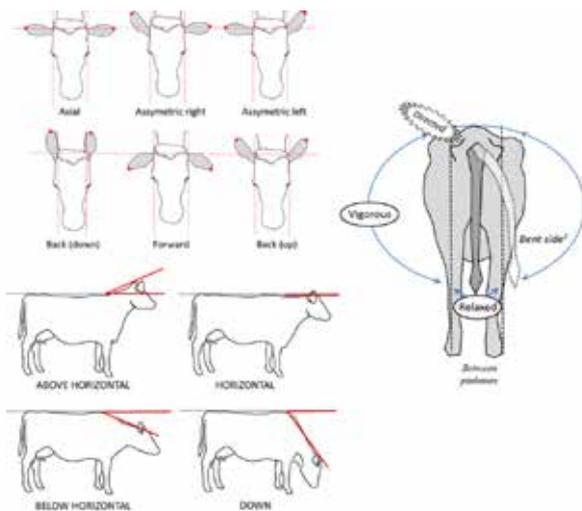
## MATERIAL AND METHODS

Behavioural observations were made on 72 cows (total of 3764 observations) while they were performing three different stationary routine activities (Figure 1). It was a mixed breed herd (Swedish Red and Holstein) in a loose housing system with an automatic milking system (average group size  $55.46 \pm 0.25$  (mean+se), average lactation number  $2.16 \pm 1.52$  and average milk yield  $30.9 \pm 0.6$  kg/day).

## RESULTS AND DISCUSSION

The results showed that a typical body posture during feeding was ears back up and neck down, with tail wags directed towards the body, during queuing their ears were mainly axial and forward, their neck below the horizontal and the tail hanging stationary and during brushing, their ears were backwards and asymmetric, the neck horizontal and the tail wagging vigorously. To understand how these different specific positions contributed to the overall body language, a principal component analysis was carried out. The different activities clustered specific body positions, confirming that cows express themselves differently when performing different activities in the barn, even if these activities all occur when the animals are standing still (Figure 2).

Emotion is often described in relation to two characteristics; their valence (how positive or negative it is) and the level of arousal that is involved [5]. Our knowledge of feeding and brushing was used to orientate the mapping of



**Figure 1** – Diagrammatic representation of the six ear postures, the four neck postures and the five tail postures used in the behavioural observations of cows feeding roughage from individual feed bins, queuing to be milked in the individual automatic milking system or using one of the mechanical rotating brushes.

these activities into this arousal/valence framework. There were no assumptions about the valence or arousal associated with queuing, so these results suggest that queuing to be milked is experienced more negatively and with a large variation in the level of arousal. Also important, is that there were no assumptions about what a specific body posture tells us about the valence or arousal levels of the cow with that posture. From Figure 2, therefore, we would predict that having the right ear back (ears asymmetrically right) is associated with more positive welfare than having the left ear back. The right side of the body is controlled by the left side of the brain, so this prediction is indeed in keeping with the currently accepted view of a lateralization pattern for emotional processing where there is a left-hemisphere dominance for processing positively connotated emotions [6]. Regarding tail wagging in cows there is a clear gap in our knowledge. Nevertheless, we can speculate that tail wagging in cattle might be associated with positive welfare, based on the stronger loading of vigorous wagging on the positive valence axis than tail hanging stationary, but their rather similar loadings on the arousal axis.

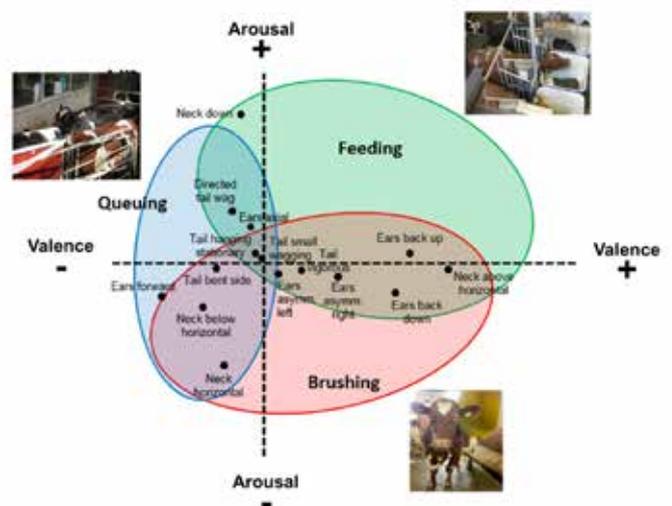
The key test of the worthiness of the methodological approach proposed here is whether the predictions are supported by new, independent studies. The usefulness of this new methodological

“Welfare assessment schemes have long been a part of dairy production. In almost all cases, the focus is on reducing the risk of poor welfare. Of course, this is important, but indicators of good welfare are also needed. It is only very recently that body language associated with ‘feeling good’ rather than ‘feeling bad’ has been studied.”

**Linda Keeling and Daiana de Oliveira**

approach for assessing positive welfare therefore remains to be confirmed and the results here should be considered as a first step. To our knowledge this study is the first to assess systematically a variety of different body postures in cattle from a holistic point of view and the novelty of this analysis brings new knowledge to the understanding of expression of emotion in cattle.

The full publication of this work is: de Oliveira, D. and Keeling, L.J. (2018) Routine activities and emotion in the life of dairy cows: Integrating body language into an affective state framework. *PLoS ONE* 13 (5), 10.1371/journal.pone.0195674



**Figure 2** – Illustration of ear, neck and tail postures of dairy cows during brushing, feeding and queuing in a loose housing system plotted as if on the arousal/valence framework using the results from a principle component analysis. Also illustrated are the 95% cluster for each of the three behavioural activities.

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## EMERGENCY SITUATION

# Fires in dairy barns - Prevention and recommendations

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### UN SDGs



### SUMMARY

- **Location:** Canada
- **IDF Welfare Action Area:** Husbandry practices
- **Resource based measure:** fire prevention and evacuation plans, fire safety protocols, appropriate euthanasia and depopulation protocols
- **Animal based measure:** skin condition, respiratory rate, mucosa and submucosa evaluation
- **Group demographics:** This practice includes dairy farmers, veterinarians, firefighters and stock personnel

### INTRODUCTION

Barn fires are among the most common emergency disasters in the dairy industry compromising the lives and welfare of animals and humans and causing significant economic losses and can usually be prevented with appropriate detection systems and maintenance. We briefly review the implications of barn fires, available prevention strategies and animal and resource-based measures to aid in prevention.

### THE SCOPE OF THE PROBLEM IN NORTH AMERICA

It is impossible to obtain full data for barn fires in North America because reporting is not mandatory, and those reported are usually related to insurance claims and media reports. Reported events are registered with the Federal Emergency Management Agency (FEMA) in the USA and provincial fire departments in Canada. The scope of the problem is large - the Animal Welfare Institute reported over 2000 cows dying in barn fires in the USA between 2013–2017, with 500 cows killed in a single fire [1]. In Ontario, Canada, over \$103 000 000 in losses are estimated following barn fires between 2013–2017 including damages, injuries and fatalities

with over \$29 million estimated in economic losses reported in 2015 alone [2]. These estimates are for barns housing livestock and are not organized by species or production systems. Although the total number of dairy cattle that perish or require euthanasia is small compared to other species, such as chickens, protection of all animals in the event of fire is essential because of welfare concerns.

### DISCUSSION

Profound changes in dairy production systems over recent decades have led to increased herd and barn sizes, emphasizing the necessity for emergency preparedness. The main causes of barn fires are faulty electrical systems and heating devices (due to environmental corrosion or faulty installations), misuse of ignition equipment, spontaneous flames caused by lightening, careless handling of open flames, such as cigarettes or welding equipment and wildfires [1, 3]. Barn fires occur predominantly during the winter months in North America, when adjunct heating systems might be required, although barn fires secondary to wildfires can happen year-round [4]. Climate change, shifting demographics and changes in land use are important factors in the development and management of wildfires [5].

The OIE recently developed guidelines for disaster management, published in the Terrestrial Animal Code [6]. Evacuation of animals might not be possible in all scenarios and potential short- and long-term emergency shelter sites should be discussed in advance as part of a disaster plan [7]. Preventive measures could include conducting annual checks of electrical systems in barns, ensuring that fuel tanks are stored away from barn walls, equipping barns with appropriately sized

fire extinguishers and training staff in their use. Safety of farm staff and emergency personnel is of paramount concern and rescue of trapped cows in burning barns is not always recommended. Animals that are easy to reach should be prioritized, but cattle can be difficult to move individually because of their strong desire to remain with other cows.

”Profound changes in dairy production systems over recent decades have led to increased herd and barn sizes, emphasizing the necessity for emergency preparedness. The OIE recently developed guidelines for disaster management, published in the Terrestrial Animal Code”

### Patricia Turner

Dairy cattle might be killed or severely injured from the fire itself or present with secondary health problems following smoke inhalation. Animal-based measures, such as skin and mucosa conditions and signs of respiratory injury, can be used to assess welfare after fires. Fire-associated complications are often the result of direct thermal injury from cinders and burning beams, chemical irritation and CO<sub>2</sub> and CO intoxication. Animal triage and aftercare measures should be determined following consultation with veterinarians. Animals with extensive burns should be immediately euthanized. Producers are generally in shock after a barn fire and are unable to provide intensive management and analgesia treatment for moderately to severely injured animals. As dust and debris can accumulate on the back of a cow both during a fire and in the process

of removing the animal from the barn, the full extent of eschar and burns might not be immediately apparent. Surviving animals should be closely observed for several days after a barn fire to ensure that they are uninjured and remain in stable condition. Veterinarians and producers should discuss in advance euthanasia and depopulation methods to be used in this type of disaster. Resource-based measure preparedness, such as fire detection, prevention and evacuation plans, fire safety protocols, barn design considerations, training of personnel and euthanasia and depopulation protocols can be used indirectly to assess the risk to animal welfare in the event of a barn fire.

In Canada, the Code of Practice for Dairy Cattle recommends installation of effective smoke detector systems and fire extinguishers in all buildings [8]. The National Farm Building Code of Canada includes minimal requirements for fire safety in farms. Additional fire prevention measures include monitoring and inspection of buildings with a focus on electrical systems, identification of problem areas, such as fuel tanks and diesel generators, with specialized personnel from fire departments and insurance companies, development of emergency plans and training of personnel [9, 10]. Similarly, in the USA, there are no mandatory standards. The National Fire Code defines minimal fire and human safety requirements for buildings housing animals, and the National Fire Protection Association has more specific recommendations and resources for municipalities [11]. None of these recommendations include guidelines for extensive grazing and outdoor farming systems, which might still be impacted by sudden wildfires.

## CONCLUSIONS

Barn fires in the dairy industry cause significant animal health and welfare concerns and economic losses. There are several preventive strategies, checklists and other resources available for fire prevention and response which can be used by producers and veterinarians to mitigate risk. Veterinary practitioners should include fire mitigation and disaster plans in their farm visits and understand the basics of fire behaviour and veterinary aftercare.



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## REPRODUCTION

# Adjusting the dry period length to improve animal welfare and health

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### SUMMARY

- **Location:** Uppsala, Sweden
- **IDF Welfare Action Area:** Health management
- **Resource based measure:** Feed composition
- **Animal based measure:** Energy balance, production diseases, milk production
- **Group demographics:** The research group consists of 2 women and 3 men

### INTRODUCTION

Dairy cow health and welfare can, with relatively simple and cost-efficient means, be improved by disputing established management practices and making adaptations to the physiology and needs of the modern, high-yielding cow. Presently, it is generally recommended that the dry period comprises approximately eight weeks, but today's dairy cows are often still in a high milk yield when it is time for drying off, which increases the risk of mastitis and metabolic problems during the dry off.

A postponed dry off procedure decreases the yield at dry-off which ameliorates the strain on the cow at dry off. However, a short dry period can reduce the milk yield

especially in the early phase of the next lactation. The reduced yield might limit the negative energy balance and thus the metabolic profile on the transition cows. Thus, a shorter dry period potentially improves their fertility. The current project addresses management practices which aim to improve cows' health and thereby also their welfare and the economy for the milk producer.

### MATERIAL AND METHODS

This project is based both on an experimental trial and an observational study with data from 78 577 lactations in the Swedish Official Milk recording scheme (SOMRS). In the experimental study multiparous cows of Swedish Red (SR, n=43) and Swedish Holstein (SH, n=34) were blocked by breed and parity and then randomly allocated to two different treatments; a conventional dry period (DP) of 60 days (60d) or a short DP of 30 days DP (30d).

### RESULTS AND DISCUSSION

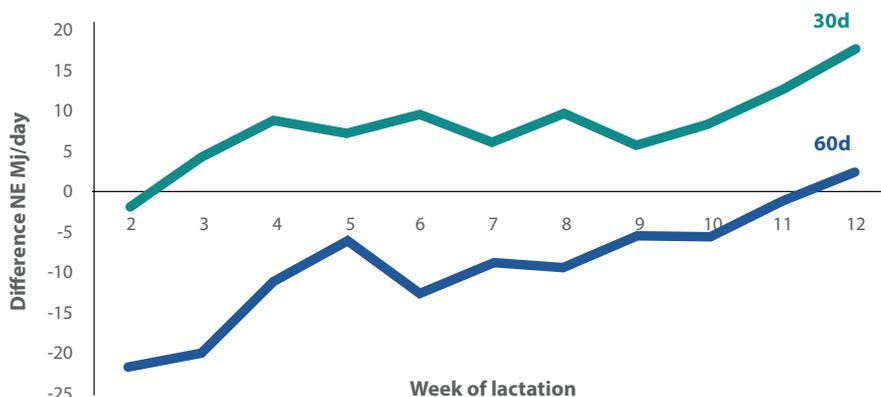
Shortening the dry period resulted in a reduction in milk yield in the following lactation. However, when the milk produced during the extended lactation

### UN SDGs



was added, the difference diminished (Table 1). Feed intake was virtually identical between cows subjected to short and conventional dry period respectively ( $P = 0.56$ ). The reduced milk production while feed intake was maintained in 30d cows completely abolished their negative energy balance (Figure 1). Endometritis, pyometra, anoestrus, ovarian cyst, mastitis, SCC and commencement of luteal activity did not differ between groups with a short or conventional dry period in the experimental study. One concern about shortening the DP has been the quality of the colostrum, however, the colostrum quality did not deteriorate in cows with a shortened DP and the concentration of IgG in plasma showed no difference between calves born to cows subjected to a 30 d DP or a 60 d DP.

Likewise, in the observational study, milk production was reduced in early lactation, though, not less, when including the extra milk produced in the previous lactation in cows with a shortened DP (Table 1). Culling rate was decreased in cows with a shortened DP but no measurable differences were discovered in the other analysed health and fertility traits. However, chances of significant improvements are low, as the Swedish dairy cow population (in comparison to other countries with corresponding milk production) already has low incidences of common production related diseases like mastitis and endometritis [1]. The metabolic status of the cows in the observational study was not measured, although the reduction in milk production in early lactation in cows with a shortened DP could have ameliorated the metabolic load on these cows. However, cows with dry periods longer than 70 days also produced less milk, but, a DP>70 days



**Figure 1** – Energy balance (difference in net energy (NE), MJ NE/day) during lactation week 2 to 12 postpartum for the two treatments 30 days (30d) and 60 days (60d) dry period.

|   | Milk production (kg) |                   |          |          |
|---|----------------------|-------------------|----------|----------|
|   | 30-39d<br>O          | 60-69d<br>O       | 30d<br>E | 60d<br>E |
| Milk production week -9 to -4 pre partum (kg)   | 746 <sup>1</sup>     | 330 <sup>1</sup>  | 793      | 214      |
| Milk production week 1–12 post partum (kg)      | 3454 <sup>2</sup>    | 3589 <sup>2</sup> | 2931     | 3470     |
| Milk production total prepartum+postpartum (kg) | 4200                 | 3919              | 3724     | 3684     |

<sup>1</sup>Based on an estimation from the last test day before dry off. <sup>2</sup>Based on an estimation from the first three monthly test milking occasions.

**Table 1** – Milk production (kg) in Swedish Red and Swedish Holstein cows with a 30 day dry period (30 d, DP), a 30–39 day DP (30–39 d) or a 60 day DP (60 d) or a 60–69 days DP (60–69d) during the last 9 weeks prepartum and the 12 first weeks postpartum in one observational study (O, n=78 577) and one experimental study (E, n=77).

was associated with higher somatic cell count, culling to a higher extent and less chance of cows being pregnant 30 days after the herd voluntary waiting period.

## CONCLUSIONS

Shortening the dry period decreased milk production especially during the early phase of the following lactation, but the reduction was compensated for by milk generated during the longer previous lactation. A short dry period markedly improved energy balance of the transition cows. However, health and fertility were apparently not improved by the shorter DP. Nevertheless, culling rate was reduced among cows with a short dry period. The concentration of immunoglobulin G in colostrum was not affected by dry period length.

”Shortening the dry period decreased milk production especially during the early phase of the following lactation, but the reduction was compensated for by milk generated during the longer previous lactation.”

**Elisabeth Andrée O’Hara**

## REFERENCES

This is part of a PhD thesis with the title “The effect of dry period length on milk production, health and fertility in two cow breeds” to be defended September 27th 2019 by PhD student Elisabeth Andrée O’Hara.

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## CONTACT OF COW AND CALF

# Alleviating cow and calf stress after prolonged contact

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### SUMMARY

**Location:** Norway

**IDF Welfare Action Area:** Stockmanship

**Resource based measure:** Housing systems

**Animal based measure:** growth of calves, milk yield and composition

**Group demographics:** Both men and women contribute to this system

### BACKGROUND

Public acceptance is pivotal for a sustainable dairy production, and the early separation of cow and calf is a management practice which the public finds problematic. Dairy farmers and the industry in the Nordic countries now show an increased interest in allowing more cow-calf contact (CCC) to improve animal health and welfare. We present research on management procedures which can be implemented in cow-calf contact systems.

### CHALLENGES AND OPPORTUNITIES ASSOCIATED WITH COW-CALF CONTACT

Conventionally, dairy calves have been separated from their mother within hours after birth and placed in a single pen. Feeding restricted amounts of milk or milk replacer has been common to encourage concentrate intake. In light of scientific knowledge on maternal behaviours and the increased emphasis on animal welfare in society, this tradition has also become questioned by farmers. Although higher milk allowances and earlier social housing of calves are now encouraged, the behavioural repertoire associated with the cow's care of the neonate, maternal bonding and complex social environments is still prevented. Under natural conditions, the calf feeds several times per day during the first weeks and spends up to one-hour suckling per day. The cow exhibits a range

of behaviours targeting the establishment of a strong maternal bond and mutual recognition. In the natural situation, calves might continue to suckle long after they are functional ruminants, until about nine months of age, whereas the dairy calf will have to be weaned much earlier.

Rearing systems allowing CCC are currently practiced in both loose-housing and tie stall barns with year-round or concentrated calving. A recent review of scientific peer-reviewed literature on cow and calf health provided no consistent evidence in support of early separation [1]. With regards to production, saleable milk is decreased during the suckling period, but not necessarily in the longer term [2]. It is important to note that these conclusions are based on a few studies from small sample sizes. Calves suckling their dam can grow very well, up to 1.3 kg/day. The welfare advantages for calves include more normal social behaviours and reduced abnormal behaviours associated with housing in isolation; improved ability to adapt and learn. Long-term positive effects on social skills have been revealed at introduction of heifers into the dairy herd. However, there are challenges to be solved. These include e.g., separation and weaning distress, methods to ensure sufficient colostrum intake and hygienic challenges for the calf when housed in the cow-stall. Long-term effects on health, fertility and production have not been sufficiently studied and need further investigation [3, 4]. In the following sections, we summarize design elements for a successful CCC system based on current knowledge.

### BONDING IN A MATERNITY PEN

Isolation of the cow-calf pair in a maternity pen during the first few days after birth is important for the development

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”Dairy farmers and the industry in the Nordic countries now show an increased interest in allowing more cow-calf contact (CCC) to improve animal health and welfare.”

### Julie Føske Johnsen

of a bond and to establish suckling. Many suckling calves receive too little colostrum, although calves that get up and suckle by themselves generally drink sufficient amounts [5]. However, additional colostrum should be fed to calves of low vitality, inferior colostrum quality or poor udder confirmation.

### FULL DAY CONTACT VS. HALF DAY CONTACT

Full day contact entails cow and calf having unlimited access to each other, for example by co-housing cow and calf in loose housing systems. This resembles the natural situation, and suckling might be initiated by the cow or the calf. In a half day system, the cow and calf have access during the day or the night. The advantages with this system are that the calves could become more used to human handling and that cow and calf get used to being apart. Further, half day systems can prepare the calf for the weaning process, as described below. Knowledge is now needed on how technology can be used to facilitate cow-calf separation in existing and new barns.

### CALF NUTRITIONAL INDEPENDENCE

A suckling calf likely drinks 10–15 L of milk per day during the first six weeks. When these calves are separated from their dam



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**Figure 1** – There is an increased interest in calf rearing systems which allow cow-calf contact. Photo: L. Lidfors.

abruptly and concurrently weaned from milk (as occurs in beef cattle only at a later stage), calves lose weight and experience a profound stress reaction. Considering the need for an economically viable system, separation of the calf is necessary at some point. Therefore, the CCC system should encourage calf nutritional independency before separation from the dam, to reduce separation stress. This can easily be done in a half day system, e.g., by giving the calves an alternate source of milk during the hours they are separated from the cows [6]. If calves learn to drink milk from e.g., a milk feeder while they are still suckling their dam, separation stress and weight loss is alleviated [7].

### PHYSICAL CONTACT DURING SEPARATION

Separation of cow and calf is stressful regardless of the calf's age when it occurs, and any cow-calf contact systems thus need to outweigh separation stress. If cows and calves are allowed physical

contact during the days after separation, e.g., by adjacent pens allowing some physical contact, behavioural distress might be alleviated [8]. Separation from the dam and weaning off milk should not occur concurrently but shifted in time. A calf that is nutritionally independent at the time of separation can be gradually weaned off milk at a later stage.

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# Cow and calf together – work in progress

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## SUMMARY

- **Location:** Sweden
- **IDF Welfare Action Area:** Husbandry practices
- **Resource based measure:** Housing systems, feed intake
- **Animal based measure:** Udder health, growth of calves, milk yield and composition
- **Group demographics:** Both men and women contribute to this system

Alongside the introduction of milking machines, today's standard management of separating calves from their dam at birth was established. At the time there was, and still are, very good reasons for doing so, but there are also good reasons to study alternatives to this practice. There are growing concerns among farmers and consumers over the impact on cows and calves from their early separation. Investigations into consumer attitudes convincingly show similar patterns in Germany, North America and Brazil [1, 2] and when consumers become more educated about farming, their resistance to early separation gets stronger [3, 4, 5]. There is no reason to believe that other consumer groups in Europe and America respond differently. Organic production has a particular challenge with early separation since it does not follow the ideology of natural production, but the discussion goes beyond organic production.

A number of farms around Europe are adopting management systems where calves and cows have access to each other all day or parts of the day, but this has largely been done without the support of science. The limited available science on this topic has been very well reviewed by Johnsen et al. [6], Beaver et al. [7] and Meagher et al. [8]. The main attention has been on immediate effects on the calf. There is still a lot to learn about effects on

the calves when they reach adult age and also how the cow is affected by contact with her calf. The EU COST initiative "DairyCare", which closed in 2018, had an incubator group working on cow and calf contact and this allowed the formation of a network of scientists from all over the world which has an interest in this research field. Also, the recent CoreOrganic call for research funding in 2017 included a specific request for research on keeping cows and calves together. Research in this field is now increasing, with several projects on-going or just starting in Europe, funded by CoreOrganic and other sources. Key issues are yield of saleable milk, milk composition, udder health, metabolism and reproduction in the cow, health, intake of solid feeds and growth of the calves, housing systems including the distribution of time together vs time apart during the day and also a suitable time and routine for separation. Some of the research projects will follow calves that are kept with their dams in early life until adult age and collect information about reproduction and how they perform in their first lactation. Overall effects on labour, farm economy and carbon footprint are as relevant as effects on activity, behaviour and welfare in the animals. Another intriguing aspect is the suitability of different genotypes for such systems. All aspects of dairy production might be affected by this change in management and there are many challenges to solve, but there is also a lot of possibility. Production with cows and calves together will probably not be for all farms, but a possible addition to the variety of dairy production systems already in place. The research is carried out in research herds and in commercial herds and any contacts with herds that you know of where dairy cows and calves are kept together will be very useful for researchers in this field.

## UN SDGs



"There are growing concerns among farmers and consumers over the impact on cows and calves from their early separation."

**Sigrid Agenäs**

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## LAMENESS

# Technology redefines best practice In treating lameness in dairy cows

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### SUMMARY

- **Location:** United Kingdom
- **IDF Welfare Action Area:** Husbandry practices
- **Resource based measure:** Improved farm profitability, Reduced antibiotic use, Improved farmer image
- **Animal based measure:** CowAlert Technology objectively identifies lameness (often before it is visible), Thermal Imaging validates the lameness reports of CowAlert, Thermal imaging directs stockmen to the affected claw
- **Group demographics:** The workshop involved 4 males and 1 female

### INTRODUCTION

Lameness is amongst the costliest health problems of dairy cows, together with mastitis and reduced fertility. In addition, with the increasing herd sizes, farmers have less time to monitor each individual cow. This means that lame cows in the herd are often detected when they are already severely lame (if they are detected at all), compromising their health and welfare [1, 2]. CowAlert had launched the lameness reporting module in September 2017 and had encountered resistance due to the numbers of apparently healthy cows appearing on the lameness alerts. Having met with George Coles of Miracle Tech, and previously experienced the CowAlert lameness technology in action, Innovation for Agriculture identified the potential of thermal imaging cameras in providing additional information on alerted cows and arranged a workshop to evaluate the potential synergy. The workshop was part of the Horizon 2020 project 4D4F Data Driven Dairy Decisions for Farmers ([www.4d4f.eu](http://www.4d4f.eu)).

### MATERIAL AND METHODS

The workshop took place at Bridge Farm, Glastonbury, Somerset on 11 April 2018 with these objectives:

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- To evaluate the effectiveness of thermal imaging cameras in determining actions to be taken with cows highlighted as Red alerts from CowAlert's lameness alerts.
- To create an SOP which combines CowAlert and thermal imaging cameras.
- To assess the amount of technical knowledge and training required to operate a thermal imaging camera.
- To assess the effectiveness of different specifications of Thermal Imaging Cameras.
- To validate the CowAlert Lameness alerts.

### METHOD

All the cows (6) that were categorised as Red Alert were separated out, along with one cow picked out by the herdsman with visual lameness signs and categorised as an Amber alert. Only one Red alert cow showed any sign of being lame on a specific foot/leg the other five would not have foot lameness diagnosed by an experienced stockman.

Each cow was then inspected through two types of thermal imaging cameras, examined in a *Wopa* foot trimming crush, inspected again by thermal imaging cameras and finally foot trimmed and treated as necessary.



The thermal imaging cameras used were Satir PK 160 tablet and a higher specification Satir Hotfind-S (Figure 1).

**Figure 1** – Thermal Imaging Cameras Used.

”Combining CowAlert’s objective lameness monitoring with the diagnostic capability of thermal imaging cameras can have a big impact on farm profitability and animal welfare.”

**Richard Lloyd**

### OBSERVATIONS

- Four inexperienced users were quickly able to use the thermal cameras, meaning that they are suitable for use on farm.
- The cameras picked up issues which were not visible to experienced stock-people.
- Cameras could identify the specific claw in which a problem lay, giving the foot trimmer valuable knowledge (and confidence) as to where to explore further with a foot trimming knife.
- Thermal imaging cameras picked out problems in cows which showed no visible sign of lameness and would therefore not be examined further by herdsman.
- White line disease, sole ulcers and bruising were found in cows that did not look lame.
- It was the difference in temperature rather than the actual temperature that was important.
- Visual assessment vastly underscores the specificity of CowAlert’s Red Alert lameness cow list.
- The cheaper thermal imaging camera (PK160) was easier to use and was just as effective. It also came installed on a tablet and so data could be directly transferred to management system.
- The use of thermal imaging cameras worked best in establishing the issue with cows on an alert list rather than being used to generate an alert list.

## RESULTS AND DISCUSSION

A 4D4F video showing Cow Alert and the workshop can be seen at [here](#).

| Cow No         | Visual   | Thermal   | Diagnosis   |
|----------------|--|---|---|
| 975            | Nothing obvious  | Front left, right rear<br>Cow alert – lying 3 hours more  | Growth rear right – terramycin spray.                                       |
| 544            | Shoulder   | Minor changes FR – more obvious visually<br>Confirmed no infections in 4 feet   | Not put in crush due to shoulder injury and no sign of problems in her feet |
| 152            | Swollen Hocks<br>Nothing on FL visually<br>On cow alert for a while                                  | Heat on front left inside, as well as hocks<br>Picked up a secondary issue that would have been overlooked.<br>“application as a diagnosis tool”<br>Much earlier intervention | White line FL<br><br>Would not have been seen visually<br>Blocked           |
| 133<br>(white) | Nothing obvious  | Overgrown feet  | Bruised claw<br>Anti-inflammatory   |
| 150            | Overgrown feet   | Cold cow – low circulation<br><br>Cow alert – low amber since December.<br>Increased in March – now red.  | Monitor and trim when not busy.   |
| 877            | Good locomotion  | Hot spot on back left<br>Herdsman predicts – digital dermatitis   | Digital Dermatitis confirmed.<br>Terramycin Spray                           |
| 610            | Herdsman submitted due to visual lameness. Back on back legs – but not obviously favouring any foot. | Amber cow alert. (Several months)<br>Abrasions on hock.<br>Hot all the way down both back legs, hotspot on back left.   | Old ulcer on back right<br>Big ulcer on back left                           |

**Table 1** – Results of the workshop.

## CONCLUSIONS

Combining CowAlert’s objective lameness monitoring with the diagnostic capability of thermal imaging cameras can have a big impact on farm profitability and animal welfare. Cows that showed no visual sign of lameness were identified as lame by technology and, therefore, were treated much earlier, and more accurately, than was possible before.

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A 4D4F video showing Cow Alert and the workshop can be seen at <https://www.youtube.com/watch?v=q2REYOHhOVI>

# The Claw Coin – a national programme to reduce lameness in Swedish dairy cows

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## UN SDGs



## SUMMARY

- **Location:** Sweden
- **IDF Welfare Action Area:** Health management
- **Resource based measure:** Claw health recordings and statistics
- **Animal based measure:** Lameness, claw disorders
- **Group demographics:** Both men and women contribute to this system which includes dairy farmers, hoof trimmers and veterinarians

## INTRODUCTION

Lameness is one of the main concerns regarding animal welfare in dairy herds worldwide. The main cause for lameness is impaired claw health. However, by regular claw trimming, claw health can be improved and, hence, the prevalence of lameness can be reduced [1].

Lameness and claw disorders are recognized by the Swedish government as an animal welfare problem. As part of a national programme to improve animal welfare in Sweden a reimbursement, called the Claw coin, was introduced in 2016. This report presents the results so far concerning improvements in claw health and thereby, also lameness.

## MATERIAL AND METHODS

In order to obtain the welfare reimbursement, the farmers need to apply to the Swedish Board of Agriculture. The requirements to receive the Claw coin is that each dairy cow, that the reimbursement is applied for, should be trimmed twice yearly by a certified claw trimmer. This should be done at least every three months and all lesions found at trimming should be treated properly. In addition, a claw health plan should be written [2]. In the plan, the farmer records the trimming strategy i.e., dates or schedule for the hoof trimmer to visit

the farm. Claw health statistics will be calculated and if exceeding the national average for the lameness causing claw disorders (sole ulcer, digital dermatitis and interdigital hyperplasia), an action plan should be made. In the action plan, different types of interventions should be listed in order to improve the situation within the herd.

In Sweden, there are about 100 certified claw trimmers. About 70% of these send the claw health records to the national database in Växa, Sweden. From this database, data are summarized every year to monitor the claw health status nationally and regionally using descriptive statistics. In total, data from approximately 460 000 trimmings of approximately 265 000 cows are summarized and described (Figures 1 and 2).

## RESULTS AND DISCUSSION

Since the introduction of the reimbursement, approximately 2200 farmers have applied for the subsidiary for approximately 212 000 dairy cows each year. Hence, two out of three dairy cows in Sweden now receive the Claw coin. Moreover, about 60 per cent of the dairy cows in Sweden are trimmed at least twice per year compared to once a year, an increase of almost 30 per cent since the introduction of the programme.

Since the claw coin was introduced in 2016, national statistics show a decrease in the proportion of trimmings with a recorded claw disorder (Figure 1). Regarding the specific disorders, there is a reduction in the prevalence of heel horn erosion, sole haemorrhage and sole ulcer. We can assume that the decrease in sole ulcers leads to fewer lame cows since it has been found in several studies that sole ulcers have a very strong association with lameness [3, 4].

Prevalence claw trimmings with a claw disorder (%)



Figure 1 – Prevalence of claw diseases at claw trimming during the milk-recording years 2009/10 to 2017/18. The prevalence is calculated as percentage of cows with remarks at each claw trimming of total number of claw trimmings during the period.

Prevalence claw disorders (%)

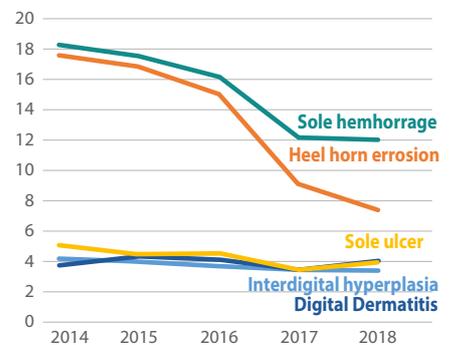


Figure 2 – Prevalence of claw trimmings with registration of digital dermatitis, heel horn erosion, sole haemorrhage, sole ulcer or interdigital hyperplasia during the period 2014 to 2018.

However, it is of great importance that the claw trimmers' records are based on equal assessments of the claw disorders. Therefore, a follow up of the quality of the claw health records will be performed to confirm the relevance of the figures.

## CONCLUSIONS

A welfare reimbursement on a national level can improve claw health and decrease lameness in dairy cows according to our figures.

## STOCKMANSHIP

# The importance of stockmanship in calf rearing

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### UN SDGs



and veterinarians. Interviews were audio-recorded and transcribed in full before grouping interview extracts by topic to further compare opinions and practices.

### RESULTS AND DISCUSSION

All participants agreed upon the most important aspects of calf rearing; colostrum management, calf nutrition, calf environment and the early detection and prevention of disease. As an overarching theme, stockmanship is vital to all aspects of calf rearing, and good animal husbandry was believed to compensate for some less-than-ideal calf housing and equipment:

*“I’ve walked into some sheds that I have thought ‘oh my god, this is an awful place to see calves’ and actually when you look at the calves, they are growing really well - you can’t put a value on good husbandry”.* (Female veterinarian and pharmaceutical company representative, PR1)

Attention to detail was considered key to good calf rearing, early detection of disease and effective medical treatments:

*“Whether it’s colostrum management, making sure [the calves are] vaccinated, or keeping the hutches clean ... attention to detail’s the most important thing and then under that you could sub-categorise it into age of the animal and what’s important for that age, but you need detail”.* (Male farm manager, F9)

*“Check [calves that are] just not quite right, because if you pick [illnesses] up quickly, then [the calves] respond much better to treatment than if you leave them until they’re really sick [showing clinical signs of disease]”.* (Female designated calf rearer, F2)

“Hence, two out of three dairy cows in Sweden now receive the Claw coin. Moreover, about 60 per cent of the dairy cows in Sweden are trimmed at least twice per year compared to once a year, an increase of almost 30 per cent since the introduction of the programme.”

Frida Åkerström

### SUMMARY

- **Location:** United Kingdom
- **IDF Welfare Action Area:** Husbandry practices
- **Resource based measure:** Claw health recordings and statistics

### INTRODUCTION

Youngstock performance is critical to dairy farm economic efficiency. On most farms, it takes at least 1.5 lactations to cover the cost of rearing a replacement heifer from birth to first calving. Costs can be minimised by achieving an earlier age of first calving and maintaining good calf health and welfare [1]. Despite campaigns and resources highlighting scientific recommendations for rearing healthy dairy calves, there is evidence of high rates of infectious diseases, particularly diarrhoea and bovine respiratory disease, contributing to poor growth rates and calf mortality [2] on farms. This suggests dissemination efforts have failed to stimulate uptake of best practice by farmers. Farmer attitudes have been shown to impact husbandry practices related to calf survival and could be influenced by input from veterinarians [3] and other advisors. This PhD project explored perceptions of calf rearing in the dairy sector, aiming to better understand why recommendations for best practice might or might not be implemented.

### MATERIALS AND METHODS

To examine how differing experiences and perspectives affect actions relating to calf management, 40 face-to-face, in-depth interviews with farmers (n=26) and advisors (n=14) in England were conducted. Participants included; designated calf rearers, farm and herd managers, farm workers, feed and pharmaceutical company representatives

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“Monitoring calf growth performance and health can provide useful data to inform management decisions. Encouraging quality stockmanship according to personal preferences, motivations and skillsets can result in the rearing of quality replacement heifers.”

**Laura Palczynski**

The results of my PhD study, and similar research projects exploring attitudes and factors affecting dairy farm management, provide insight into perspectives which have very real impacts. Both farmers and farm advisors have individual perspectives, experiences and contexts which impact their actions relating to calf rearing. On-farm decisions must consider a complex net of interlinked factors which compete for limited resources. Appreciating diversity is important for achieving a holistic understanding of calf health and welfare at farm level, without isolating it from other farm aspects, and can inform knowledge transfer efforts to better encourage real-world application of research findings.

## CONCLUSIONS

Having a patient, passionate and skilled stockperson committed to the job of calf rearing can play an important role in maintaining good calf health. Allowing calf rearers sufficient time to properly conduct calf husbandry practices (particularly those which ensure good colostrum management, hygienic feeding equipment and clean, dry bedding) and observe calves to allow for quick intervention if problems arise. It was often believed that this was easiest to achieve when farms were able to employ a designated calf rearer, and technologies, e.g., automated milk feeders and fever tags, were mentioned as useful aids for monitoring calf health, but these measures are not feasible for many farms. Monitoring calf growth performance and health can provide useful data to inform management decisions; some participant farmers valued the information and motivation gained from recording this type of data, others kept no such records and lacked the time and/or inclination to weigh calves. Encouraging quality stockmanship according to personal preferences, motivations and skillsets can result in the rearing of quality replacement heifers.

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# Health and herd health planning in organic dairy herds

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## SUMMARY

• **Location:** France, Germany, Great Britain, the Netherlands, Spain and Sweden

## INTRODUCTION

The status of European organic dairy production does not, in all aspects, meet organic principles with regards to the aims of good animal welfare and health and consumers' expectations. Therefore, it needs to be improved. The aims of this thesis were to; assess the status of animal health in organic dairy herds; assess the structural characteristics and their relation to implementation of animal health plans; and to investigate a structured participatory and farm-centric approach.

## MATERIAL AND METHODS

In total, 218 farms in Germany, Spain, France and Sweden were included in the study. All farms were visited, and general characteristics were collected through an on-farm protocol. The same procedures for calculations were made to get comparable herd level indicators. A sample of the lactating cows on each farm was scored for lameness. Data for the analysis of farm structures (192 farms), contained a battery of farm and farmer descriptors

“The odds of lameness were five to six times higher in France and Germany and slightly higher in Spain, than in Sweden.”

**Karin Sjöström**

## UN SDGs



A visit to a farm where the impact matrix is discussed.

from which typologies were derived. Three farm clusters were identified and rates of implementation of health improvement actions were explored. Actions, as part of a health plan, were identified during a structured participatory approach, with farmer, veterinarian and advisor, by use of an impact matrix analysis, on 122 farms in France, Germany and Sweden.

## RESULTS AND DISCUSSION

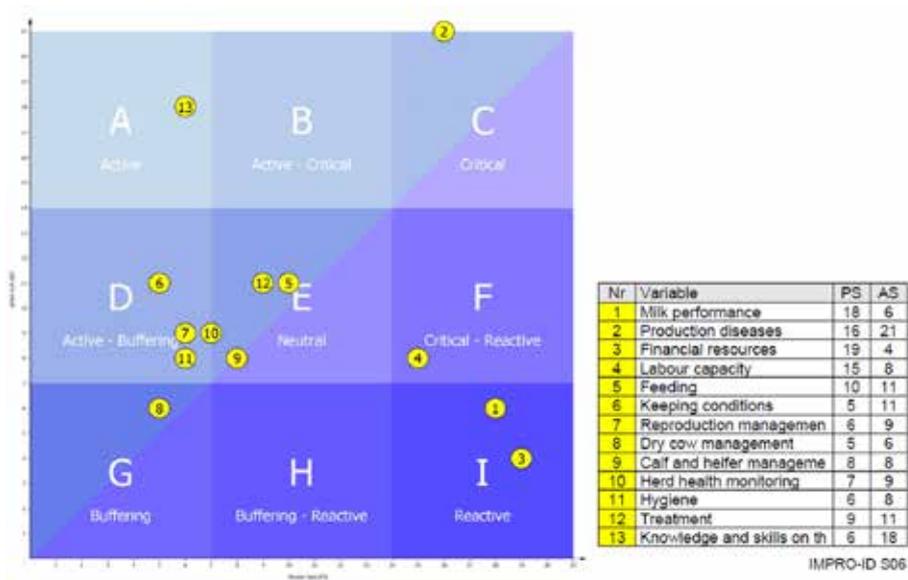
The prevalence of animal health indicators varied widely between farms and countries. The odds of lameness were five to six times higher in France and Germany and slightly higher in Spain, than in Sweden. This might be particularly true in large herds with cows of the Holstein breed and in zero-grazing herds. Farms in the different clusters implemented different strategies towards animal health planning. The degree of implementation of the actions was good. At follow-up (by data), no direct associations were seen between change in animal health indicators and the structured participatory approach. [1, 2, 3, 4, 5, 6, 7, 8]

## CONCLUSIONS

Using the Impact Matrix in a participatory approach, involving farmer, veterinarian and advisor, could give a holistic perspective towards the farm as a complex system, and it is possible to examine how all areas in a system (a dairy farm in this case) affect each other if a change is made somewhere in that system (figure 1). Using this approach, it becomes easier to find where changes in the system will create the greatest impact; all areas are brought up for discussion and even unexpected areas are included. A dairy farm is a very complex system and it is easy to miss where changes could actually be made and this could be something completely different from what seems to be the most logical at first glance.

“No two dairy farms are the same”  
 (Karin Sjöström)

The great difference in prevalence of production diseases implies that there is room for improvement. The need to



**Figure 1** – Impact matrix and output graph. After completing the impact matrix, system roles for all variables were calculated by a data program (developed during IMPRO and modified from Vester's sensitivity model), based on active and passive sums of the rows and columns in the matrix. The results were presented in an output graph, where the variables with highest potential for improvement, and thereby the ones to focus on at this stage, were in the upper left corner (A and thereafter B and D) from the diagonal line. On the other hand, the areas which were placed in the right lower corner and on the right side of the output graph, were the ones that had very low potential for direct improvement and therefore no effort to focus on these was required at this stage.

enhance the quality and availability of data is reinforced by the fact that there is no unified recording in European organic dairy herds. The results could be used as a background for tailored advisory service strategies, i.e., different types (clusters) of organic dairy farms need different types of advisory approach to attain improvements, adapted to the specific farm situation.

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# Water trough capacity in small free-stalls and milk yield

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## UN SDGs



## SUMMARY

- **Location:** Norway
- **IDF Welfare Action Area:** Feed and water.
- **Resource based measure:** Access to water in milk producing animals.
- **Animal based measure:** Increased milk yield as a result of good water access especially for younger animals at low rank.

”Increasing water trough access is an easy and cheap way to boost animal welfare and, moreover, will lead to an increase in milk production.”

**Olav Østerås**

## INTRODUCTION

Reducing feed bunk space has had a negative effect on feeding behaviour, especially for low ranked cows [1]. In several recommendations [2, 3], the importance of an adequate water supply is identified. Cows are found to prefer, and to drink more, from larger troughs [4]. However, any evidence of possible negative effects on milk yield from reducing feed bunk space or amount of water supply is scarce. This paper presents the finding from a large Norwegian study from 204 free-stall herds constructed from 1995 to 2005 published by Næss et al. [5].

## MATERIAL AND METHODS

This material consists of data from 20 221 different lactations from 204 free-stall herds in Norway. Data were extracted from the Norwegian animal recording scheme. The water trough capacity was recorded at herd visit, together with lots of other variables. Water trough capacity (WTC) was expressed as a percentage according to the recommendation of 100% being equal to be one drinking bowl per 8 cows or 10 cm accessible perimeter of a water trough per cow [2]. WTC was divided into five hierarchical dummy variables with 10, 25, 50, 75 and 90% of the herds respectively. The 305-day milk yield was derived from lactations that started with a normal calving in 2005, 2006 or 2007.

## RESULTS AND DISCUSSION

The results from the complete study could be found in Næss et al. [2]. Presented here are only the final model results on the association between WTC and milk yield. In herds with less than 80% WTC the milk production was 230 kg less milk per cow compared to herds with access to above 80% WTC. If the WTC was less than 47% of the recommended amount, the milk yield was additionally 325 kg less, a total decline in production of 555 kg per 305 days in milk. This compares to 8% of the production at the time of study. A WTC capacity between 47 and 80% would compare to a reduction in production of 3.4%.

## CONCLUSIONS

The key message from this study is that increasing water trough access is an easy and cheap way to boost animal welfare and, moreover, will lead to an increase in milk production of 3 to 8 per cent if access is extended to approximately 50% to 20% of the WTC recommendations until the recommended one drinking bowl for every 8 cows or 10 cm accessible perimeter in drinking troughs is achieved.

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# The Swedish dairy herd health advisory service - team up with your farms

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## SUMMARY

- **Location:** Sweden
- **IDF Welfare Action Area:** Stockmanship
- **Resource based measure:** Access to feed and water, cubicle dimensions.
- **Animal based measure:** Body condition, lesions, cleanliness.
- **Group demographics:** Both men and women contribute to this system

The Swedish Dairy Association, later Växa Sverige, has created a system of animal health and welfare services for the dairy herd. The cornerstones of the system are objective observations, handling challenges for the high producing milking cow and large dairy herd, creating real change for improved animal health and welfare and also farm economy.

The initial step, the farm analysis, contains three main parts: “ask the numbers”, “ask the animals” and “ask the people” (Figure 1a). All farms that are affiliated to the Swedish Milk recording scheme receive monthly updated animal health and welfare figures in a web report called Animal Welfare Signals. Twenty-five key figures are presented, such as calf mortality, paralysis and cramps, calculated bulk tank somatic cell count and proportion of culled animals for different reasons. The advisor prepares the visit by going through these numbers. At the farm, the animals, their environment and milking machine function, among other things, are checked using checklists. By following this working routine, the advisor will not miss any important parts. The checklists will help the advisor to stay objective while observing the animals and the environment, and together with the Welfare signals the checklists will help to pinpoint areas with potential for both improved health and economy.

At the farm, a thorough interview with the whole staff is also performed, usually as a group. It was found that it is of great

## UN SDGs



importance for success to listen to their thoughts about goals and interests, but also about what they perceive as problems.

After having asked the numbers, the animals (and their environment), and the people, usually a clear picture presents itself of areas which have potential for improvement (health-wise and/or economy-wise) and what actions probably will have the best effect. The interview will also give information about what areas the people at the farm are most likely to be motivated to work towards. The observations and problem areas are presented at a farm council, again with the whole staff present (Figure 1b). The farm council then discusses and sets an action plan together, specifying goals and actions to reach the goals (Figure 1c). The action plan should include who is responsible for what and deadlines. The advisor’s role is to be a supportive co-player, to help, support and guide, by lifting good ideas or finding better alternatives to presented ideas.

The system of animal health and welfare services for the dairy herd also includes a set of ready to use on-farm courses in different areas of animal health (Figure 1d) Further education within one or two of these areas are often part of the action plan. The action plan usually spans six to twelve

“The systematic and preventive work performed in the system, is intended to strengthen animal welfare and profitability in dairy production, as well as enhance knowledge and understanding among farmers and their employees.”

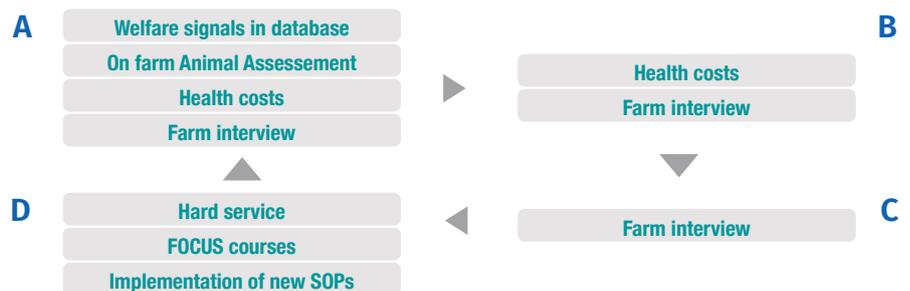
## Åsa Lundberg

months, and after this time, a follow-up and a new farm analysis is recommended.

The systematic and preventive work performed in the system, is intended to strengthen animal welfare and profitability in dairy production, as well as enhance knowledge and understanding among farmers and their employees.

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**Figure 1** – Schematic illustration of the workflow in the Swedish system of animal health and welfare services for the dairy herd. Ask the numbers, animals and people (a). Discuss the most important areas of improvements at a farm council (b), create an action plan with specific goals, deadlines and who is responsible (c) and work with implementation and increasing knowledge (d).

## HEALTH – MASTITIS

# Mastitis control: a sustainable model for the developing world

### AUTHOR

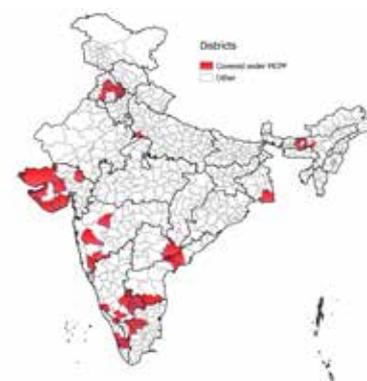
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### UN SDGs



### SUMMARY

- **Location:** National Dairy Development Board's (NDDB) model for control of bovine mastitis titled Mastitis Control Popularisation Project (MCP) is being implemented in more than 1500 dairy cooperative societies (DCS) across nine states in India (Figure 1) focusing on a simple, cost-effective, efficacious, environmentally friendly and sustainable approach.
- **IDF Welfare Action Area:** Animal Health management
- **Resource based measure:** (i) Reduction in treatment costs in bovine mastitis (ii) Dissemination of knowledge to the farmers, especially ethno-veterinary medicine (EVM) (iii) Management of many other common bovine ailments (other than mastitis) by EVM.
- **Animal based measure:** i) Increase in milk production (ii) High cure rates (iii) Non-invasive and therefore painless.
- **Group demographics:** Small-holder livestock farming is largely practiced in India. More than 80% of dairying activities in the household are carried out by women who also carry out measures for control and management of mastitis.



**Figure 1** – MCP implementation in 25 locations covering more than 1500 DCS across nine states in India.

### INTRODUCTION

The annual losses due to mastitis in India is estimated to be INR 72 billion (USD 107 million) as per 2009 assessments. With over 70 per cent of dairy animals being maintained by the small and marginal farmers in the country, mastitis is one of the main causes of huge losses to this cross section of farmers who, more often than not, do not have the means necessary to get their animals treated.

NDDB's approach on mastitis control attempts to provide a cost-effective, efficacious and easily implementable model which would enable the farmer to manage the disease effectively, thereby making it a sustainable proposition. The use of EVM could hold the key to achieve this and also minimize the use of antibiotics. The recent report of Inter-Agency Coordination Group (IACG) on antimicrobial resistance (AMR) also focuses on creating awareness, monitoring and restrictions on the use of antimicrobials [1].

NDDB's model uses a three-pronged strategy to control mastitis in cattle and buffaloes: (i) detection of sub-clinical mastitis (SCM) and its control by use of trisodium citrate (TSC) (ii) use of alternative approaches like EVM to manage

clinical cases of mastitis and reduce antimicrobial usage and (iii) identification and management of chronically infected animals.

In order to have a multifaceted analysis on the outcome of control strategy, the knowledge on the major bacterial agents associated with clinical and sub-clinical forms of mastitis in India, especially in the project implementation areas, and their AMR profile would play a pivotal role in supporting the evaluation of the efficacy of the therapeutic agents. The data generated would also aid in understanding translational outcomes and efficacy of the disease control through use of TSC and EVM.

### MATERIAL AND METHODS

#### DETECTION AND CONTROL OF SUB CLINICAL MASTITIS (SCM)

The Dairy Cooperative Society (DCS) was the point of initiation for the mastitis control programme. Pooled milk brought to the DCS by the individual farmer was tested using the California Mastitis Test (CMT) to identify farmers with animals that have been sub-clinically infected by mastitis. The next level of CMT testing was at the farmers' homestead to identify individual animal(s) with SCM. The affected animal(s) thus identified, were provided with an oral

regimen of TSC at a rate of 10 g per day for ten consecutive days given by mixing with drinking water or feed. Follow-up on the animal was done a week after completion of the oral regimen by CMT. Animals still found CMT positive were provided with a further oral regimen of TSC for ten days and retested again after a week of completion of second regimen of TSC. Animals that still remained CMT positive were then treated with antibiotics and other supportive therapy. If such animals still remained CMT positive on follow-up, they were classified as chronically infected and farmers with such animals were advised on its management, such as milking them last, not using milking machines on them and so on, to limit the spread of infection to healthy animals. The workflow adopted for detection and control of SCM is given in Figure 2.

"With over 70 per cent of dairy animals being maintained by the small and marginal farmers in the country, mastitis is one of the main causes of huge losses to this cross section of farmers"

**S K Rana**

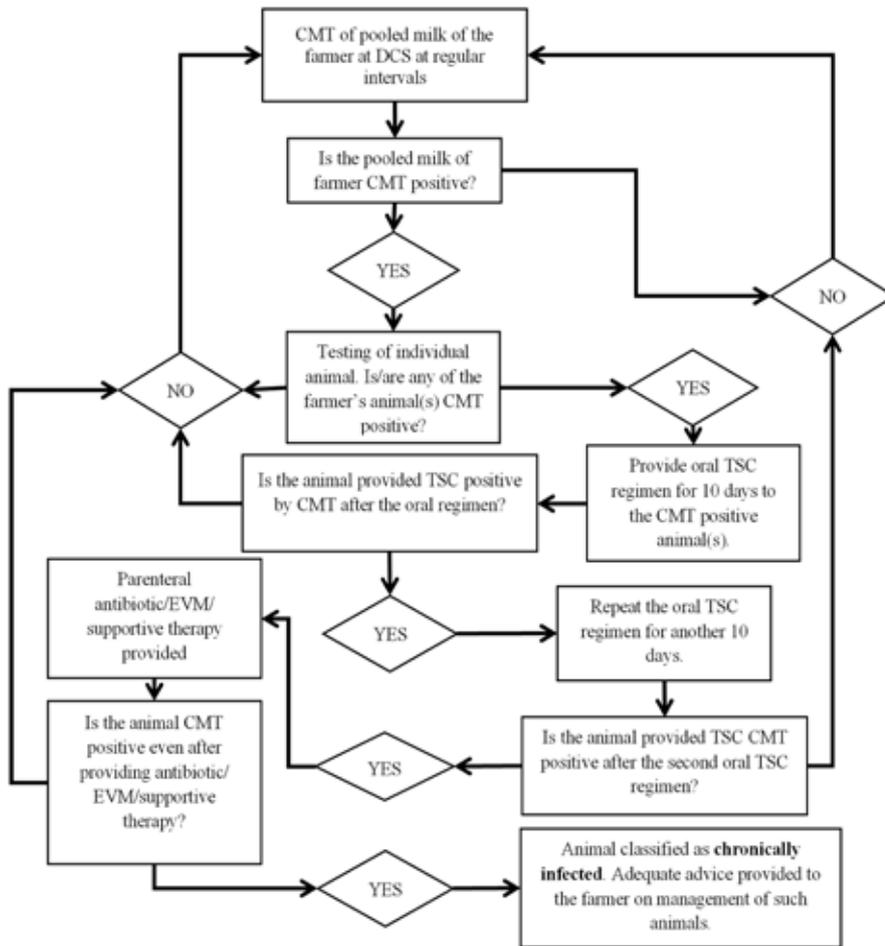


Figure 2 – Workflow adopted for detection and control of sub-clinical mastitis.

### USE OF ETHNO VETERINARY MEDICINE (EVM) TO RATIONALIZE ANTIBIOTIC USAGE

EVM was used as an alternative approach to management of acute mastitis, thus avoiding the use of antibiotics. The EVM preparation for acute mastitis was done as per the procedure suggested by Punniamurthy [2] and Nair et al. [3]. This protocol has also been published by NDDDB as a booklet “Ethnoveterinary Formulations for Important Ailments in Bovines” [4]. A combination of Aloe Vera (250 g) leaves, Curcuma longa (50 g) and calcium hydroxide (20 g) were blended together to form a reddish paste. One handful (approximately seventy-five grams) of this paste was mixed with 150 ml of clean water to make it thin. Udders of the affected animals were cleaned, washed with water and milk stripped out completely. The mixture was then applied topically thoroughly covering the entire udder with the firm application of palm pressure. The application was repeated 7–10 times a day for 3–5 days, prepared freshly each day.

### ETIOLOGICAL BACTERIAL PROFILING

In the milk sheds, where management of SCM and clinical mastitis were undertaken using TSC and EVM respectively, a synchronised surveillance was carried out on etiological agents of mastitis and its AMR.

Bacterial agents associated with mastitis cases were established by culturing aseptically collected mastitis milk samples of affected animals using standard microbiological methods [5]. Further identification of organisms was done using automated microbial identification system (BD Phoenix-ID/AST system). Antimicrobial sensitivity/resistance against frequently used antibiotic classes (penicillins, cephalosporins, aminoglycosides, tetracyclines and sulfonamides) was established for major bacterial agents like *Staphylococcus aureus* (*S.aureus*), *E. coli*, *Klebsiella sp*, by the use of BD Phoenix-ID/AST system in accordance with the CLSI guidelines [6, 7]. Presence of specific AMR determinants in these isolates and genetic elements

for other traits with relevance to biofilm and virulence was studied by molecular methods (PCR, sequencing and whole genome sequencing etc.). For agents like *S. aureus* reported for causing contagious mastitis, spa, MLST and agr typing were carried out to ascertain the relationship within the isolates and their evolutionary lineages [6].

### RESULTS AND DISCUSSION

The strategy used for detection and management of SCM was able to reduce the incidence of CMT positivity of individual farmers’ pooled milk samples from 55% at the time of initiation of the programme in Jan–Feb 2015, to 31% in Jan–Mar 2019. This 44% reduction in CMT positivity was recorded in a period of four years where the project was being implemented in around 100 DCS and, after testing a total of 285 455 pooled milk samples (Figure 3). A similar trend in reduction (45%) in CMT positivity by detection and control of SCM after testing 315 621 pooled milk samples was observed over a span of two years when this intervention was expanded to 22 milk unions covering around 1100 DCSs (Figure 4).

Around ninety per cent of the animals provided with TSC turned CMT negative after the first or second oral regimen. The cost incurred per animal was also minimal at around INR 30 (USD 0.50) for a ten-day schedule. The CMT positive animals which became negative post TSC supplementation also recorded an average increase of 10–15% in daily milk yield.

The profiling of bacterial agents associated with clinical and sub-clinical mastitis revealed the presence of *Streptococcus uberis* (19%), *Staphylococcus aureus* (14%), *St. dysgalactiae* (14%), *St. agalactiae* (4%), *Klebsiella sp* (7%), *E.coli* (5%), *S. xylosus* (4%), other non *S. aureus* (23%), *Aerococcus viridians* (2%), *S. epidermidis* (2%) etc. Further, the antimicrobial resistances (AMR) of the major bacterial agents viz., *S. aureus*, *E.coli*, *Klebsiella spp* were studied by both phenotypic and genotypic analysis. The study revealed the presence of variable degree of AMR including multidrug resistance in these bacterial agents. For instance, 30% of *S. aureus* isolates were found to be resistant to methicillin (methicillin resistant *S. aureus*, MRSA).

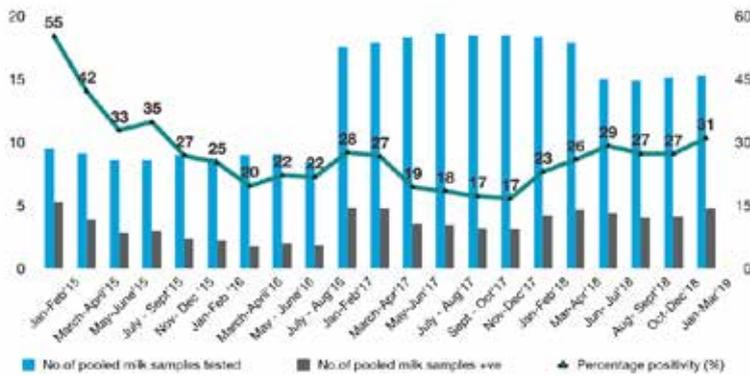


Figure 3 – Reduction in SCM as detected by CMT in 100 DCS in one milk union.

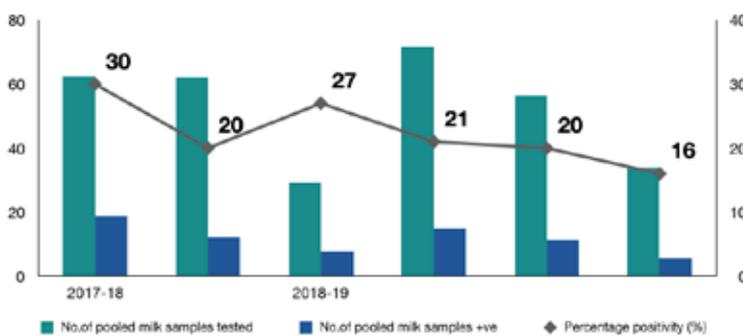


Figure 4 – Reduction in SCM as detected by CMT in 1100 DCS in 22 milk unions.

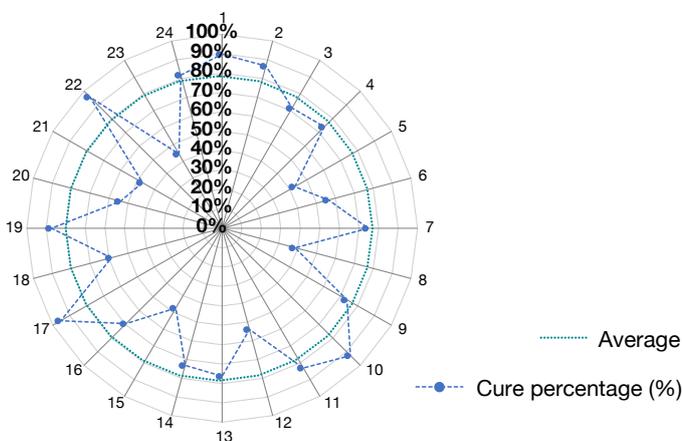


Figure 5 – The recovery rates of acute mastitis cases treated by EVM in 24 milk unions.

Similarly, 14% of *S. aureus*, 18% of *E. coli* and, 50% of *Klebsiella spp.* isolates exhibited multidrug resistance to various classes of antimicrobials like penicillins, cephalosporins, tetracyclines, gentamicin, trimethoprim/sulfamethoxazole etc. Thus, in many instances, these agents result in development of multidrug resistant mastitis. Typing of *S. aureus* isolates (n=30) revealed the presence of 6 spa, 8 MLST and 2 agr (I&III) types. No specific pattern of geographical distribution of these isolates could be observed and

typing results also indicated the likelihood of inter-species transmission of the same *S. aureus* types [6]. A higher percentage of *S. aureus* isolates harboured most of the genes involved in biofilm production, which might also be responsible for securing the organisms from antimicrobials, making antibiotic treatment ineffective in many instances.

EVM provided a cost effective and efficacious alternative to conventional allopathic treatment which has helped

in significantly reducing the use of antibiotics [6, 7]. A total of 48 469 of acute mastitis cases in 24 milk unions were treated using EVM alone of which 78% (38 045) reported complete clinical recovery (Figure 5). Antimicrobial activity of EVM preparation and probable mode of action have also been reported elsewhere [8, 9]. The cost for a complete treatment course was around INR100 (USD 1.5). Wherever the procedures for preparation and application were followed judiciously, the success rates were above 90%. Lower success rates could be attributed to improper preparation and application procedures and use of inferior quality ingredients.

### CONCLUSIONS

The success of antibiotic treatment depends on various factors viz. form of mastitis, extent of pathological damage to the udders, type of pathogen involved, drug sensitivity pattern etc. The multi-etiological nature of mastitis and presence of AMR is the main constraint in the development of an efficacious control strategy. Etiological profiling of mastitis in the present study revealed the association of several bacterial agents with variable degrees of AMR, including multidrug resistance. On the basis of limited studies, it is felt essential to reinforce the effort of minimizing the use of antibiotics in treatment and control of mastitis.

The mastitis control model rationalizing the use of antibiotics through alternative approaches being propagated by NDDB is a cost-effective and efficacious proposition for controlling this scourge in developing countries like India, where the resources with the stakeholders are limited. Transferring this EVM knowledge to the farmer would empower them to manage mastitis and other important ailments which dent their already meagre income at minimal costs. This would also help to drastically reduce the usage of antibiotics, thereby stalling the emergence of AMR. The use of TSC and EVM was also found to be an effective alternative for treating SCM and clinical mastitis, irrespective of the etiological agent(s) which had varying degrees of antimicrobial resistance and virulence.

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# Control of *Streptococcus agalactiae* to reduce subclinical mastitis in pastoralist dairy camel herds in Kenya

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## SUMMARY

- **Location:** Isiolo and Laikipia county, Kenya
- **IDF Welfare Action Area:** Health management
- **Resource based measure:** Milking hygiene, watering intervals, supplementary feeding, frequency of changing of enclosure.
- **Animal based measure:** Udder condition, body condition, somatic cell count, inflammatory markers in milk, milk production, intramammary infection, tick infestation

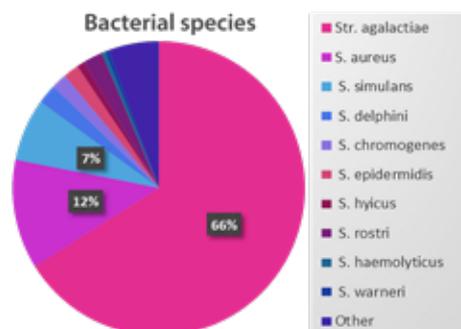
## INTRODUCTION

Camels are vital for the subsistence of pastoralists inhabiting arid and semi-arid regions in Africa, the Middle East and Asia. Due to their unique adaptations to harsh climate, the camel is an important production animal, providing milk, meat, hair, hides and a means of transport. The camel population in Kenya is estimated to be approximately 1 million and the majority are kept under traditional management. Camel milk calculates for 70% of all milk consumed by pastoralists in northern Kenya as well as 40% of their daily calorie intake [1]. Mastitis is a common problem among dairy camels [2, 3] and is an important constraint to milk production, with implications for animal welfare, household economy and public health [4]. Symptoms of clinical mastitis (CM) are well-known by the herders, whereas subclinical mastitis (SCM) is difficult to assess without relevant diagnostic tools. Consequently, camel herders are less aware of the occurrence of SCM. The prevalence for SCM in dairy camels in reports from Sudan and Somalia has been calculated to 16–

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44% [2]; however, in a study from Kenya, the SCM prevalence was 87.3% [5]. A mastitis pathogen commonly isolated from dairy camels in the region is *Streptococcus (Str.) agalactiae*, which severely reduces milk production and is likely to develop into a chronic infection. A joint project between research partners from Kenya and Sweden targets the issue of SCM in pastoralist dairy camels in Kenya, with a special focus on *Str. agalactiae*. The aim of the project is to extract a work package tailored to pastoralist conditions in order



**Figure 1** – Bacteria isolated from milk from dairy camels (n=93) in Isiolo, Kenya. Numbers are the percentages based on the total of isolated bacterial specimen (n=233).

| Level   | Subclinical mastitis | Total |
|---------|----------------------|-------|
| Herd    | 100% (n=20)          | 20    |
| Camel   | 46% (n=95)           | 206   |
| Quarter | 26% (n=207)          | 804   |

**Table 1** – Prevalence of subclinical mastitis, defined as a California Mastitis Test score  $\geq 3$  and the absence of clinical symptoms of the udder, in 20 dairy camel herds in Isiolo, Kenya.

”Only 5% of the camels showed symptoms of CM, supporting the theory that SCM is a much more widespread problem in dairy camel herds than CM”

Dinah Seligsohn



to reduce and control SCM with the principal objective of reducing hunger and improving food security.

#### MATERIAL AND METHODS

As a first step, a prevalence study of SCM and its causative agents was conducted. A total of 20 pastoral camel herds in Isiolo County, Kenya, were selected for the study. From each herd, ten lactating dams were randomly chosen for sampling. The udder in selected camels was palpated and inspected visually, milk was examined by California Mastitis Test, and milk samples were aseptically collected for culturing. Bacterial isolates were confirmed by Matrix Assisted Laser Desorption Ionisation-Time of Flight Mass Spectrometry. In connection with the sampling, interviews were conducted with animal owners and/or herders using a pre-defined structured questionnaire targeting management issues and risk factors.

#### RESULTS AND DISCUSSION

Subclinical mastitis was defined as a CMT-score  $\geq 3$  and absence of clinical signs of mastitis. Our results suggest that the prevalence for SCM at quarter level in the examined herds was 26% ( $n=207$ ) and 46% on individual camel level ( $n=95$ ) and there was at least one camel with SCM in each visited herd. In contrast, only 5% of the camels showed symptoms of CM, supporting the theory that SCM is a much more widespread problem in dairy camel herds than CM. For intramammary infection (IMI), the prevalence was 33% ( $n=215$ ) on quarter level; 64% ( $n=93$ ) of all the sampled camels had at least

one infected quarter. There was a strong correlation between CMT-score and IMI. This demonstrates that CMT is a simple and efficient diagnostic instrument for detecting IMI-positive camels and could serve as an important tool for camel owners in monitoring udder health in their own herds. The most frequently isolated udder pathogen was *Str. agalactiae*, followed by *Staphylococcus aureus* and *non-aureus streptococci*. On quarter level, camel level and herd level, the prevalence for *Str. agalactiae* was 19% ( $n=154$ ), 32% ( $n=65$ ) and 95% ( $n=19$ ) respectively. This is similar to previous reports from the region where the prevalence of *Str. agalactiae* was established to be 12–27%. The maintenance and spread of *Str. agalactiae* within camel dairy herds could be attributed to insufficient milking hygiene practices. The difficult sanitary conditions under which pastoralist camel dairy herds operate are one of the main challenges in improving the udder health. Limited access to clean water in combination with a low awareness of disease transmission and hygienic milking measures among owners are all factors likely to contribute to the situation. This further highlights the need for efficient interventions encompassing multiple aspects of camel husbandry under pastoralist conditions.

In conclusion, SCM is a common problem in pastoralist dairy camels in Kenya and contagious mastitis pathogens, in particular *Streptococcus agalactiae*, account for a majority of the udder infections. The California Mastitis Test is an efficient tool for detecting IMI-positive camels and

could be an initial step towards controlling and monitoring udder health in pastoralist camel herds. The next phase of the project includes studying the epidemiology of *Str. agalactiae* in camel herds in detail, as well as collecting qualitative data to develop control strategies adapted to a pastoralist setting.

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## NEW TECHNOLOGY FOR WELFARE ASSESSMENTS

# Computer vision algorithms as a modern tool for behavioural analysis in dairy cattle

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### SUMMARY

- **Location:** Sweden, Scania County
- **IDF Welfare Action Area:** Health management
- **Resource based measure:** Dairy barn design and functionality, Management practices, Area Analysis.
- **Animal based measure:** Social Behaviour, Welfare, Comfort.

### INTRODUCTION

Looking at modern dairy production, loose housing, i.e., free stalls, has become one of the most common housing solutions. The layout and management of these systems do not always ensure optimal animal welfare. The housing of cows in large groups requires a sound knowledge of the cows' basic social behaviour, an ability to monitor and understand the needs of individual animals within the group and appropriate care interventions to prevent health and welfare problems [1]. The analysis of interactions occurring between cows (and barn environment) and their effect on welfare, health and performance is of great importance for sustainable, animal-oriented production [2]. The general aim of this work was to develop computer vision (CV) algorithms for optimised dairy barn assessment and better animal welfare. These CV algorithms could serve as easy-to-use tools for effective assessment and evaluation of the specific areas of modern dairy barns aimed at different user groups (farmers, dairy advisers, officials). The synergy between animal-oriented measures of welfare and features related to the functionality of dairy barns could help with day-to-day control of the animal production environment.

### MATERIALS AND METHODS

The experiments investigating the potential of CV solutions for detecting and tracking cows and their behaviour in relation to the social structure of the



Figure 1 – Example frames from the recorded video material.



Figure 2 – The frames from Figure 1 projected onto the cow shoulder plan and stitched together to form the overview over the entire waiting area.

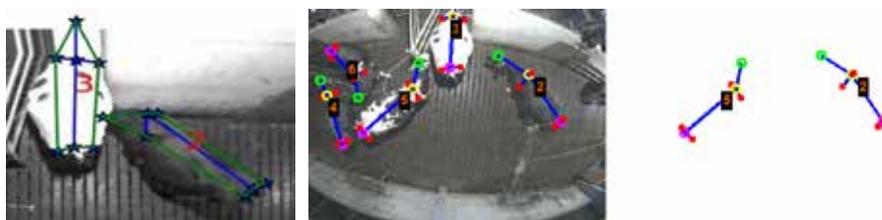


Figure 3 – Example of the shape model (landmark points assigned to every animal).

herd and their physical environment were carried out at a commercial dairy barn at Skåne County, Sweden. There were 250+ Swedish Holstein cows in different parities during the time of these studies that had free access to the waiting area to four automatic milking stations. Video recordings were made using three Axis M3006-V cameras with a broad view angle of 134 degrees. They were placed in the ceiling of the barn at the height of 3.6 metres, pointing straight down to optimise overview of the study area (Figures 1 and 2). The data (almost three years of continuous 24/7 video recordings) were then used to build a 7-point shape model (describing the cow as a mathematical object, see Figure 3). This shape model was used as an input for both behavioural detector and

cow-tracker modules based on state-of-the-art advances in CV and Deep Learning (DL). Artificial Neural Networks were trained to allow behavioural studies and their analysis on farm level [3].

### RESULTS AND DISCUSSION

The value of the CV system for barn assessment is linked to three main parameters: detection of cows in single images (Figure 4), behavioural detection (Figure 5) and tracking/identification of cows in video sequences (Figure 6). Our experiments resulted in the development of a CNN-based cow detection system. The proposed solution can detect and count the cows present in the image with high precision (92.8%). Adding an entirely automatic learning-based framework for

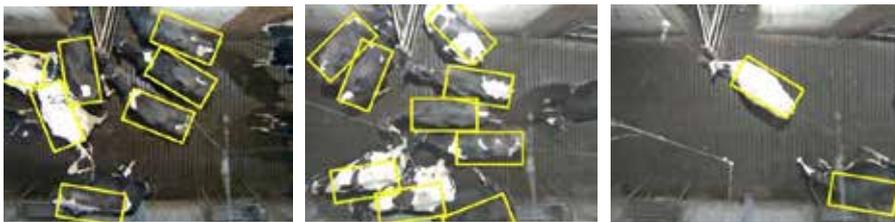


Figure 4 – Example frames from the recorded video material.

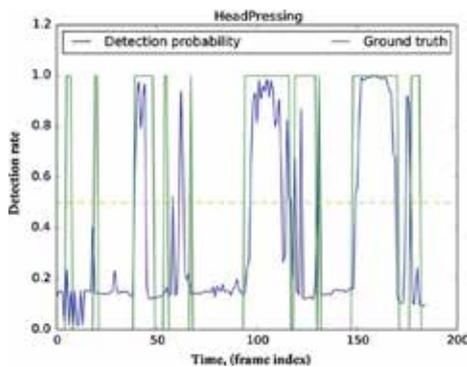


Figure 5 – The accuracy of the detector for the Body Pushing behaviour in a test fragment.



Figure 6 –Example frames with tracked cows. The red ID-numbers are placed on the correct cow by the tracker, while the blue numbers are placed manually (validation).

”Continuous surveillance by using CV technology is potentially one of the most substantial technological advances which can revolutionise the livestock production and make welfare assessment of the farm environment more animal-oriented, flexible and reliable.”

Oleksiy Guzhva

behaviour monitoring (85% of accuracy when comparing it to ground truth levels) and combining it with the flexible and non-invasive algorithm for tracking and identification of individual cows allowing the first step towards fully automated barn monitoring tool.

## CONCLUSIONS

CV solutions can be used at the farm level to increase revenue in a relatively simple and automated way, evaluating different management practices and function of the dairy stall. Thereby, animal flow and occurring interactions could be optimised on each farm so that each animal will be able to produce up to its' ability without jeopardising their longevity, welfare and health. Continuous surveillance by using

CV technology is potentially one of the most substantial technological advances which can revolutionise the livestock production and make welfare assessment of the farm environment more animal-oriented, flexible and reliable.

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# With 3D image analysis system “cow body scan” - keeping animal welfare of dairy cows under control

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## SUMMARY

- **Location:** Germany
- **IDF Welfare Action Area:** Health management
- **Measure:** This 3D image analysis system determines three key parameters of success: body condition, locomotion and body measurements.

## INTRODUCTION

Animal welfare and animal health are very much in the public eye. Ebert et al. [1] estimate that up to 50% of cows in a herd suffer from claw and limb diseases which are the second largest causes of death [2]. Monitoring early signs of lameness and excessive conditioning in dairy cows requires much training. Scoring is subjective, arduous and somewhat stressful for the test subjects. Irregular scoring can have severe consequences for herd management.

The assistance system, CowBodyScan (CBS) is a further development of the technology used in contactless evaluation of moving dairy cows by means of 3D image sensors [3]. The aim of this technology is to support everyday animal observation and to automatically and successfully determine body condition, gait and body measurements.

## MATERIAL AND METHODS

The 3D image sensor is installed above an obstacle-free walkway with the electronic animal identification. The cows have to pass the measurement range one by one.

A 3D model is produced of each cow that goes along the walkway and defined body points are marked. From the output values, algorithms determine the new parameters “Cow Condition Score” (CCS), “Cow

Movement Score” (CMS) and “Cow Size” (CS). The herd management system HERDEplus receives the ccs, cms and cs parameters via an online interface. The system assesses the animal-specific progressive graph for the individual parameters and detects deviations from the ideal value and generates alerts to help decide whether any action needs to be taken.

## CBS PARAMETERS

### Cow Condition Score (CCS)

The ccs describes the development of the body condition of dairy cows. Body regions are marked in the 3D-cow-model. The body fat reserves are determined with the radius of curvature of the marked body regions. Then the CCS is calculated by stochastic methods. The body condition scoring [4] serves as a template for the algorithms and is used for evaluation. The CCS parameters are transferred to the HERDEplus database after a quality check. Real development and ideal development of body fat reserves for each cow are calculated taking into account the ccs data of the previous day, the age, milking day, milk yield and the reproduction status. An alarm is activated by the system if the real development is outside the tolerance. An arrow shows the farmer the individual development of his cows in the single animal representation of HERDEplus

Further evaluation tools are freely selectable for the user, for example, graphical representation or group overview.

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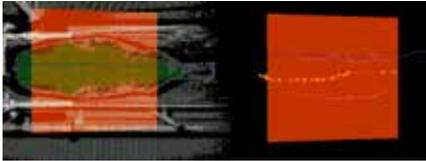
Figure 1 – Single animal representation to the cbs-parameters (© HERDEplus).

### Cow Movement Score (CMS)

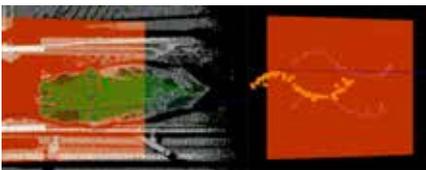
The cms estimates the movement of body points in three-dimensional space and estimates the mathematical function parameters. Any deviations from the previous estimates are determined and combined into a CMS counter.

Figure 2 shows the marked body points and the extended back line on the left side. The tracking of the trace of body points in three-dimensional space is shown on the right. The cow has no locomotion problems in this example and receives a score of zero.

By contrast, Figure 3 shows a cow with locomotion problems. The cow passes the measurement range very slowly with a strong irregular gait. This cow receives a cms >10. This corresponds to a score by SPRECHER et al. [6], of 4.



**Figure 2** – 3D gait profile of a cow without lameness (© DORSCH SOFTWARE).



**Figure 3** – 3D gait profile of a cow with lameness (© DORSCH SOFTWARE).

These visual scoring systems and diagnoses are used for evaluation. Information on the claw health and treatment history of the individual animal would be considered for the creation of the alarm lists.

#### Cow Size (CS)

Further body points can be found, marked and measured in the 3D-cow-model. The parameter CS includes six different body measurements. The data are also transferred to the herd management programme and the farmer receives information about the height of tailhead, sacrum, withers, the distance of pin bones, hip bones, shoulders and the length of back and rump.

#### DISCUSSION

Determining the key figures for body condition and gait with no added work load and the fast presentation of cows suspected of having claw problems opens up a whole new dimension for farmers in terms of animal monitoring and preventive health care.

“With the assistance system, farmers can improve both animal welfare and the economic situation of their dairy farms.”

Franziska Deißing

Combining the parameters might greatly improve early detection of lameness and general claw health.

CBS supports targeted animal monitoring and reduces the response time for necessary treatments.

With the assistance system, farmers can improve both animal welfare and the economic situation of their dairy farms.

#### CONCLUSIONS

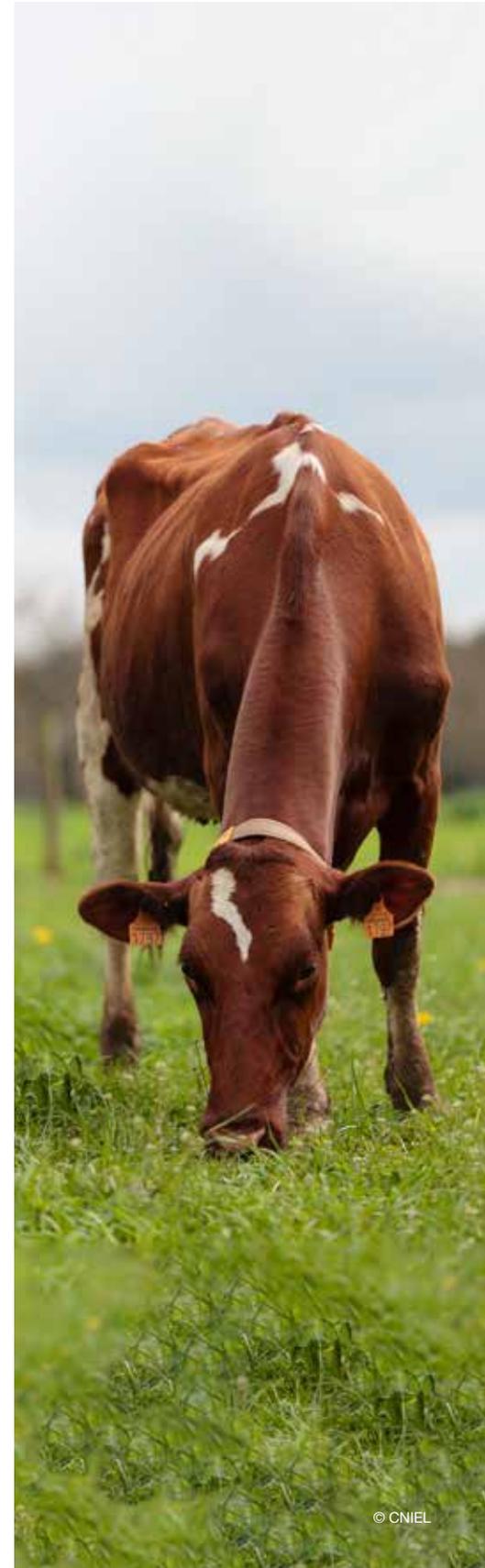
The CBS 3D image analysis system enables automated observation of the dairy cows on the fly. The assistance system measures cows and collects current development data on body condition, locomotion and growth. It is possible to include master data in the evaluation by linking with the herd management programme. Individual animal deviations from the expected value are displayed to the user.

#### ACKNOWLEDGEMENTS

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# GLOBAL INITIATIVES

## OIE

### Third OIE annual data collection on antimicrobial agents intended for use in animals: responses from 155 countries.

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#### SUMMARY

**Location:** Worldwide coverage (information from 155 OIE Member Countries from the five OIE Regions: Africa; Americas; Asia, Far East and Oceania; Europe and the Middle East)

#### INTRODUCTION

The World Organisation for Animal Health (OIE) has worked actively for more than two decades on veterinary products, including antimicrobial agents, and developed a coherent strategy for its activities in this area [1]. Monitoring of antimicrobial use (AMU) is an important source of information which, together with surveillance of antimicrobial resistance (AMR), should be used for the assessment and management of risks related to AMR.

The OIE has built a global database on antimicrobial agents intended for use in animals, contributing to the Global Action Plan on AMR and supported by FAO and WHO.

The OIE launched its annual data collection on AMU in 2015, and published its first report in 2016. The second report, published in 2017, introduced a new methodology to report quantitative data in the context of relevant animal populations and included for the first time an annual analysis of antimicrobial quantities adjusted for animal biomass on a global and regional level. The third report, using the same methodology, was published in February 2019 [2].

#### MATERIAL AND METHODS

The OIE ad hoc Group on Antimicrobial Resistance developed a template for harmonised AMU data collection in animals, as well as guidance for its completion that are available in the three official OIE languages (English, French and Spanish).

Each year in October, the template and accompanying guidance documents are sent to all 182 OIE Member Countries. Data are received and checked for completeness until mid-May of the following year.

The template can be answered by any country and collects general information on topics including the use of antimicrobials as growth promoters and any barriers to reporting quantitative data on antimicrobial agents used in animals.

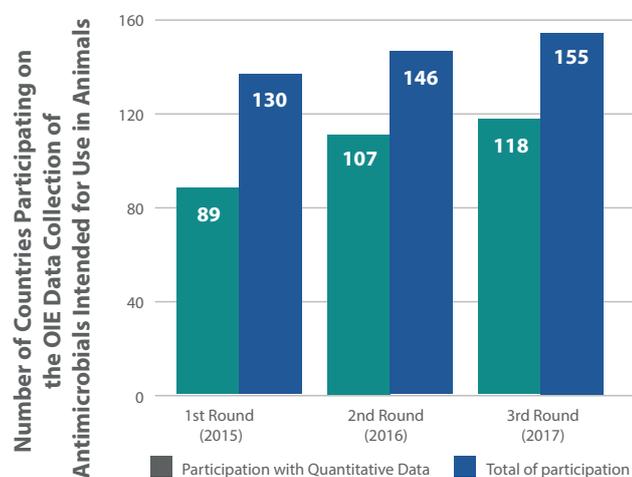
To compare quantitative data reported on antimicrobial agents intended for use in animals between regions and over time, a scale is necessary to evaluate these data in the context of the relevant animal populations, which might vary in size and composition.

While several methodologies have been developed for the calculation of animal biomass, none could be directly used for the OIE global database on antimicrobial agents intended for use in animals. Particularly, these methodologies utilise available data on animal populations detailed by production class, estimates of live animal weights, import/export data, and total annual populations of production groups living less than one year (i.e., poultry, veal calves, fattening pigs, lambs and kids). On a global level, such detailed data are not yet available for many countries and, therefore, a new methodology was developed by the OIE mainly using globally available datasets - the OIE World Animal Health Information System (WAHIS) and the United Nations Food and Agriculture Organization Statistics (FAOSTAT).

#### RESULTS AND DISCUSSION

During the third round of the data collection, 155 countries submitted their national reports, an increase of 19% since the data collection started, and 32% increase in the number of countries reporting quantitative data, in addition to reporting qualitative data since the data collection started.

For the third round, 2015 was the target year and had the highest number of submissions of quantitative data. Therefore, animal biomass was calculated for food-producing species of countries reporting quantitative data for the year 2015. The calculations of animal biomass allowed for an analysis of antimicrobial quantities reported, adjusted by a denominator. Animal biomass is calculated as the total weight of the live domestic



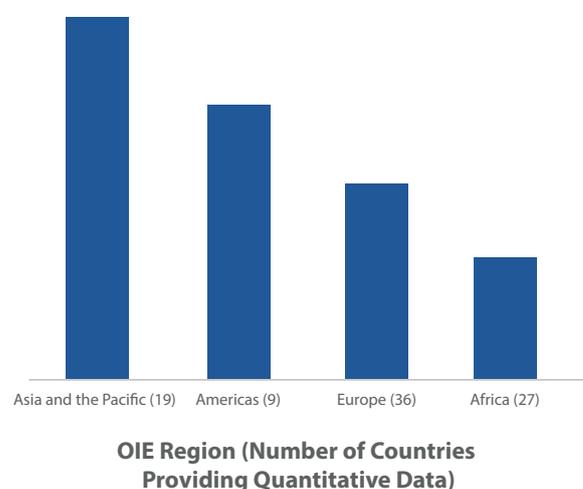
**Figure 1** – Number of Countries Participating in All Rounds of the Data Collection.

animals in a given population and year, used as a proxy to represent those likely exposed to the quantities of antimicrobial agents reported.

The global estimate of antimicrobial agents used in animals in 2015 adjusted by animal biomass, as represented by the quantitative data reported to the OIE from 91 countries, was 168.75 mg/kg. The 2015 analysis reflects a much stronger global participation in the data collection, with an increase of 31 reporting countries and an estimated global biomass coverage of 71%, increased from 37% in 2014.

Figure 2 provides a regional view of antimicrobial quantities adjusted by animal biomass of countries within each region. These results show that in 215, Asia, the Far East and Oceania reported the most antimicrobial agents intended for use in animals among the four regions. However, this region also displayed the most variation between individual countries.

Figure 2 - 2015 Regional Comparison (mg/kg). Based on Quantities of Antimicrobial Agents Intended for Use in Animals Adjusted by Animal Biomass.



**Figure 2** – 2015 Regional Comparison (mg/kg). Based on Quantities of Antimicrobial Agents Intended for Use in Animals Adjusted by Animal Biomass.

”An automated system for this calculation (conversion of antimicrobial active ingredients in veterinary medicines into kilograms) will be developed over time to assist countries in this effort.”

**Elisabeth Erlacher-Vindel**

## CONCLUSIONS

The OIE will continue working closely with its Member Countries to support them in reporting quantities of active ingredients of antimicrobials. An automated system for this calculation (conversion of antimicrobial active ingredients in veterinary medicines into kilograms) will be developed over time to assist countries in this effort. This automated system will particularly help Member Countries with the burden of manually calculating kilograms of active ingredients and avoid errors with these calculations.

The OIE will also continue to refine its methodology for the calculation of animal biomass, based on globally available data and communication with its Member

Countries through its regional offices. An important next step in this process is the collaboration with the OIE World Animal Health Information and Analysis Department (WAHIAD). In consultation with the OIE ad hoc Group on Antimicrobial Resistance, new species and animal sub-categories have been added to the OIE WAHIS data collection guidelines. These new population sub-categories are now being implemented in WAHIS and will allow the refinement of the data on animal biomass over time.

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