In vitro antimicrobial resistance among Gram-positive agents from Danish dairy cows with clinical mastitis

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ANIMAL HEALTH REPORT

Research progress | Global insights | Expert opinion

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PREFACE

MESSAGE FROM THE IDF DIRECTOR GENERAL

Dairy farming and proper animal care, at all scales and in all regions, contribute to food security and the achievement of sustainable development. It is widely known that milk and dairy products provide essential nutrients and are an important source of high-quality proteins and fats, calcium, iodine and many other vitamins and minerals, but many are not aware of the other major contributions of dairy animals to the achievement of the UN Sustainable Development Goals. Indeed, dairy animals provide nutritious food, contribute to farmers' livelihood, and deliver eco-systems services.

IDF's dynamic work on dairy animal health and welfare supports constructive science-based dialogue within the dairy sector and its stakeholders on how to best approach animal health and welfare, its implications for disease prevention and the consideration of all aspects related to farm management, food safety, human health, and dairy technology.

This new Animal Health Report contribute to knowledge and experience sharing. We extend our thanks to the authors, whose contributions have helped to add value to this 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

Over that last 12 months, the focus on global food production and sustainability have been in the spotlight through the United Nations Food Systems Summit held in New York in September and the recently completed 26th UN Climate Change Conference of the Parties (COP26) in Glasgow in November. Through the formal and informal dialogues that took place before, during and after these world-shaping events it has become clearer that feeding the world's growing population will require many different and innovative approaches, and that dairy will continue to be an important part of the global food solutions puzzle. While producing and delivering the wholesomeness of dairy is what brings our IDF community together, we are reminded in this edition of the Animal Health Report that dairy production looks very different across our global member countries, and just like the challenge of feeding our growing world population, there is no one size fits all dairy production system.

In this edition of the Animal Health Report, we explore issues around welfare and housing in Nigeria, New Zealand, Chile, Israel and across the EU. We explore new technologies for tracking mastitis and milk quality, biosecurity, disease detection and antimicrobial use and resistance. The report finishes with a global look at antimicrobial use and animal welfare by the OIE. In each article, we see that there are significant initiatives being implemented by IDF members that showcase how dairy contributes to the UN Sustainable Development Goals. While the path ahead to meeting the challenges of sustainably nourishing the planet's population will not be easy, it is very encouraging to see that the global dairy community is leading on this long and winding road.

In closing, I would like to recognize the tremendous work done by our IDF Team at Head Office in putting together another wonderful Animal Health Report.

I hope you enjoy reading it.

Prof. Dr. David Kelton
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MESSAGE FROM THE SCIENTIFIC EDITOR

Dear Reader,

It is an honour to present the 15th edition of the International Dairy Federation Animal Health Report. You will find inspiring programs improving animal health and welfare as it relates to farm productivity, food security, safety and quality. This issue shows a selection of articles from the members of the animal health and welfare standing committee to inform our experts about the latest developments in the dairy sector.

The breadth of issues IDF covers in its work is extensive. I invite you to read more about current projects on animal health and welfare on the IDF website.

We wish all readers an interesting read.

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NEWS FROM IDF MEMBER COUNTRIES

STOCKMANSHIP

Improving animal welfare in Nigeria is a demanding but important task

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UN SDGs

Summary

Location: Nigeria

IDF Welfare Action Area: Stockmanship

Animal based measure:

- Increased milk production per cow
- Better fed cows, leading to higher immunity
- Increased likelihood of cow longevity

BOOSTING MILK PRODUCTION IN NIGERIA

The Nigerian dairy industry can only supply less than 10% of the country's demand for dairy products, a gap that continues to widen due to population growth. Most Nigerian dairy farmers are small-scale and use a low-yielding dairy breed, so they are unable to fill this gap. In addition, animal management is based on traditions that have led to under-utilisation of animals, low performance, inefficient productivity and high culling rate.

In 2017, Arla Foods, SEGES/DAFC, CARE Denmark and CORET founded the Milky Way partnership with the aim of establishing sustainable market-driven growth in the dairy value chain. This partnership has led to increased milk production and improved animal welfare through increased knowledge, knowhow and technology.

SUPPORTING DAIRY FARMERS WITH CLEAR TARGETS

Since the inception of the Milky Way project, the main objective has been the establishment of a well-functioning dairy value chain in Nigeria. To this end, the objectives of the project have been to provide numerous training lessons and practical training sessions on how to work with dairy cows to achieve maximum potential. Also, by analysing the needs of the farmers, who are mostly pastoralists, so that they can produce more milk and at the same time take proper care of their animals. Furthermore, increasing access to adequate feed for the animals by creating fields with fodder production and irrigation and increasing access to concentrates. Finally, milk collection centres have been set up, where farmers can milk their cows and deliver the milk to Arla Foods.

These initiatives have been partly financed by the partners, but also by the farmers themselves, through the sales of raw milk to Arla Foods.

STABILITY AND IMPROVED FARMER SKILLS

With the establishment of synchronised milk collection from dairy farmers in Kaduna State and the delivery of numerous training sessions with a special focus on animal welfare and care, it has been possible not only to increase milk production, but also to improve animal welfare at the same time.

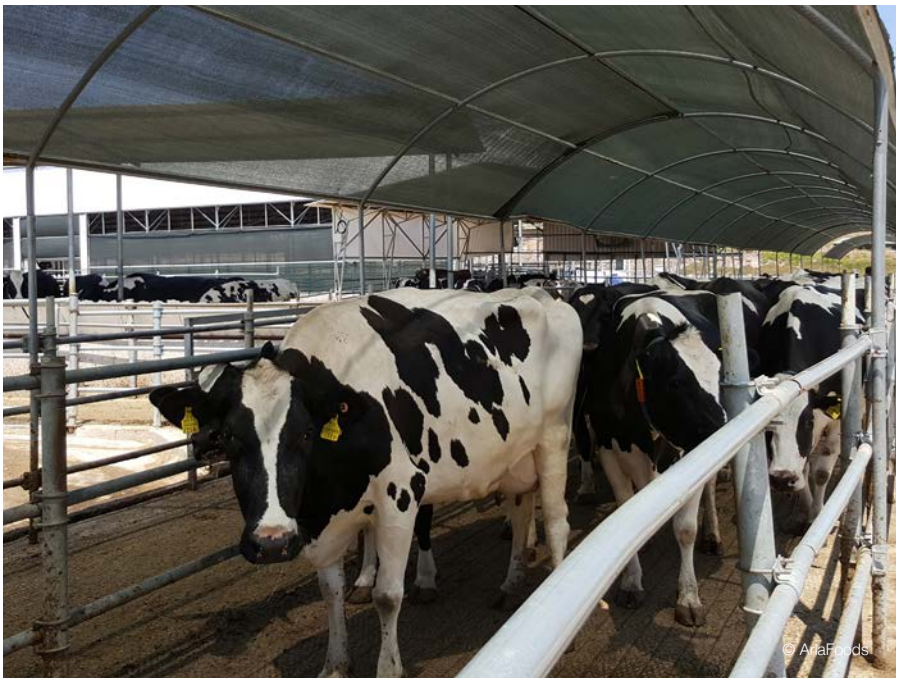
In addition, the local dairy farming community environment has become more stable/sustainable through the creation of numerous farm clusters and capacity building. This has led to improved services provided to farmers, such as veterinary and breeding services, by the different service providers for optimal dairy farming. Improved access to water, both for animals and fields, has also proven to be essential for improved animal welfare, with many more possibilities to feed animals properly, resulting in healthier dairy cattle and higher milk production.

COLLECTIVE WORK IS THE KEY TO SUCCESS

The Milky Way Partnership project has demonstrated that by working collectively (from various local and international companies, governments, and NGOs), it is possible to positively influence local dairy farming in a developing country with a given work process. Through continuous training sessions and capacity building, this project has, among other things, improved dairy herd management through improved feeding, access to clean water and general improvement of animal health. This has led to increased production and longevity of the dairy herd and has generally made them better able to cope with disease and the harsh climatic conditions in Nigeria.

”The Milky Way Partnership project has stregthen the Nigerian dairy herd as well as local farming practices.”

Snorri Sigurdsson



New Zealand's journey from Welfare to Wellbeing - the power of language to inspire change

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UN SDGs

Summary

Location: New Zealand

IDF Welfare Action Area:

- Good stockmanship
- Proper nutrition
- Adequate physical environment
- Responsible husbandry practices
- Robust health management

PROVIDING POSITIVE EXPERIENCES FOR ANIMALS IN OUR CARE

There is increasing global awareness of animal sentience, and greater interest in understanding the quality of life experienced by the animals in our care. The focus for animal welfare has therefore shifted from simply aiming to reduce negative experiences, to recognising the importance of providing opportunities for positive experiences.

This increased interest in positive welfare may explain why many organisations are replacing the Five Freedoms concept with the Five Domains framework (Mellor et al. 2020) as a more holistic tool to measure animal quality of life.

While animal welfare seeks to measure the subjective experience of non-human animals, it cannot escape the economic, political, ethical, cultural, social, and religious perspectives of the human species. As we strive to improve quality of life for dairy cattle, it is therefore essential to consider how we engage with their human carers to inspire change.

WELLBEING, A MORE UNDERSTANDABLE TERM FOR PRODUCERS AND CONSUMERS

Despite New Zealand's animal welfare standards being generally well-regarded internationally, anecdotal feedback from farmers in New Zealand suggests many of them associate the term 'animal welfare' with poor welfare and negative media attention. This may be a barrier preventing farmers from engaging with animal welfare initiatives – even when the focus is on positive welfare.

In mid-2020 leaders within the New Zealand dairy sector decided to change the language used when discussing animal welfare with farmers, to spotlight positive aspects of cattle welfare in New Zealand.

The term animal wellbeing was chosen because of its familiarity for farmers; wellbeing is often used in the context of human wellbeing and the meaning is therefore understood by most people. Wellbeing is also a positive word, which mirrors the overall intent to provide a positive life experience for the dairy cattle in our care.

FARMER ATTITUDE CAN INFLUENCE CATTLE WELLBEING

Following this deliberate change in language, animal wellbeing is now being used to convey information related to animal welfare to farmers by several of New Zealand's agricultural leaders.

Feedback on the terms animal welfare, positive welfare and animal wellbeing was sought from dairy farmers via a small focus-group (unpublished). Responses indicated that while most farmers were comfortable to discuss the topic regardless of the terminology, they associated both animal welfare and positive welfare with the care provided by humans (inputs) whereas they associated animal wellbeing with the subjective experience of the cattle (outcomes).

Previous research has identified that farmer attitudes influence welfare outcomes for the animals in their care, with positive attitudes being associated with higher welfare outcomes (Adler et al. 2019, Munoz et al. 2019). While positive framing of messages can be effective in motivating behaviour change (Gifford & Bernard 2005, Van de Velde et al. 2010), use of the term 'positive welfare' has generated mixed results with both consumers and the public (Vigors 2019).

A SUCCESSFUL CHANGE OF TERM

Early indications from New Zealand's experience in changing language from welfare to wellbeing suggest this may be an effective means by which to increase farmer interest and comfort in discussing animal sentience and quality of life.

It is hoped that this increased discussion and focus on positive wellbeing will ultimately lead to better wellbeing outcomes for dairy cows in New Zealand. Dairy sector leaders in New Zealand will continue to use the term animal wellbeing and hope to be able to share further learning from this approach in the future.

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"Wellbeing is a positive word, which mirrors the overall intent to provide a positive life experience for the dairy cattle in our care."

Katie Saunders

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PHYSICAL ENVIRONMENT

Preference and behaviour of dairy cows with access to an artificial shelter in winter when calving

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UN SDGs

Summary

Location: Valdivia, Chile

IDF Welfare Action Area:
Physical environment

Resource based measure:

- Measure 1: access to shelter in winter

Animal based measure:

- Measure 1: preference of parturient dairy cows Measure 2: lying, standing and sleeping behaviour

EVALUATING ACCESS TO SHELTER FOR CALVING DAIRY COWS IN WINTER

In many pasture-based systems in temperate regions such as southern Chile, where spring-seasonal- calving predominates, cows may be exposed to cold and wet winter conditions. Previously, we found that pre-calving cows exposed to adverse weather conditions utilise shelter if given the opportunity with behavioural and physiological benefits (Cartes et al., 2021). Given that many cows calve in outdoor paddocks during winter, it remains unclear whether they prefer a sheltered environment for calving, and what factors may affect their choice. The objective of our study was to compare the use of artificial shelter in the 24 hours prior to calving and the day before in dairy cows housed outdoors and exposed to winter weather conditions.

WE STUDIED EIGHTEEN PRE PARTURIENT COWS

Eighteen multiparous Holstein cows were evaluated during the winter months (July and August) in southern Chile. Approximately two weeks before the expected calving date, cows were paired and assigned to an open paddock (42 m2/cow) with access to an artificial shelter until calving. This shelter consisted of a 6 x 3 m metal structure, with 3 sides covered with zinc sheeting, a polycarbonate roof and a thick layer of dry sawdust covering its surface. The use of the shelter and the behaviour of the cows inside (lying, standing and sleeping) were continuously video-recorded and analysed by continuous observation. Observations were divided into 2 periods: day before calving (48-24 h before calving) and calving day (24 h before calving until calving). An automated weather station recorded daily ambient temperature (7.5 ± 0.3°C; mean ± SE), relative humidity (84 ± 0.8%), wind speed (2.9 ± 0.4 m/s) and rainfall (10 ± 2.2 mm).

ACCESS TO SHELTER IS IMPORTANT FOR THE COWS BEFORE AND DURING CALVING

The majority of cows (94%) chose to use artificial shelters for calving, while a minority of cows calved in the paddock (6%) (Fig. 1). This preference was not affected by time of day or the presence of another cow in the shelter. Regardless of

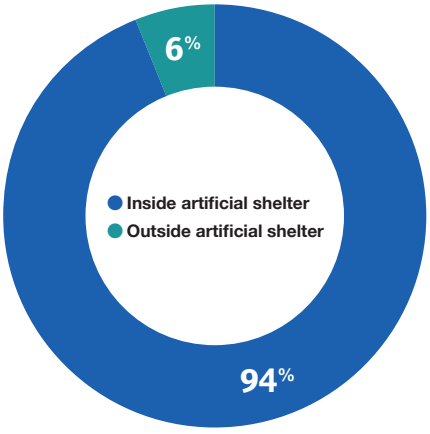

Figure 1 – Percentage of dairy cows that calved inside and outside of artificial shelter.

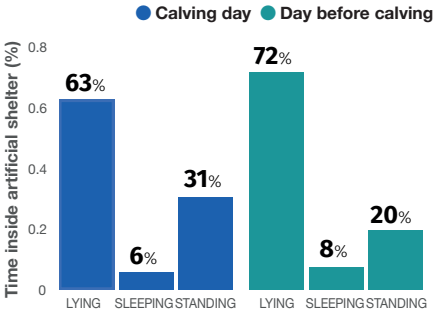

Figure 2 – Percentage of behavioral budget inside of artificial shelter in the calving day and day before calving.

the day, cows spent approximately 64% of their time inside the shelter and, once inside, spent most of their time lying down (Fig 2), suggesting that cows entered the shelters when they were motivated to lie down. We also found that cows spent more time inside the shelter during the night than during the day, which could be the result of low temperatures during the night or because during the day the motivation to seek and use the shelter is subordinated to the motivation for other behaviours (such as feeding).

Understanding what cows prefer at calving time can provide valuable information for making decisions about housing facilities in pasture-based systems

We conclude that shelter is an important resource for dairy cows exposed to wet and cold weather conditions in temperate climate zones. Therefore, if producers use outdoor paddocks during winter for dairy cows to give birth, the provision of a sheltered area may be beneficial for cow behaviour.

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”Access to housing facilities in pasture-based systems is important on dairy cows exposed to wet and cold weather conditions.”

Pilar Sepúlveda-Varas

The economic benefit of cooling dry cows

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UN SDGs

Summary

Location: Tel Aviv, Israel

IDF Welfare Action Area:
Physical environment

DRY COWS ARE NEGATIVELY AFFECTED WHEN SUBJECTED TO HEAT STRESS CONDITIONS

Summer losses in milk production are often related to the negative impact of summer heat stress on the lactating cow. In the last 40 years, studies in different parts of the world have shown that also dry cows are negatively affected when subjected to heat stress conditions. These losses are mainly related to lower milk volume and solids production, as well as fertility traits in the early stages of later lactation. Dry cows under heat stress also suffer from a higher incidence of diseases and metabolic disorders after calving (mainly due to reduced immune function of the cow). All these changes take place after calving and in the early stages of subsequent lactation, although they occur in autumn and early winter, when the heat stress has already passed.

Current studies have been carried out in different climatic conditions (dry and humid regions), and using different cooling methods (direct cooling, using a combination of humidification and forced ventilation) and indirect cooling, using high- and low-pressure fogging). In most studies, the positive effect of cooling dry cows on their milk production is compared with that of cows that are only provided with shade. The results in table 1 show that on an average:

- Body temperature of cooled dry cows was 0.4 C lower compared to non-cooled cows (38.9 C and 39.2 C), respectively.
- Dry matter (DM) intake was 1.5 kg/day higher in cooled dry cows compared to non-cooled cows (11.4 kg/d and 9.8 kg/d), respectively.
- Calf birth weights were 4.4 kg higher in calves born to cool dry cows compared to those born to non-cooled cows (42.4 kg and 38.0 kg), respectively.
- Calf weaning weights were 7.7 kg higher in calves born to cooled dry cows compared to those born to non-cooled cows (77.7 kg and 70.0 kg), respectively.
- Milk production in the following lactation was 3.5 kg/day higher in cooled dry cows compared to non-cooled cows (35.8 kg/d and 32.3 kg/d), respectively.

In a survey carried out in the different parts of the USA, the production losses of milk production in subsequent lactation were related to the number of days in a year, where average daily THI was above 72. The losses in milk production in subsequent lactation averaged 450 kg/year in the average US cow, ranging between 230 kg/year in the "coldest state", where 12% of the dry cows experience heat stress per year, and 1170 kg/year, in the "warmest state" where 70% of the dry cows in the herd experience heat stress per year. Economic losses due to heat stress in dry cows for the entire US dairy sector was estimated to be 810 million US$ annually (87 US$/cow/year). In an average, subsequent lactation dropped in 4.7 kg/d, for each stressful day in the year (average daily THI above 72). Economic annual losses per dry cow ranged between 68 US$ in Wisconsin, and 230 US$ in Florida.

"Heat stress can negatively affect the subsequent lactation of cows experiencing heat stress during late gestation."

Israel Flamenbaum

IN CONTRAST TO LACTATING COWS, VERY FEW STUDIES EVALUATED THE ECONOMIC BENEFIT OF COOLING DRY COWS.

An experiment conducted on a 3,000-cow farm in central California, comparing daytime cooling of cows using a combination of humidification and forced ventilation in a shaded feed line with exclusive humidification of the cows (Urdaz et al. 2006). The cooling systems were operated between 09:00 and 20:00 hours and were supplied to cows in the last 3 weeks of gestation. The addition of fans to the spray system in the feed line increased the annual profit per cow by almost $10.

In 2009, Adin et al examined the benefit of cooling dry cows using a combination of humidification and forced ventilation on a commercial dairy farm in southern Israel. The researchers found that an additional 80 kg of milk was needed in the following lactation to cover the costs of cooling the cows (cooling equipment and its operation). Milk production in the subsequent lactation of the cooled dry cows increased by 190 kg over the control cows that were only provided with shade, leaving the farmer with the benefit of an additional 110 kg of milk for each dry cow that received the cooling treatment.

The latest and most detailed evaluation was published recently by Ferreira et al (2016). The cost-effectiveness of providing a direct cooling system to dry cows was calculated for the "average US cow", and for a dry cow in Florida. In the US there are in an average 96 stressful days per year (26% of year time). Assuming milk and feed dry matter prices of 0.54/kg and 0.28/kg US$, respectively, and an increase of 5 kg of milk production in the following lactation for each day of stress, direct cooling increased the annual net income per dry cow cooled by 62 US$. In Florida, with 257 days of stress per year and a milk price of US$ 0.44/kg, direct cooling increases the annual net income per dry cow by US$ 140. Assuming that 70% of Florida cows experience heat stress in their dry period, this means US$ 100 per

year, per cow in Florida herds. Investment in dry cow cooling starts to pay off when the number of stressful days increases to 50 in moderate climatic conditions and about 10 stressful days in extremely hot regions such as Florida and the south of the USA.

The effect of heat stress on pregnant heifers (assumed to be more thermotolerant) was also studied. Cooled heifers had higher milk production (35.8 vs. 31.9 kg/day) compared to heifers that experienced heat stress at the end of gestation. Cooling heifers at the end of gestation is effective in promoting thermoregulation and results in higher milk production in their first lactation.

It can be concluded that heat stress can negatively affect the subsequent lactation of cows experiencing heat stress during late gestation and that the application of effective cooling devices to cows during this period can pay for itself very quickly and improve the annual net income of the dairy farm.

Cooling Treatment	Source	state	Cooled	Not Cooled	Diff. Kg/d
Shade Vs No shade	Collier et.al. 1982	Florida	26.7	25.5	1.2
Indirect cooling (high pressure fogging)	Armstrong et. al. 1994	Arizona	41.3	39.7	1.6
Direct cooling (wetting and forced ventilation)	Wolfenson et. al. 1988	Israel	40.7	37.2	3.5
Indirect cooling (low pressure fogging)	Avendano reyes et. al. 2006	Mexico	26.1	24.3	1.8
Direct cooling	Adin et. al. 2009	Israel	44.8	41.4	3.4
Direct cooling	Urdaz et. al 2006	California	33.7	26.2	7.5
Direct cooling	Do Amaral et.al. 2011	Florida	34.5	32.2	2.3
Direct cooling	Tao et. al. 2011	Florida	33.9	28.9	5.0
Direct cooling	Tao et. al. 2012	Florida	34.0	27.7	6.3
Direct cooling	Thompson et. al. 2014	USA	33.8	30.0	3.8
Direct cooling	Karimi et. al. 2015	Iran	44.6	40.5	4.1

Table 1 – Average milk production (kg/d), in subsequent lactation of dry cows from different climatic regions, cooled by different cooling methods, as compared to cows provided only shade.

HUSBANDRY PRACTICES

Differential Somatic Cell Count – A new parameter for udder health management through dairy herd improvement testing

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UN SDGs

Summary

Location: Hilleroed, Denmark

IDF Welfare Action Area: Husbandry practices

DSCC PROVIDING MORE DETAILED INFORMATION ON THE ACTUAL UDDER HEALTH STATUS

Differential Somatic Cell Count (DSCC) represents the combined proportion of polymorphonuclear neutrophils (PMN) and lymphocytes as a percentage of the total SCC. A new generation of high-throughput flow cytometers allows to determine SCC and DSCC simultaneously in milk-testing laboratories. It has been demonstrated that using both SCC and DSCC resulted in an increased sensitivity to detect mastitis (Schwarz, 2020a). The combined use of DSCC and SCC opens up the possibility to categorise cows into udder health groups (UHG) providing more detailed insights (e.g. cows in early stage of mastitis, cows with chronic mastitis) compared using SCC alone (Schwarz, 2020b). The performance of cows differs significantly between these four groups.

PILOT PROJECT TO BUILD UP PRACTICAL EXPERIENCE

The combination of SCC and DSCC test day results is used as follows to categorise cows into four different UHG (Figure 1):

A – healthy: SCC <200,000 cells/ml and DSCC ≤65%,

B – onset of mastitis: SCC <200,000 cells/ml and DSCC >65%

C – (subclinical) mastitis: SCC >200,000 cells/ml and DSCC >65%

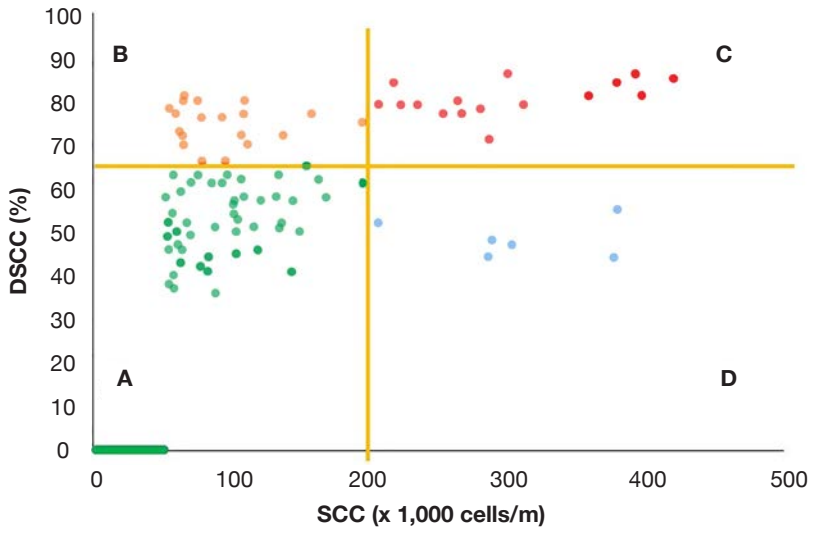

Figure 1 – Dairy herd improvement results of one dairy farm (random example) to illustrate the four different udder health groups: A – healthy, B – onset of mastitis, C – (subclinical) mastitis, D – chronic mastitis.

D – chronic mastitis: SCC >200,000 cells/ml and DSCC ≤65%

The threshold of 200,000 cells/ml is according to IDF (2013) recommendation, whereas the threshold of 65% was identified as optimal by Schwarz (2020a).

We selected a total number of 11 dairy farms (150-900 lactating cows each) in Thuringia, Germany. The farms had different proportions of cows in the four udder health groups and visited them to better understand management practises and associations with the UHG concept. At the same time, we introduced the new DSCC parameter and a new SCC and DSCC-based udder health report to the farms and all of them agreed to join a pilot project where they would get access to the new report once per month for a period of 1 year.

EXPERIENCES FROM PILOT PHASE AND NEXT STEPS TO IMPLEMENT THE NEW PARAMETER INTO PRACTICE

We observed a versatile application of the new udder health report: on herd and on cow level each. An example for applying the data on herd level is the optimisation of cubicle management. In terms of cow level, herd managers were particularly interested in the UHG results for fresh and late-lactating cows. Cows with stable udder health falling in UHG A before dry-off were dried off without antibiotics. As for fresh-lactating cows, group B was of high interest because mastitis can be spotted at a very early stage here and the herd management can then be adjusted to prevent more mastitis cases.

All of the participating dairy farms agreed at the end of the pilot phase that “the information provided through the new report is valuable because it helps to

reduce the consumption of antibiotics, reduce the amount of wasted milk, and improve animal health and performance."

In a next step, a newly developed online tool for presenting the udder health report based on SCC and DSCC information will be launched and the tool will be rolled out broadly.

A NEW, PRACTICAL, AND INEXPENSIVE TOOL TO AID IN TACKLING MASTITIS

Mastitis is still a huge challenge on dairy farms and is one of the key reasons for premature culling of dairy cows. The new DSCC parameter can be measured in a practical and cost-efficient way given that it can simply be integrated as an additional parameter in existing DHI testing programmes. Our pilot project on working with a new SCC and DSCC-based udder health report revealed that it helps dairy farmers to better manage udder health in their herds. Improvements in terms of dairy cow health, welfare, and performance and less antibiotic treatments were already seen during the pilot project. In the long run, improvements regarding cow longevity and milk quality in general can also be expected.

"Using both SCC and DSCC resultes in an increased sensitivity to detect mastitis"

Daniel Schwarz

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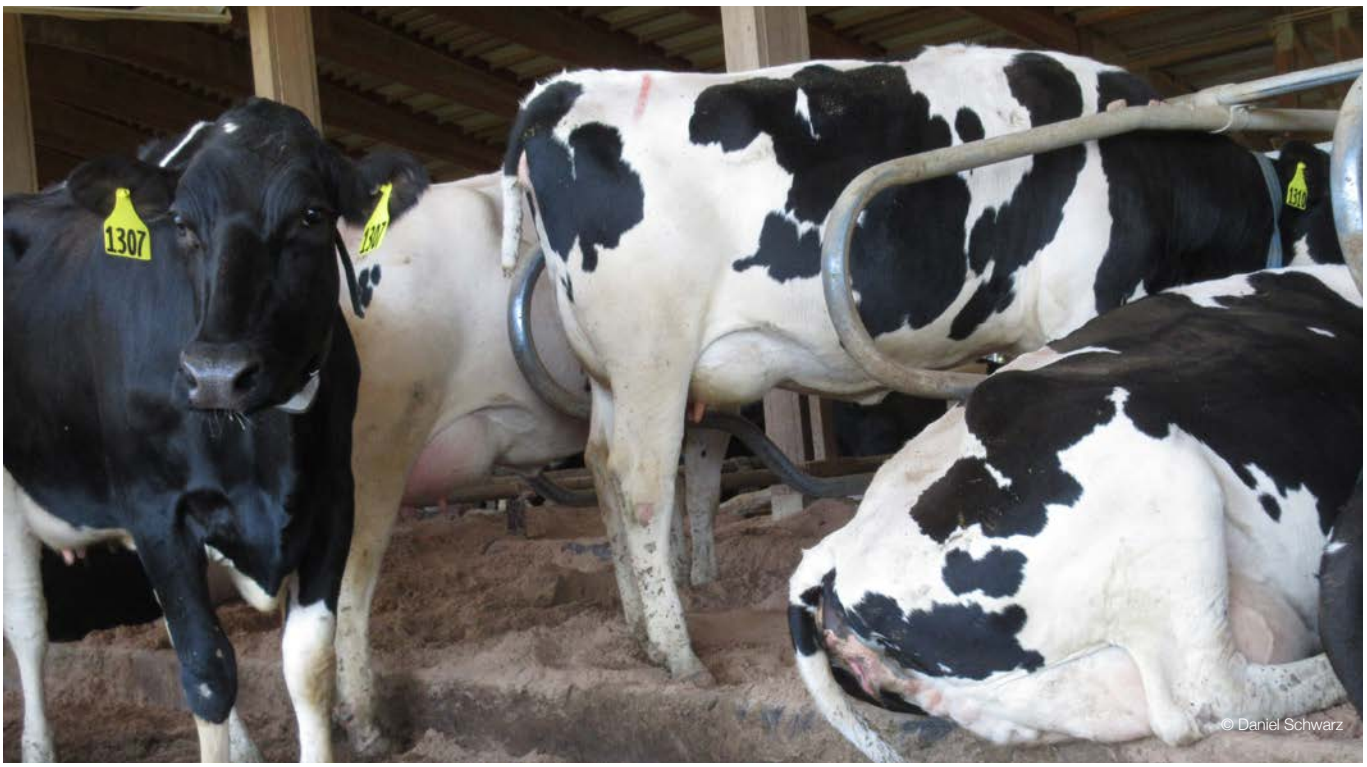

ERA-Net SusAn project FreeWalk: Develop economic sound free walk farming systems elevating animal welfare, health and manure quality, while being appreciated by society

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UN SDGs

Summary

Location: Germany; The Netherlands; Slovenia

IDF Welfare Action Area: Husbandry practices

Resource based measure:

The free-walk system can be considered sustainable in terms of animal welfare, resource efficiency and soil improvement. Optimal bedding conditions are achieved through proper management and sufficient space per cow. Dry bedding not only keeps cows clean and prevents the transmission of pathogens, but also allows for better composting of the bedding into a valuable fertilizer.

Animal based measure:

Welfare of cows in free-walk housing is positive, as there are fewer injuries and lameness. More comfort around resting was found due to absence of typical problems with cubicle housing (collisions with environment, laying outside supposed lying area). Dirty hindquarters and lower legs in some farms indicate reserves in bedding management.

ALTERNATIVE HOUSING OPTION FOR COWS IN EUROPE

Free-walk housing systems including compost-bedded pack barns (CBP) with a completely free (and soft) walking and lying area attract increasing attention, because they support better health, longevity and welfare of cows [1] by utilizing organic waste products as bedding materials that in turn improve soil structure of the arable land. Also consumers associate the CBP system with better animal welfare and there is an overall positive attitude towards the use of composting materials as well as re-using compost from the CBP for other purposes (e.g. energy, growing produce) [2]. Research groups in the FreeWalk project were assessing the actual situation in CBP barns working on cattle housing, breeding, health, NPC balances and (socio-) economics.

IN-DEPTH RESEARCH ON EUROPEAN FREE-WALK FARMS

To perform system comparisons, 22 reference farms with cubicle housing (CH) were assigned to 22 compost-bedded pack barns (CBP) according to similar housing, herd size and production level in six European countries (Austria, Germany, Italy, Netherlands, Slovenia, Sweden). In 2017-2019 the farms were visited six times to record animal-, climate- and bedding-related data and to document several management aspects and relevant key figures. For welfare evaluation a revised version of the European Welfare Quality® assessment protocol was applied. Monthly milk recording data as well as reproduction and culling information for (generalized) linear mixed model analyses were retrieved for the project period. For genomic studies using udder health indicators six German farms were visited to collect udder quarter milk and hair samples. Consumers in eight European countries were questioned about their view on the different housing systems. Farmers and non-milk consumers were excluded. Also six focus groups were held in three countries.

PROMISING RESULTS AS USEFUL ASPECTS FOR FUTURE FARMING STRATEGIES

The CBP farms in this study provide a relatively large lying area of 12 m²/cow [3]. Advantages and disadvantages of a variety of straw- and wood-based bedding materials and new alternative materials was proven by physical and chemical investigations [4]. Optimal processing, aeration and re-spreading require special skills, because climate and texture of bedding materials are related to activity of microbes in the composting process. Though, the number of bacterial positive udder quarters was higher in German CH than in the compared

> ”Compost-bedded pack barns provide enhanced welfare conditions for cow comfort and longevity provided cow coat hygiene,and high quality materials.”
>
> **Kerstin Bruegemann**

CBP farms with indications, that associated genes have immunosuppressive effects during stressful conditions [5]. At the European level, clear advantages have been found in CBP systems with regard to longevity [6], species-specific behaviour, lameness and injuries [7]. However, comparison of cell count levels in milk [6] and cow cleanliness [7] show that there is still room for improvement, which is limited by quality and costs of bedding materials [3]. Consumers questioned did not really focus on the housing system, but more on grazing and organic farming [2].

IMPROVEMENT OF ANIMAL WELFARE, MANURE QUALITY AND SOCIAL ACCEPTANCE IN AN INTEGRATED WAY

CBP barns provide enhanced welfare conditions for cow comfort and longevity. But cow coat hygiene, which is related to udder health and is an indicator for wet bedding conditions, should get more consideration in CBP barns. It can be improved by frequent cultivating, ventilating, and adding fresh material to achieve a dry bedding. Advisory networks and incentives for the use of high-quality materials, as well as adapted evaluation schemes that recognize

social and sustainable performance, can help CBP systems establish themselves as an animal-friendly and resource-efficient alternative to existing CH barns to produce safe dairy products.

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HEALTH MANAGEMENT

In vitro antimicrobial resistance among Gram-positive agents from Danish dairy cows with clinical mastitis

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UN SDGs

Summary
Location: Denmark
IDF Welfare Action Area: Health management

PENICILLIN REMAINS FIRST DRUG OF CHOICE FOR TREATMENT OF CLINICAL MASTITIS

Antimicrobial usage is a major focus worldwide, as it contributes to development of antimicrobial resistance (AMR). The World Health Organization (WHO) considers AMR an urgent global health threat for both humans and animals. Therefore, WHO emphasize the performance of AMR surveillance studies as a key part in the action of fighting AMR (World Health Organization, 2015). In the dairy production, usage of antimicrobial agents is primarily for bovine mastitis. In Denmark, simple penicillin is the first drug of choice for treatment of clinical mastitis (CM) caused by Gram-positive agents (DANMAP, 2019). Usage of broad-spectrum antimicrobials requires further analysis of milk samples (Wilm *et al*., 2021), including pathogen identification and antimicrobial susceptibility testing (AST). This study reports AMR data on Danish isolates from cases of CM, collected in 2018 and 2019. The results are compared with literature, possibly exploring novel trends.

PATHOGEN IDENTIFICATION AND DETECTION OF PHENOTYPIC ANTIMICROBIAL RESISTANCE

The isolates included in this study comprised *Staphylococcus aureus, Streptococcus uberis and Streptococcus dysgalactiae* (n=96 in total), and recovered from milk samples submitted to Center for Diagnostics, Technical University of Denmark (CfD, DTU) from different dairy practices throughout 2018 and 2019. The samples were submitted in relation to different research projects or for diagnostic analysis. All samples originated from cases of CM. Species identification was performed based on matrix-assisted laser desorption ionization-time of flight mass spectrometry (MALDI-TOF MS) analysis (Nonnemann *et al.*, 2019). AST was carried out using the broth microdilution method with SensiTitre. The test panel and breakpoints applied for interpreting the minimum inhibitory concentrations (MICs) were those routinely used at CfD, DTU for AST of veterinary isolates (Chehabi *et al.*, 2019). However, due to the general lack of approved breakpoints specifically for mastitis pathogens, the interpretations must be regarded with caution. Resistance percentages were calculated, and the MIC_{50} and MIC_{90} were found, representing the MICs required to inhibit the growth of respectively 50% and 90% of the test isolates (Bolte *et al.*, 2020).

> ”In our study on danish dairy cows, we reported low resistance levels among *S. aureus*, *S. uberis* and *S. dysgalactiae*.”
>
> **Desiree Corvera Kløve Lassen**

ANTIMICROBIAL RESISTANCE WAS GENERALLY LOW AMONG DANISH MASTITIS ISOLATES

This study included *S. aureus* (n=24), *S. uberis* (n=39), and *S. dysgalactiae* (n=33). Overall, low resistance levels were detected for all bacterial species against the 14 antimicrobial agents tested. For *S. aureus*, only a single isolate was resistant towards penicillin, and another was cefoxitin resistant. Since cefoxitin resistance may indicate methicillin-resistant *Staphylococcus aureus* (MRSA), this isolate was sent for validation by whole-genome sequencing (WGS) (results awaiting). However, literature suggest that the prevalence of MRSA in dairy cows are generally low (Jong *et al.*, 2018). The highest resistance levels were observed for sulphamethoxazole and spectinomycin, which is in accordance with previous data from Denmark (Chehabi *et al.*, 2019). For the Streptococcus spp., resistance was detected against erythromycin, tetracycline and trimethoprim (Table 2-3). All isolates were susceptible towards penicillin. However, more than 40% of the *S. uberis* isolates were penicillin intermediate, with MIC values of 0.25µg/ml or 0.5µg/ml. *S. uberis* isolates with decreased susceptibility against penicillin, has been observed in previous literature (Chehabi *et al.*, 2019) (Jong *et al.*, 2018) and penicillin-associated resistance mutations have been identified (Haenni *et al.*, 2010). In future research, the penicillin intermediate *S. uberis* isolates from this study will be screened for presence of such mutations.

LOW RESISTANCE LEVELS WERE OBSERVED AMONG *S. AUREUS*, *S. UBERIS* AND *S. DYSGALACTIAE* ISOLATED FROM DANISH DAIRY COWS

This study reports updated phenotypic AMR data among *S. aureus*, *S. uberis* and *S. dysgalactiae* isolated from Danish dairy cows with CM. Overall, low resistance levels were observed among all drug/bug combinations (resistance ≤23%). All Streptococcus spp. and almost all *S. aureus* isolates (n=23/24) were susceptible towards penicillin, hence usage of simple penicillin as first drug of choice for treatment of CM in Denmark seems to remain reasonable. However, we encourage interpreting the data provided here cautiously, due to the missing breakpoints for bovine mastitis

pathogens. In order to reduce the risk of biased interpretation of AMR occurrence, due to usage of different MIC breakpoints, we have provided the MIC distributions, along with the MIC50 and MIC90, which may be used for comparison in future AMR surveillance studies.

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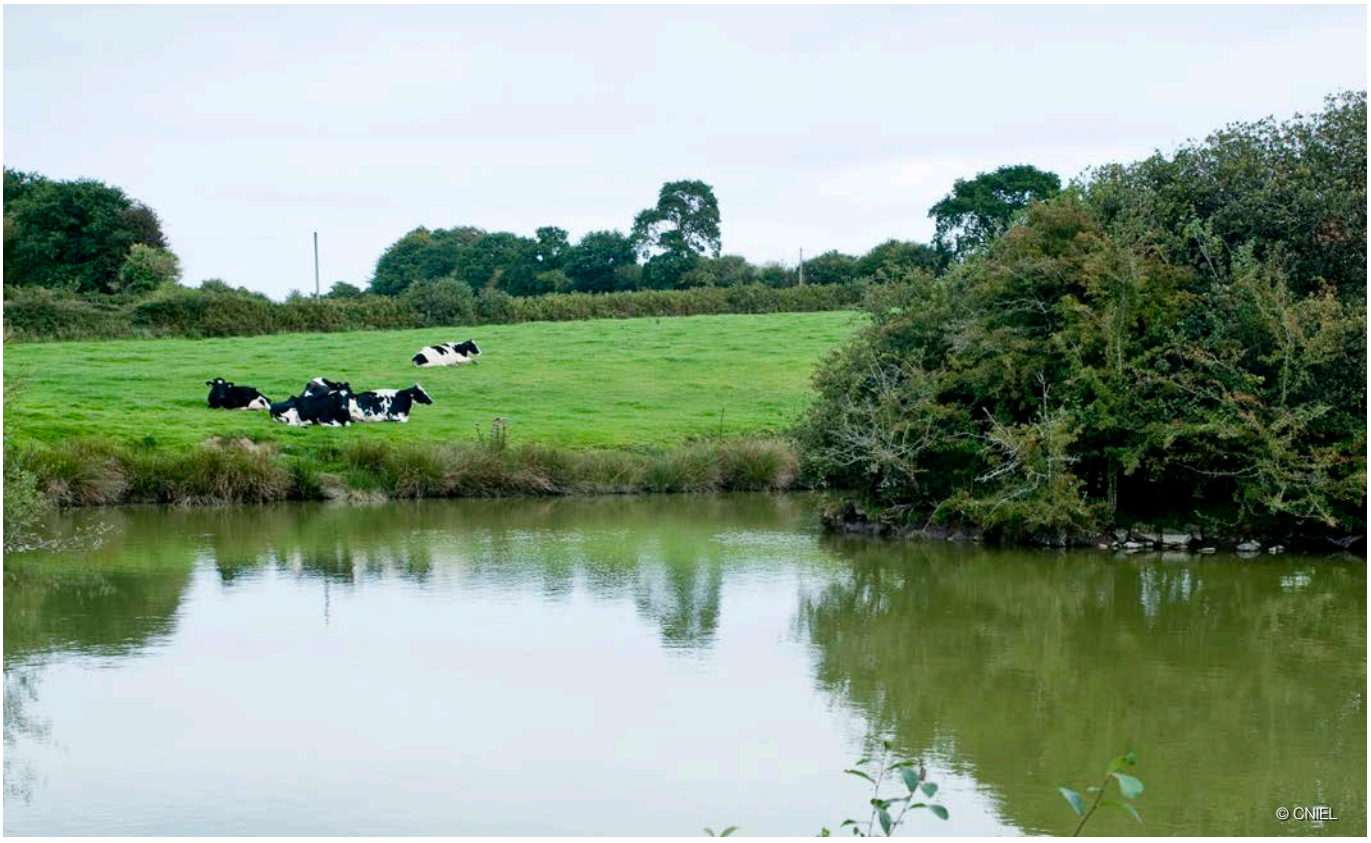

Data driven indicators for mastitis and milk quality in automatic milking systems

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UN SDGs

Summary

Location: Sweden

IDF Welfare Action Area: Health management

MAKE DATA SPEAK THE FARMERS LANGUAGE

An automatic milking system (AMS) needs to be able to detect deviations and issue alerts to detect potentially sick cows and prevent milk of bad quality to end up in the bulk tank. Many parameters linked to mastitis can be measured using sensors and AMS delivers a lot of data from different sources several times daily. For the farmer to act upon problems, the information from the system needs to be easy to understand and interpret. The aim of the thesis was to use sensor data form the AMS to predict two established and well-known indicators of mastitis and milk quality: somatic cell count (SCC) and changes in the milk homogeneity (clots).

”Somatic cell count data obtained from sensors of the automatic milking system can be helpful for farmers to identify mastitis cases.”

Dorota Anglart

MACHINE LEARNING MODELS TRANSLATING SENSOR DATA INTO PREDICTIONS

Somatic cell count data were collected using weekly DHI samples from 372 cows milked in an automatic milking rotary (AMR, DeLaval, Tumba Sweden). Clot data were collected using in- line filters, sampling each quarter of 624 cows at 4 voluntary milking system (VMS, DeLaval, Tumba, Sweden) farms during 30 consecutive hours at three occasions. Figure 1 shows how the filters were scored according to clot density on a scale between 0 and 5 (Hallén Sandgren et al. 2021). Sensor data and cow information was used as input variables in machine learning models, where SCC and clot scores respectively were the outcomes. We evaluated three machine learning methods (random forest, generalized additive model and multilayer perceptron) with different setups of information to the algorithm for predictions of SCC. Clots in milk were predicted during one milking but also a 30-hour period (as suggested in ISO, 2007) of consecutive milking.

WHAT DATA WAS NEEDED AND HOW GOOD ARE THE PREDICTIONS?

The best method to predict SCC was the generalized additive model with a low prediction error, demonstrated in Figure 2 using a threshold value. Including the cow number in the model (an indirect information regarding the cows’ overall level of SCC) improved prediction, which is important knowledge regarding

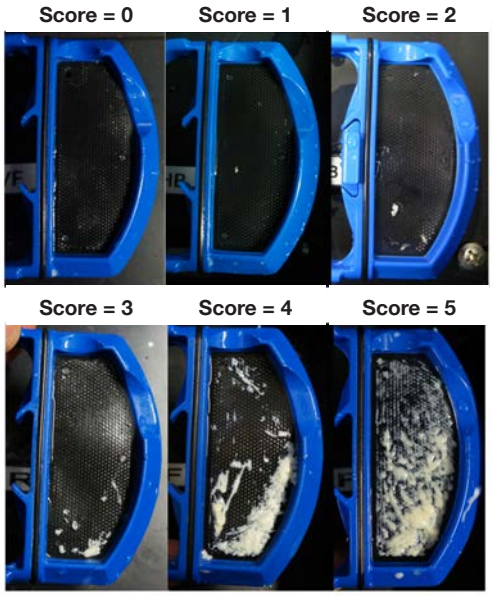

Figure 1 – Score on the filters scored for density: 0 = no sign of clots; 1 = trace; 2 = mild; 3 = moderate; 4 = heavy; 5 = very heavy assemble of clots (Adapted from Hallén Sandgren et al. 2021)

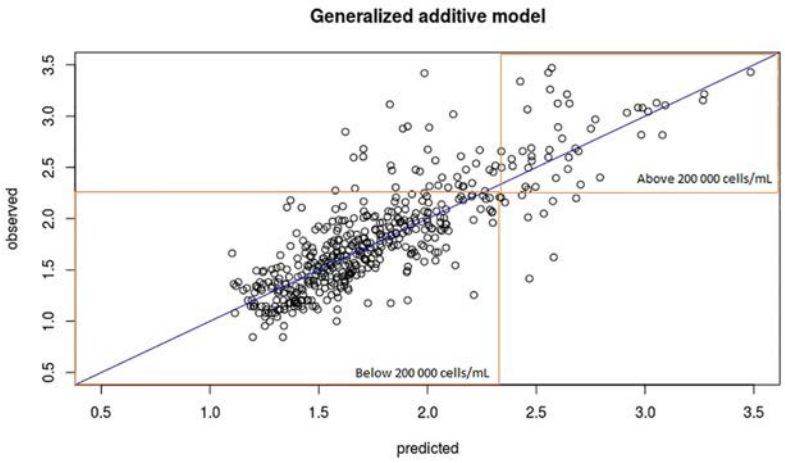

Figure 2 – The predicted values of somatic cell count (log 10) by the generalized additive model compared against the measured values. The squares visualize the predictive performance of the model; majority of predicted values would categorize the cows into the correct class, here using a threshold value of 200 000 cells/mL. Adapted from Anglart et al. 2020.

what information the algorithm needs to accurately predict the SCC for new cows. The models predicting clots showed a high ability to identify milkings and periods free from clots (specificity = 0.98) while the low sensitivity (0.26) indicated a poor ability to detect clots. Based on the low prevalence (2.4 %) of milkings with clots (i.e., score >1), the farmer would experience a lower false-positive rate in practice, as the overall positive predictive values were moderate to high (50–70%). However, a lower misclassification rate was observed for the severe cases; for score 4 and 5, 63% and 100 % of the cases were correctly identified.

WHAT COULD BE GAINED USING DATA DRIVEN METHODS?

Data based methods to predict the level of SCC for individual cows seems promising and could be a useful tool for farmer to use in between the ordinary DHI test samplings as quick check-up, without any additional workload or costs (consumables). Predictions of clots in milk will demand more investigations. Furthermore, clots scored as 1 and 2, corresponding to a trace or mild case of clots (Figure 1) should probably be treated as negative, since they are probably not meaningful to detect; neither from a milk quality nor a udder health perspective, as the repeatability of these scores was below 50%.

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Harnessing the power of artificial intelligence to improve the health and welfare of dairy cattle: Using activity and rumination data for early detection of anaplasmosis in dairy heifer calves

AUTHOR

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Summary

Location: USA; Brazil.

IDF Welfare Action Area: Health management

Animal based measure:

- Anaplasmosis present clinical signs that can allow detection by sensors
- Rumination and activity data can be used for early anaplasmosis detection in heifer calves
- The early anaplasmosis detection can improve the recovery of sick animals

BOVINE ANAPLASMOSIS CAUSES LARGE ECONOMIC LOSSES ON DAIRY FARMS

On dairy farms, systematic monitoring of animal performance, behaviour, intake and other complex phenotypes is unfeasible due to labour, costs and animal stress. Artificial intelligence applications on sensor and image data are becoming increasingly important due to their ability to generate real-time, non-invasive and accurate animal-level information. The use of artificial intelligence requires sophisticated statistical and computational approaches for efficient data management, as it involves massive datasets. The objective of this report is to provide an example of artificial intelligence application to develop a data management model for early prediction of anaplasmosis in calves. A collaborative effort between Embrapa, the University of Wisconsin-Madison and the Federal University of Minas Gerais-UFMG.

THE FEASIBILITY OF USING WEARABLE SENSORS TO PREDICT ANAPLASMOSIS HAS BEEN INVESTIGATED

Twenty-three calves of 119 ± 15 (mean ± SD) days of age and 148 ± 20 kg body weight were challenged with 2 × 107 erythrocytes infected with UFMG strain 1 (GenBank number EU676176) isolated from Anaplasma marginale. After inoculation, the animals were monitored daily by assessment of packed cell volume. The lowest packed cell volume value (14 ± 1.8%) and positive rickettsemia were used as criteria to classify an animal as sick (day 0). Rumination and activity data were collected continuously and automatically, using SCR Heatime Hr collars. Two time series were constructed that included the last sequence of -5, -7, -10 or -12 days prior to day 0 or comprised a randomly selected sequence of 5, 7, 10 or 12 days in a window of -50 to -15 days prior to day 0 to ensure a sequence of days in which packed cell volume was considered normal (32 ± 2.4%). Long short-term memory was used as the prediction approach, and a leave-one-animal-out cross-validation was used to assess the quality of the prediction.

RUMINATION AND ACTIVITY DATA CAN BE USED FOR EARLY ANAPLASMOSIS DETECTION IN HEIFER CALVES

The anaplasmosis disease reduced 34% and 11% of rumination and activity, respectively (Figure 1). The accuracy, sensitivity, and specificity of long short-term memory to detect anaplasmosis ranged from 87 to 98%, 83 to 100%, and 83 to 100% respectively, using rumination data. For activity data, the accuracy, sensitivity, and specificity varied from 70 to 98%, 61 to 100%, and 74 to 100%, respectively. The predictive performance was not improved when combining rumination and activity. The use of longer time-series did not improve the performance of models to predict anaplasmosis.

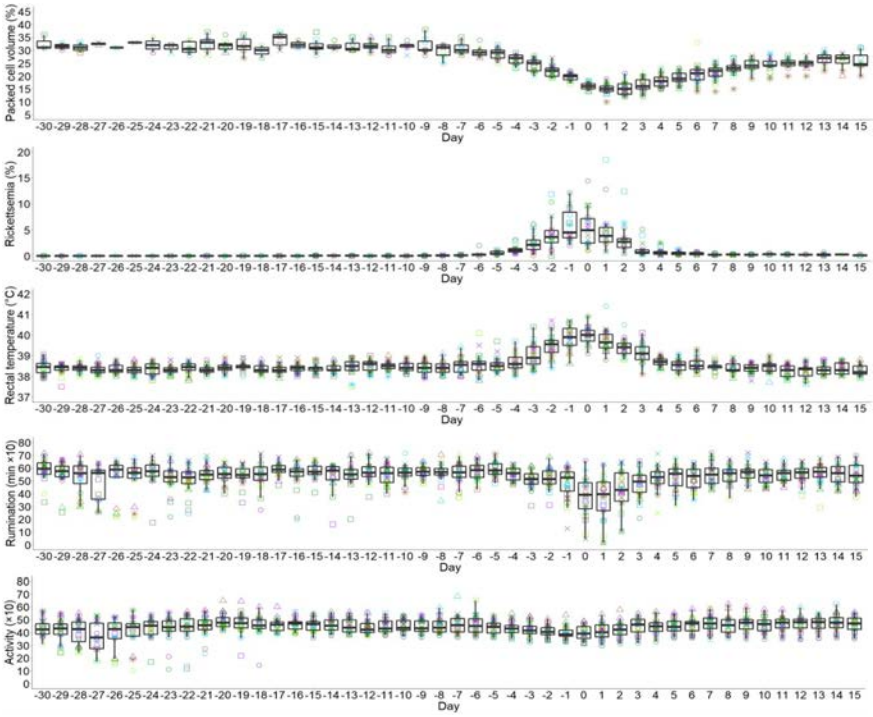


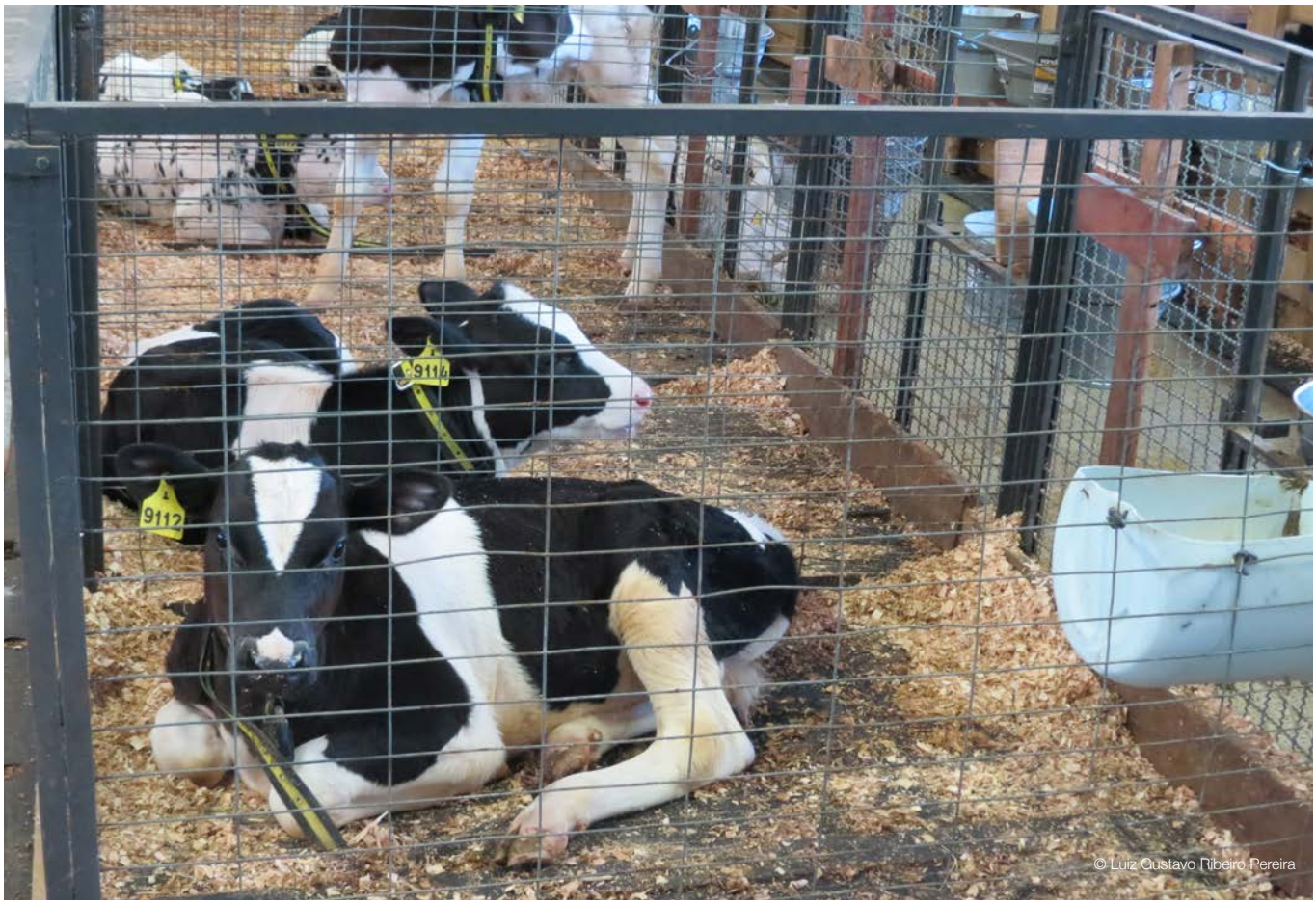
Figure 1 – Effects of Anaplasma marginale inoculation on packed cell volume, rickettsemia and rectal temperature, rumination time and activity index measured by SCR Heat time Hr® collars, in dairy heifer calves according to days relative to sickness

THE EARLY ANAPLASMOSIS DETECTION BY SENSORS CAN IMPROVE THE RECOVERY OF SICK ANIMALS IN DAIRY FARMS

The accuracy and sensitivity to predict anaplasmosis up to 3 days prior to the clinical diagnostic (day 0) were greater than 80%, confirming the possibility to early identify anaplasmosis diseases. Such accomplishments indicate great potential of wearable sensors to early identify anaplasmosis diseases. This could positively impact profitability of dairy farmers and animal welfare.

”Rumination and activity data can be used for early anaplasmosis detection in heifer calves.”

Luiz Gustavo Ribeiro Pereira



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FARM Biosecurity: The Next Step in Protecting the U.S. Dairy Herd from a Foreign Animal Disease Outbreak

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UN SDGs

Summary

Location: USA

IDF Welfare Action Area: Health management

THE FARM PROGRAMME HELPS ENSURE THE SUCCESS OF THE ENTIRE DAIRY INDUSTRY

A foot and mouth disease (FMD) outbreak in the U.S. could devastate livestock producers and the U.S. economy. The Secure Milk Supply (SMS) Plan provides continuity of business guidance for dairy farmers during an foot and mouth disease outbreak. The National Dairy Farmers Assuring Responsible Management Program (FARM) helps ensure the success of the entire dairy industry by demonstrating U.S. dairy farmers are committed to producing high quality, safe milk with integrity through modules in animal care, antibiotic stewardship, environmental stewardship, and workforce development.

A new FARM Biosecurity module will address: (1) enhanced biosecurity incorporating on-farm elements of the Secure Milk Supply Plan and (2) biosecurity with focus on everyday steps to take to protect dairy herds.

THE SECURE MILK SUPPLY PLAN ENHANCED BIOSECURITY IS INCORPORATED INTO FARM

U.S. Department of Agriculture (USDA) funding from 2009-2017 allowed academic partners, dairy industry representatives, and regulatory officials to produce a suite of enhanced biosecurity resources, including guidance documents, two proactive risk assessments, and outreach and training videos, for continuity of business – the Secure Milk Supply Plan. 2021-2023 USDA funding is facilitating incorporation of the Secure Milk Supply Plan enhanced biosecurity into FARM Biosecurity. Implementation will be voluntary with dairy farmers making the choice to develop an enhanced biosecurity plan. FARM will utilize its database to store the enhanced biosecurity plans and transmit them to state regulatory officials in the event of a foot and mouth disease outbreak. Additionally, everyday biosecurity resources, including guidance documents, factsheets, proactive assessments, and more, will be developed, disseminated, and evaluated through the FARM structure. Both processes are overseen by a task force composed of academic partners, dairy farmers, cooperative staff, and state animal health officials.

Permitting Guidance for Movement of Raw Milk	Condition Met?
1. Traceability information is available (PIN, GPS Coordinates, and identification information on truck/ tanker moved)	Yes
2. Biosecurity performance standards for raw milk collection and transport are in place and acceptable to Responsible Regulatory Officials	Yes
3. Dairy operation is not an Infected, Suspect, or Contact Premises	Yes
4. Destination premises and state are willing to accept the milk	Yes
5. No evidence of infection based on surveillance	Yes
Permit guidance to move raw milk if all above responses are “Yes”	Consider Issuing MOVEMENT PERMIT

Table 1 – Permitting Guidance for Movement of Raw Milk.

”The Secure Milk Supply Plan enhanced biosecurity is incorporated into FARM, which helps ensure the sucess of the dairy sector.”

Jamie Jonker

INCORPORATION OF THE SECURE MILK SUPPLY PLAN WILL RESULT IN IMPROVED AND MORE EXTENSIVE BIOSECURITY RESOURCES

The multi-year collaborative effort resulted in the 10-page Secure Milk Supply Plan and associated enhanced biosecurity resources that were pilot tested on dairy operations throughout the U.S. These resources included:

- procedures to collect and transport raw milk from farms with no evidence of foot and mouth disease infection in regulatory control areas;
- movement permit guidance; and
- training materials for enhanced biosecurity and surveillance to decrease transmission risk while supporting business continuity.

Through the FARM Biosecurity Task Force, new funding is facilitating incorporation of Secure Milk Supply Plan enhanced biosecurity and the development of everyday resources into FARM Biosecurity including:

- Biosecurity resources such as a manual and plan templates;
- Secure Milk Supply Plan on-farm enhanced biosecurity materials;
- Self-assessment and second party on-farm biosecurity evaluations;
- Everyday and enhanced biosecurity data into the FARM Program database; and
- Virtual exercises as an adjunct to the USDA Veterinary Services National Training and Exercise Program to demonstrate capabilities for information exchange from the FARM Biosecurity module to support implementation of permitted milk movement during an foot and mouth disease outbreak.

A RESILIENT FARM PLATFORM

A foot and mouth disease response will focus on stopping the spread of the disease and disrupting animal agriculture's normal movements. The Secure Milk Supply Plan offers guidance for stakeholders to move raw milk and other critical movements to maintain business continuity during an outbreak. By utilizing the FARM platform, the FARM Biosecurity module will incorporate the Secure Milk Supply Plan to standardize milk movement permitting across states and increase the number of dairy farms with both enhanced and everyday biosecurity plans to protect the U.S. dairy herd from a foreign animal disease outbreak.

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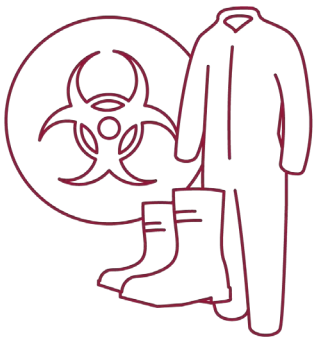

BIOSECURITY

Traditional buffalo milk chain in Bangladesh

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UN SDGs

12 RESPONSIBLE CONSUMPTION AND PRODUCTION

Summary

Location: Bangladesh

IDF Welfare Action Area: Husbandry practice; Health management

INTRODUCTION

Buffalo milk production is becoming an interesting business in Bangladesh. Water buffaloes are one of the main sources of milk in south Asia, except in Bangladesh, where this species is sharing 1.5 million heads contributing only 4% of national milk production [1]. Traditional buffalo production in a mixed-crop based livestock system is becoming popular in Bangladesh because of lower management efforts and feeding costs needed [2]. Among different types of production systems, the bathan (local name in Bengali) or free-ranging system is solely dependent on grazing on fallow land in remote islands and they are shifted to other islands based on the availability of green roughages. The household rearing system allows 5-7 hours of grazing combining supply of the minimum amount of straw, grass, and concentrates. The milk production per animal ranges from 1 to 3 L [3]. Marketing approaches of milk in these two production systems are based on supply to household needs and the remaining larger portion is used in the preparation of buffalo milk products [4]. Buffalo milk products, especially curd prepared from raw milk has a consumer preference in southern parts of Bangladesh whereas curd prepared from boiled milk, cheese, and ghee are more popular in the northern parts of Bangladesh.

> ”Buffalo milk production is rising in Bangladesh because of lower management efforts and feeding costs needed.”
>
> Shuvo Singha

TRADITIONAL, FAMILY-RUN BUFFALO MILK CHAIN IN BANGLADESH RELIES ON HAND MILKING

Agro-climatic coastal and semi-costal districts in Bangladesh dominate the water buffalo population in this country. At present, Meghna-Ganga and Jamuna-Brahmaputra river flood plains are the buffalo pockets in Bangladesh but scattered throughout the country. Milking from buffalo is performed by hand milking traditionally because of being the feasible technique in terms of economic reason and less technical knowledge is required and then raw milk is carried in a special bamboo vessel or aluminium container from bathans, and household farms in the countryside. Milk is finally carried to the milk collection centre and sweet shops. The raw milk is carried by boat to cross riverine areas and then motorbike or by walk is chosen to reach the milk collection centre. Cool chain is not maintained during the transportation but in some places, middlemen mix ices or sink palm or banana leaves in the milk container during travel to keep the bulk milk cool in a traditional way. To evaluate the present status of the buffalo milk chain in Bangladesh, we are working on a Bangladesh-Sweden-Italy-Netherlands collaborated project entitled “Climate change mitigation by a sustainable water buffalo dairy chain in Bangladesh” to identify the risk factors and best practices for better milk quality and safety from udder to consumer, focusing on udder health, handling practices and milk production.

CONCLUSION

In this report, we briefly illustrated the traditional buffalo milk supply chain in Bangladesh. Despite a significant number of buffalo heads, buffalo milk production is certainly low compared to dairy cows in this country. There are only a few studies that have been reported in buffalo in Bangladesh and evidence about the hygienic quality of milk and milk products along the milk value chain is limited. Especially traditional curd made from raw buffalo milk might have health consequences with the possibility of contamination with zoonotic pathogens such as *FÊ₩ü¯®o∂ooÔ ‰ ŴÔÉÔ*, *&› oüÉ/¢üd‰o∂©* etc. Enhancement of buffalo milk and milk product hygiene can be regulated by Govt. and private company supported milk chilling centres in the buffalo pockets which has been planned recently. Milk pasteurization and final buffalo milk products can be prepared in central buffalo milk stations to supply nationwide. This can be an effective way to establish an ideal buffalo milk chain in Bangladesh. Motivating people in consuming safe buffalo milk and milk products should be a priority.

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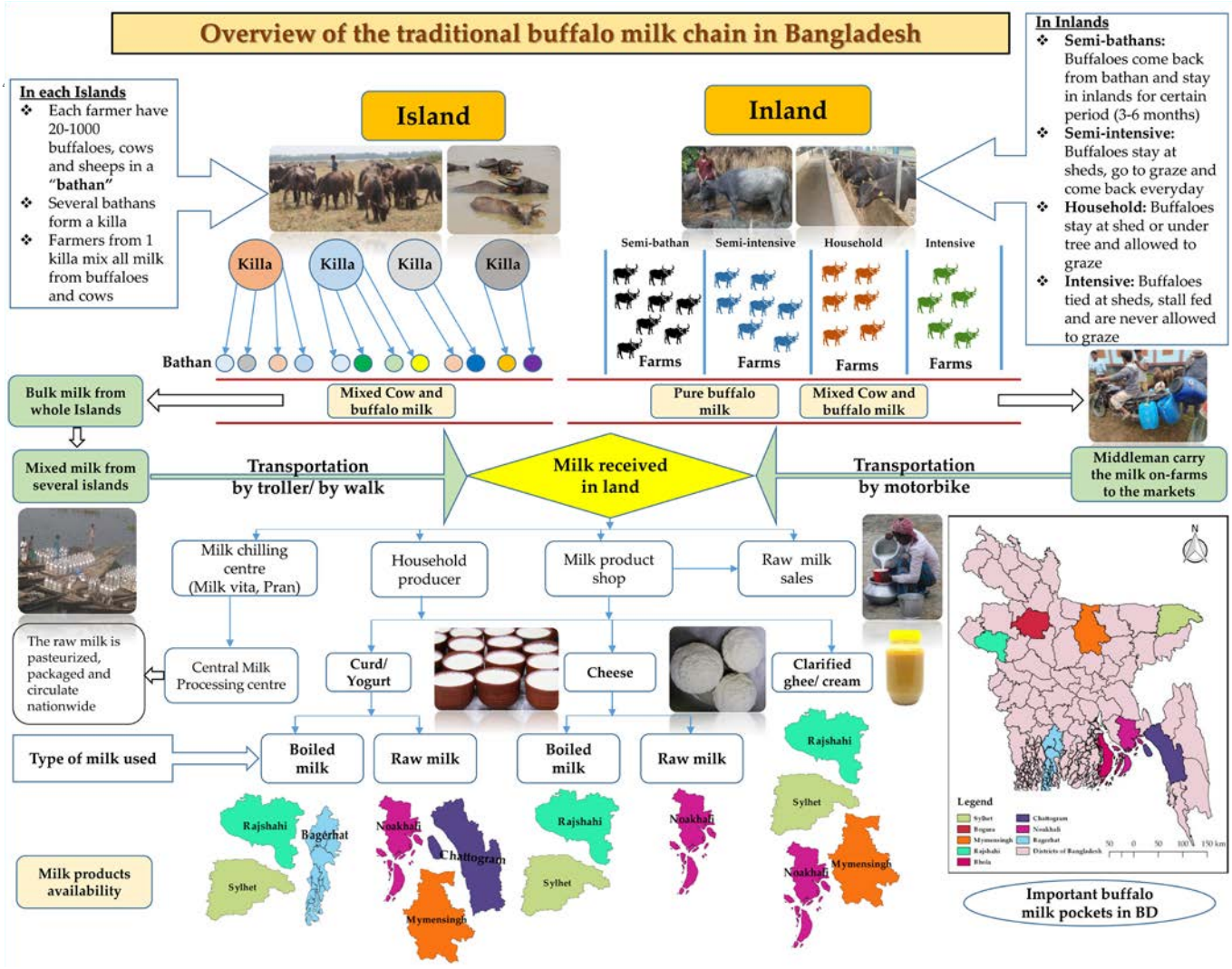

Figure 1 – Overview of the traditional buffalo milk chain in Bangladesh

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NEWS FROM INTERNATIONAL ORGANIZATIONS

Global Decrease on Antimicrobials Reported for Use in Animals to the World Organisation for Animal Health (OIE)

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UN SDGs

Summary

Location: Worldwide coverage (information from 153 OIE Member Countries from the five OIE Regions: Africa; Americas; Asia, Far East and Oceania; Europe and the Middle East)

IDF Welfare Action Area: Husbandry practices

A GLOBAL REPORTING ON ANTIMICROBIALS USED IN ANIMALS

The World Organisation for Animal Health (OIE) has worked actively for more than two decades on antimicrobial resistance (AMR) and developed a coherent strategy for its activities in this area. The OIE has built a global database on antimicrobial agents intended for use in animals, in line with the Global Action Plan on AMR and supported by FAO and WHO.

The fifth report of this global activity was published in April 2021 [1]. The report has three main sections: (1) the results of the fifth round with the participation of 160 countries; (2) a global and regional analysis of antimicrobial quantities adjusted by animal biomass for the year 2017 for 102 countries and; (3) an analysis on the trends on time from 2015 to 2017 for 69 countries.

AN ANIMAL BASED DENOMINATOR IS APPLIED TO THE DATA SUBMITTED BY THE OIE MEMBERS

Each year, the OIE AMU template [2] and accompanying documents [3, 4] are sent to all OIE Members. Data are received and checked for completeness during eight months. Furthermore, the OIE has recently developed a tool that allows countries to automatically calculate their antimicrobial quantities.

> "For the first time the OIE has presented an analysis on trends from 2015 to 2017, and an overall decreased of 34% was observed globally for 69 countries."
>
> Delfy Gochez

To compare antimicrobial quantities between regions and over time, an indicator is necessary to evaluate these data in the context of the relevant animal populations, which may vary in size and composition. The analysis is achieved by adjusting the quantity of antimicrobial agents reported by the countries (mg) with an animal biomass denominator (kg).

Animal biomass, for the OIE database, is calculated as the total weight of the live domestic animals in a given population present during a specific year, used as a proxy to represent those likely exposed to the quantities of antimicrobial agents reported by the countries.

Further information can be found in the OIE Annual Report on Antimicrobial Agents Intended for Use in Animals: Methods Used article published in Frontiers in September 2019 [5].

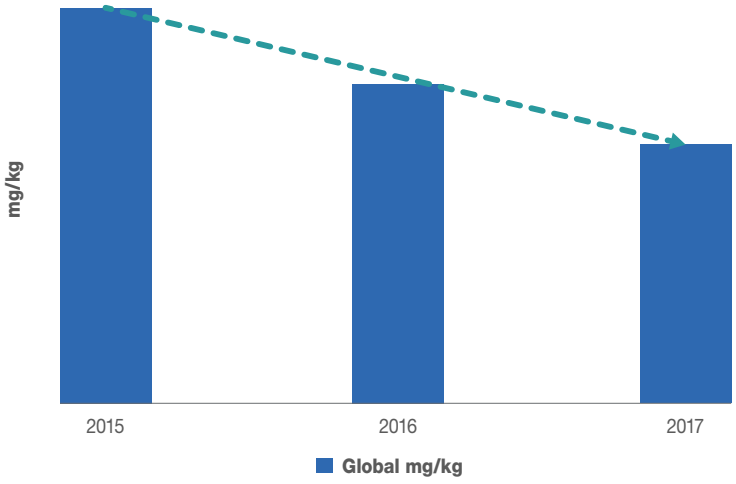

Figure 3 – Trends on time for global quantities of antimicrobial agents adjusted by Animal Biomass (mg/kg). Credits to the OIE

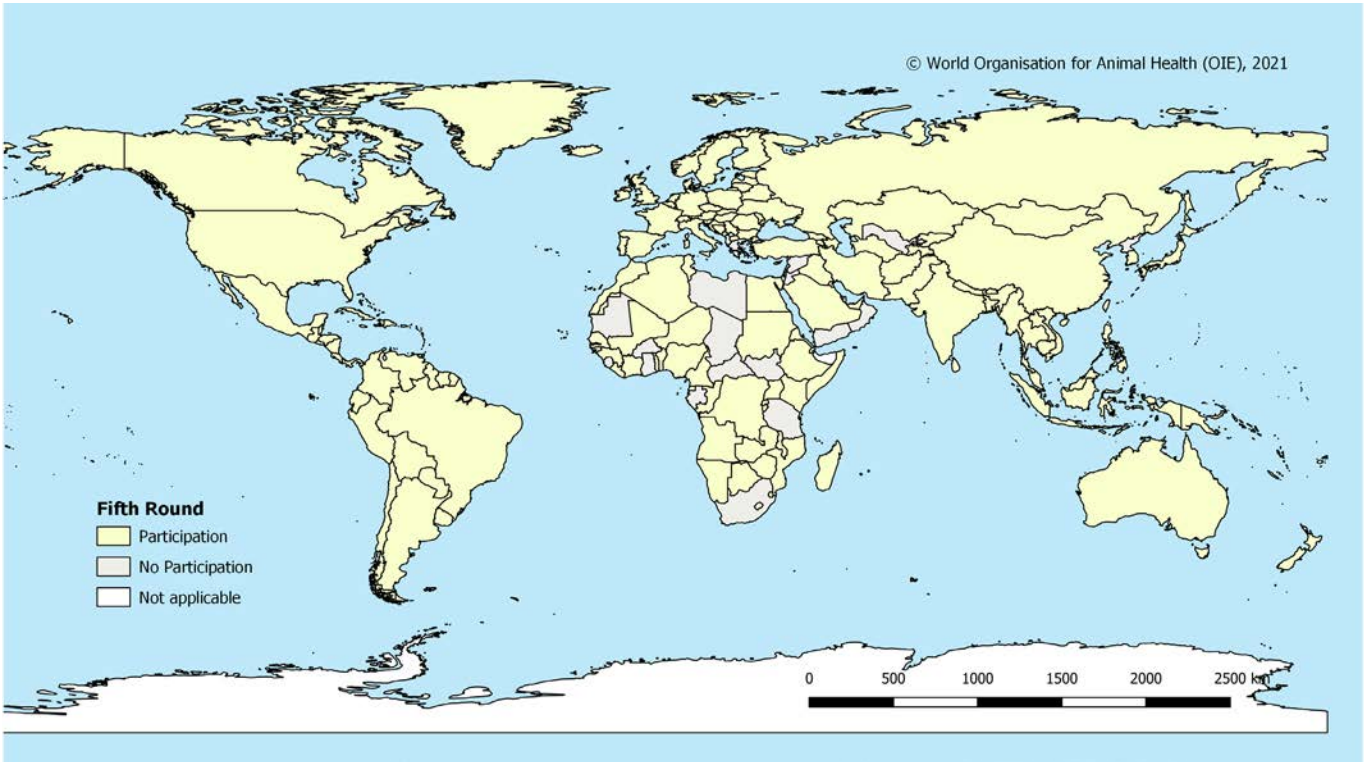

Figure 1 – World Distribution of OIE Members that Responded to the OIE Survey in the Fifth Round of Data Collection. Credits to the OIE

SUCCESSFUL PARTICIPATION SHOWS A 34% DECREASE

The fifth round recorded the greatest participation with an increase of 56% on the number of countries providing antimicrobial quantities since the creation of the global OIE AMU database. Most of the countries were, for the first time, using the OIE Reporting Option 3, which provides more detailed information supported by the OIE Calculation Tool.

For the first time the OIE has presented an analysis on trends from 2015 to 2017, and an overall decreased of 34% was observed globally for 69 countries. While all OIE Regions presented a decrease for this period, the Americas reported the most important decrease (37%), followed by Asia, Far East and Oceania.

A NEW REPORTING PORTAL SOON AVAILABLE

The OIE is currently developing an interactive and automated system for countries to report antimicrobial quantities and to allow them to access and analyse their own data that should be functional end of 2022. For the public portal, all historical data at global and regional levels will be made available.

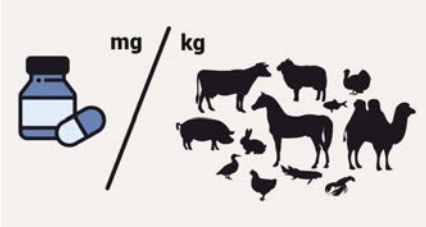

Figure 2 – Analysis of antimicrobial quantities adjusted by animal biomass. Credits to the OIE

In parallel, the OIE is exploring the possibilities to analyse field level AMU data that can be analysed in connection with the information of the AMU Global Database. This will be supported by the development of countries' pilot projects on AMU field level data collection around the world.

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3rd OIE Global Forum on Animal Welfare "Animal welfare and the UN Sustainable Development Goals"

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UN SDGs

Summary

Location: Global

IDF Welfare Action Area: Stockmanship

Animal based measure:

- Measure 1: reduced pain and improved comfort
- Measure 2: improved ability to ambulate and exercise
- Measure 3: improved quality of life

HOW IS ANIMAL WELFARE ACHIEVED THROUGH THE SDGS?

Animal welfare is not explicitly mentioned in the UN sustainable development goals (SDGs), although the majority of people working with animals know it is there implicitly. There are already good examples of research showing links between animal welfare and human health and to climate. The discussions around One Welfare highlight many more examples. The challenge is in finding a structure within which to govern trade-offs and build coherence in policy-making so we can work strategically both towards improving animal welfare and towards sustainable development as envisaged in the 2030 agenda.

The overall aims with the Forum were (i) to facilitate discussions on animal welfare and the SDGs as a means to share experiences and knowledge (ii) to quantify the strengths of the links as a basis for future policy decisions.

POTENTIAL LINKS BETWEEN ANIMAL WELFARE AND SDGS WERE DISCUSSED AT THE 3RD OIE ANIMAL WELFARE GLOBAL FORUM

The 3rd OIE Animal Welfare Global Forum, which constitutes a key activity of one of the Pillars of the OIE Global Animal Welfare Strategy (GAWS), provided a platform for participants to exchange their views and experience on how the UN SDGs are compatible with the improvement of animal welfare and vice versa. Although originally intended to be a physical meeting in 2020, the OIE held this virtual Forum over three days: Monday 26 April, Wednesday 28 April and Tuesday 4 May in 2021. It was held over two different time zones and was attended by almost 150 participants globally, something that posed its own challenges as well as opportunities (Fig 1.). Participants included representatives from the OIE National Animal Welfare Focal Points, the International Organisations with which the OIE collaborates on animal welfare topics and the OIE Collaborating Centres on Animal Welfare.

In addition to talks by invited speakers

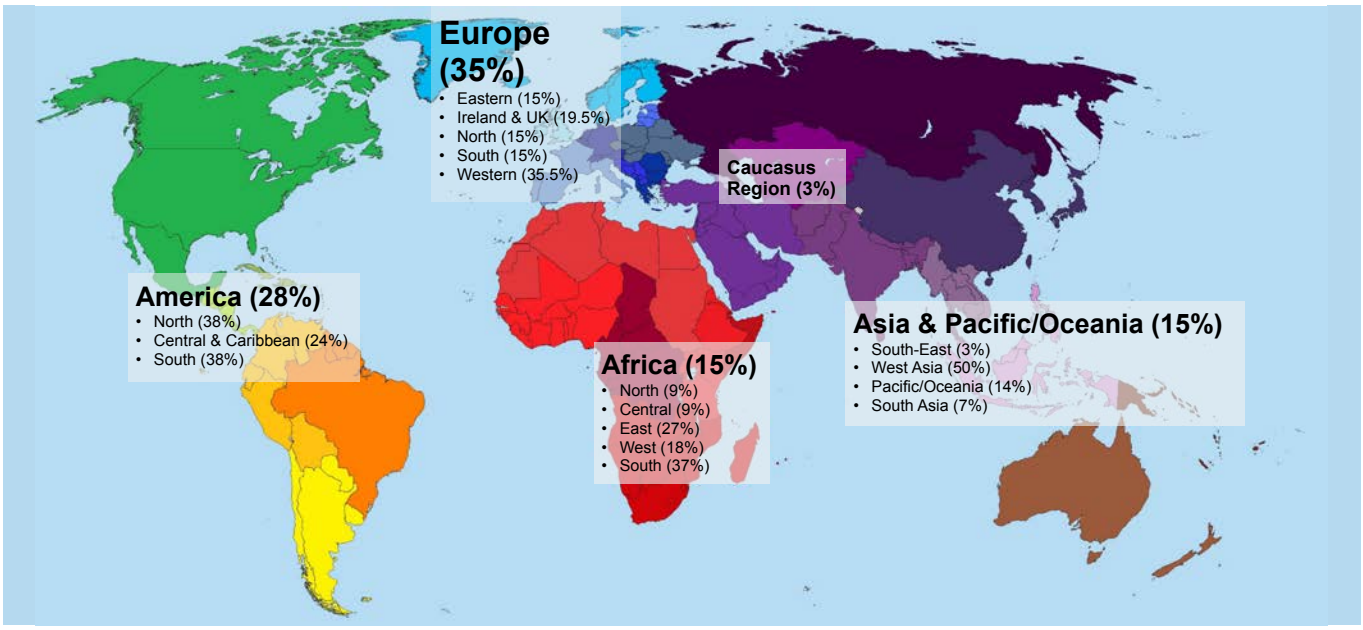

Figure 1 – Distribution of participants (N=144) attending the 3rd OIE Global forum in Animal Welfare. (Illustration by Gabriela Olmos Antillón)

to set the scene, the Forum built upon a method used previously by researchers at the Swedish University of Agricultural Sciences (Keeling et al., 2019; Olmos Antillon et al. 2021). In discussions, an impressive and diverse catalogue of potential links between animal welfare and each of the SDG was developed within the many different group works. Participants were encouraged to think about all categories of animals and to contextualise from their countries and experiences. There was then a rating exercise to determine views on the strength of the link between achieving each of the SDGs and improving animal welfare. People did this twice; once at the start of the meeting and then at the end of the meeting after hearing about the discussions and views of others. In both cases the voting was independent, using polls. The voting was carried out in both directions (AW to SDG and SDG to AW) to investigate the extent to which animal welfare can be a driver in sustainable development issues.

IMPROVING ANIMAL WELFARE ENABLED OR REINFORCED ACHIEVING THE SDG

The results are still being analysed, but already during the meeting we could report that the means of the scores were greater than zero in all of the 17 SDG – AW links. That is to say, on average participants saw that improving animal welfare enabled or reinforced achieving the SDG and vice versa, supporting the co-benefits between animal welfare and sustainable development. The results showed that the most positive links, (the impact of achieving the SDGs on improving AW, and the impact of improving AW on the SDGs), were obtained in SDG 3 (Good health and wellbeing), SDG 12 (Responsible consumption and production), SDG 14 (Life below water) and SDG 15 (Life on land). On the other hand, the least positive links were identified in SDG 5 (Gender equality), SDG 7 (Affordable and clean energy) and SDG 10 (Reduced inequalities). In most cases the impact of achieving SDGs on AW was more positive than the impact of improving AW on achieving the SDGs.

> ”Most positive links were obtained in SDG 3, SDG 12, SDG 14 and SDG 15, as well as complex interactions between animal welfare and the SDGs.”
>
> **Linda Keeling**

COMPLEX INTERACTIONS BETWEEN ANIMAL WELFARE AND THE SDGS

These results are remarkably similar to those found in the two previous studies, highlighting the robustness of the findings. The Forum has shown the complex interactions between animal welfare and the SDGs, noting also that linkage is moderated through human choices and behaviours. Therefore, there are still potential for negative impacts on animal welfare depending on choices made in pursuing SDGs; and because of that there is a need to consider animal welfare in the context of policy and planning under each SDG.

The next steps for the OIE will be to consider how the outcomes of the Forum can be used to improve the OIE work on animal welfare, including Members’ engagement with OIE animal welfare policies, in particular, in the framework of the implementation of the OIE Global Animal Welfare Strategy.

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One Welfare World Conference summary update

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UN SDGs

Summary

Location: Global

IDF Welfare Action Area: Stockmanship, Feed and water, Physical environment, Husbandry practices, Health management

THE 3RD ONE WELFARE WORLD CONFERENCE

One Welfare CIC organised the 3rd One welfare World Conference in Burgos, Spain, (virtually) on September 13-14 2021. The conference was designed to support the development, dissemination and implementation of the concept of One Welfare. The first and second conferences had taken place in Manitoba, Canada (2016) and Sydney, Australia (2019). This edition introduced for the first time a scientific conference format on One Welfare, with 6 themes aligned with the One Welfare Framework and a special session on COVID-19 and One Welfare, calling for scientific abstracts for oral presentations and posters to promote and encourage multidisciplinary research in this area.

COMMUNICATING RESEARCH ON ONE WELFARE

The conference included 6 keynote speakers' presentations, 24 short presentations, and introduced for the first time ever, 22 One Welfare Science Slam sessions (OWSM Sessions), these are short creative presentations specially designed to help communicate research specifically on the concept of One Welfare to the general public.

The conference strongly supported efforts to build up and bring together an evidence base approach around the concept of One Welfare to support interdisciplinary collaboration in order to address global challenges such as those captured within the Sustainable Development Goals.

HIGHLIGHTING A GLOBAL COLLECTIVE EXPERTISE

The conference brought together global collective expertise to discuss research developments and novel proposals within the area of One Welfare, discussing the interconnections between animal welfare, human wellbeing and environmental aspects. This helped connect the research community with those at the policy and delivery end. Over 300 delegates, from more than 45 countries, including more than 40 Universities as well as members of the industry, NGOs and country government representatives attended the conference.

Session 1 "The Social Implications of Improved Animal Welfare" Studies in the area of working equid dominated this section. This sector has fully embraced the concept and actively works under the One Welfare umbrella looking at the welfare of animals, people and the environment. Presentations raised different aspects of working equids around the world, the silent helpers who carry milk, food for livestock, firewood, coal, bricks and waste, and the urgent need to improve their welfare, for the sake of the animals, the humans who depend on them, and the environments in which they live. They highlighted major threats to working equids, such as the demand for Eijiao, as well as the impact and need of wider international collaboration in parts of the world like Latin-America, which represents over 50% of the working equids and their communities. Presentations also covered the impacts of irresponsible breeding and the need to take action using a One Welfare approach. Some studies reflected gender differences and this also requires further attention under a one welfare lens to ensure the right population segments are considered.

Session 2 "Animal Health and Welfare, Human Wellbeing, Food Security and Sustainability" showed that attention towards animal welfare is increasing globally, with pressure to move towards more animal welfare friendly systems. Speakers reflected on how society and culture can impact also on human wellbeing and put pressure on professionals to do things they feel uncomfortable with. Participants heard how most dairy farmers love their animals and many are willing to maximise animal welfare standards to improve their own wellbeing. It was presented how surveillance systems to monitor farmer wellbeing can be a helpful tool to predict suicide risks and support poor farmer wellbeing which can, on the other hand, translate into poor farm animal welfare. Speakers highlighted how we must consider actions to cope with and mitigate the negative consequences of climate change. This can include preventative veterinary medicine, higheranimal welfare, adjustment of animal production systems and social resilience. Examples of silvopastoral systems that integrate trees, pastures and animals, as a form of sustainable production, respecting animal welfare and improving farmers' income were presented. Discussions around this session concluded that we will be better able to aim for the SDGs if we adopt a One Welfare approach, considering human wellbeing improvements alongside animal welfare and environmental sustainability as well as strengthen global health systems under a One Health, One Welfare approach

Session 3 "The Connections Between Animal and Human Abuse and Neglect" explained how initiatives like "The Link" cover a number of One Welfare areas and complements the One Health approach focused on the injury and health aspects. Taking that partnership approach is key.

All agencies that support humans and/or animals must be able to identify the link and work together to support the welfare of both. Speakers explained how animal abuse can be difficult to recognise and specialist training and support for professionals is needed; How it is necessary for veterinarians to be aware of the central role they play in early detection of animal abuse cases, which may be indicators of human abuse. It is also important that society recognises this role, that we address it together with professionals and workers in other fields, that universities include the subject as a compulsory part of their curricula and that we have public policies in this regard.

Session 4 "One Welfare and Covid-19" covered Singapore's strategy to rewild urban green spaces and how natural spaces helped billions of people during the COVID-19 pandemic, becoming vital for animal and human wellbeing, in a managed reopening way to prevent crowding. Several presentations showed how both domestic animals and wildlife helped many people cope with the pandemic and its associated restrictions although they called for systems to protect the welfare of the animals, and the environment from negative impacts. Speakers also discussed how access to Veterinary Services has been a significant One Welfare challenge facing many jurisdictions and how, while the human-animal bond is mutually beneficial if supported in the context of isolation and COVID restrictions, it may however have negative impacts on both humans and animals if not supported. Much of the focus from communications received on this section were on companion animals which raised the question as to whether One Welfare interconnections in other areas have been studied thoroughly

Session 5 "Sustainability: Connections Between Biodiversity, the Environment, Animal Welfare and Human Wellbeing" highlighted that consideration of animal welfare is key to reduce the risk of zoonotic and pandemic diseases, as well as to the conservation of biodiversity. It is essential to integrate One Health and One Welfare within the post-2020 global biodiversity framework. The keynote presented the work of The Black Mambas, a women led anti-poaching organization which has established a role model in their communities, highlighting the importance of empowering women to tackle wildlife exploitation and how a One Welfare approach can help to provide solutions to poaching while maintaining livelihoods, preventing hunger, supporting animal welfare and protecting nature.

Speakers heard about how traces of metals from mines have been detected in wildlife, domestic animals and their products, suggesting that their impact on human and animal welfare and on the environment must be studied in depth. They also exposed how recent forest fires made it clear that the climate crisis is having catastrophic results, with severe damage to human wellbeing, animal welfare, biodiversity conservation and environmental sustainability, and explained how prevention and contingency planning for natural disasters would benefit from a One Welfare approach.

Session 6 "Assisted Interventions Involving Animals, Humans and the Environment" heard from the keynote about the need to promote a culture of care – built on attentiveness, responsibility, competence and responsiveness – within and beyond animal research settings, to ensure the harms of research are minimised and the benefits maximised. Several examples of successful assisted intervention strategies around the world, including Hong Kong, Italy and the US were showcased during this session.

CONCLUSION

In summary, this conference has shown many understand and embrace the concept of One Welfare globally and how they are actively engaged in researching, studying and working to improve the outcomes of One Welfare challenges within their communities and across the world.

A multidisciplinary approach under a One Welfare umbrella is needed, and there is increasing evidence that this works within different environments regardless of species, location and cultural differences. Funding these collaborations and research into measuring the outcomes, seem key in order to improve animal, human and environmental benefits. Overall, we need to ensure everyone's good intentions must be converted into action.

We look forward to the 4th conference which was announced to take place in Cartagena de Indias, Colombia (date to be confirmed) and strongly encourage all the readers to come together and join us in Colombia or virtually to share more developments within this exciting field.

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http://conference2021.onewelfareworld.org

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Implementation of the new certified reference material for somatic cell counting in milk around the globe

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UN SDGs

Summary

Location: Denmark; The Netherlands

IDF Welfare Action Area: Health management

SOMATIC CELL COUNTS CRITICAL FOR UDDER HEALTH AND MILK QUALITY

Somatic cell count (SCC) in milk is a widely used analysis and the number of tests done worldwide is estimated to be >500.000.000 per year. SCC test results from individual cow milk samples are used for udder health monitoring, farm management and breeding purposes. Beyond that, SCC results from bulk tank milk samples are relevant in food quality regulations and milk payment. A challenge for the industry is differences in the SCC levels around the world due to the application of difference reference samples for calibration of the analytical methods, as illustrated in the ICAR Proficiency Test results. These differences lead to challenges in terms of trading dairy products.

NEW CERTIFIED PRIMARY REFERENCE MATERIAL FOR SOMATIC CELL COUNTING

A joint project team of experts from the IDF and ICAR (International Committee for Animal Recording) together with the European Commission Joint Research Centre have developed a new certified primary reference material for somatic cell counting. The official name of the material is "EC JRC CRM® ERM-BD001"and it can be ordered here: link to order primary reference material

The material consists of two samples: One with a low SCC of about 50,000 cells/mL and the second one with a high SCC of about 1,000,000 cells/mL (Figure 1). The samples are produced based on bulk tank cow milk. Milk cells are preserved through spray drying and samples are afterwards homogenized, bottled, and labelled.

MILK		
Cell concentration		
	Certified value [3] [cells/mL]	Uncertainty [4] [cells/mL]
Somatic cell count (SCC) [1]	1202000	121000
Somatic cell count (SCC) [2]	1166000	79000

[1] As defined in ISO 13366-1. The certified value is the mean value of 13 accepted data sets obtained from ISO 13366-1-compliant measurements.

[2] As defined in ISO 13366-1 and ISO 13366-2. The certified value is the mean value of 13 accepted data sets obtained from ISO 13366-1-compliant measurements and 13 data sets randomly selected out of 32 accepted data sets obtained from ISO 13366-2-compliant measurements.

[3] Certified values are values that fulfil the highest standards of accuracy and represent the unweighted mean value of the means of accepted sets of data, each set being obtained in a different laboratory and with methods of determination referred to in footnotes 1 and 2. The certified value and its uncertainty are traceable to the International System of units (SI).

[4] The uncertainty of the certified value is the expanded uncertainty with a coverage factor $k = 2$ corresponding to a level of confidence of about 95 % estimated in accordance with ISO/IEC Guide 98-3, Guide to the Expression of Uncertainty in Measurement (GUM:1995), ISO, 2008.

Figure 1 – Somatic cell count levels of the two samples included in the EC JRC CRM ERM-BD001 as illustrated on the Certificate of Analysis

APPLICATION OF THE NEW REFERENCE MATERIAL

The new reference material for SCC can be applied in different ways:

- Check of calibration settings of routine methods (i.e. high throughput flow cytometry-based SCC analysers in laboratories)
- Assignment of values to secondary reference materials
- Usage in a proficiency test,

A webinar to introduce the reference material and elaborate on its application was conducted in December 2020: (link to webinar)

The new reference material is also described in detail in the recently published IDF Bulletin 508/2021: (link to IDF Bulletin)

The status on the implementation of the material was evaluated in a small study:

- **tested and adopted:** Lithuania and Switzerland
- **tested, no need for adjustment of the SCC level:** Denmark, Germany, Italy, Japan, New Zealand, UK, USA.
- **Material tested, need for adjustment of SCC level:** Canada, France, Israel, and the Netherlands
- **Material not yet tested:** e.g. Chile, China

An adjustment of the SCC level does require a dialogue with all stakeholders affected and the agreement on a strategy for transition of the SCC level.

”A new certified primary reference material for somatic cell counting helps measure SCC levels around the world.”

Daniel Schwarz

IDF/ICAR Project on Reference System for somatic Cell Counting in Milk

All laboratories considered the new primary SCC material as valuable because it opens up the possibility to monitor SCC levels on a regular basis (e.g. quarterly) and verify its correctness.

BASIS FOR GLOBAL EQUIVALENCE IN SCC COUNTING ESTABLISHED

Various different applications of the new SCC reference material are possible and have been described in a webinar and dedicated IDF Bulletin. The main target of its application, however, is to help to obtain global equivalence in somatic cell counting. While there was no need for adjustment of SCC levels in many countries, others already re-anchored their SCC level or are about to do so. Alignment of SCC levels of the commonly applied secondary reference materials with the new primary SCC reference material would likely help to obtain global equivalence even quicker.


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GLOBAL DAIRY EXPERTISE SINCE 1903

HELPING NOURISH THE WORLD WITH SAFE AND SUSTAINABLE DAIRY

The IDF is the leading source of scientific and technical expertise for all stakeholders of the dairy chain. Since 1903, IDF has provided a mechanism for the dairy sector to reach global consensus on how to help feed the world with safe and sustainable dairy products.

A recognized international authority in the development of science-based standards for the dairy sector, IDF has an important role to play in ensuring the right policies, standards, practices and regulations are in place to ensure the world's dairy products are safe and sustainable.

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