Supporting German dairy farmers: establishing a monitoring system based on health key indicators extracted from existing control systems

S. Hachenberg[1], M. Au[1], B. Behr[1], J. Brinkmann[2], J. Braunleder[3], S. Carrasco[4], J. Duda[4], D. Doepfer[5], S. Gruber[6], H. Karatassios[7], M. Kussin[7], R. Mansfeld[6], S. March[2], K.F. Stock[3], M. Tremblay[5] and F. Onken[1]

[1]German Association for Performance and Quality Testing, DLQ, Irmintrudisstraße 15, 53111 Bonn, Germany
Corresponding Author: sabrina.hachenberg@dlq-web.de
[2]Thuenen-Institute of Organic Farming, Federal Research Institute for Rural Areas, Forestry and Fisheries, Trenthorst 32, 23847 Westerau, Germany
[3]IT-Solutions for Animal Production (vit), Heinrich-Schroeder-Weg 1, 27283 Verden (Aller), Germany
[4]Landeskuratorium der Erzeugerringe für tierische Veredelung in Bayern e.V., Landsberger Straße 282, 80687 Munich, Germany
[5]University of Wisconsin, 2015 Linden Drive, Madison, WI 53706, United States of America
[6]Ludwig-Maximilians-Universitaet, Clinic for Ruminants with Ambulatory and Herd Health Services, Sonnenstraße 16, 85764 Oberschleißheim, Germany
[7]Osnabrueck University of Applied Sciences, Faculty of Agricultural Sciences and Landscape Architecture, Oldenburger Landstraße 62, 49090 Osnabrueck, Germany

Abstract

German farmers are required by law to regularly self-assess the welfare of their animals. The project Q Check is aiming at developing a system that will assist farmers to objectively assess animal health and welfare in dairy cows. For this reason, a quarterly report will be compiled from animal-based key indicators to give an overview of the on-farm situation. The anonymised and aggregated reports can also be used for national animal welfare monitoring: Continuous collection of these key indicators enables the summary and publication of figures reflecting the current animal health and welfare status and progressions at federal state and at national level. Q Check is based on four data recording and analysis systems, which are already established in Germany and implemented on a national level. Out of these systems, the most suitable indicators to describe herd health have been selected by 215 experts within a two-stage Delphi study. In addition, over 50 face-to-face interviews with stakeholders related to the German dairy sector have been performed in order to take into account the socio-scientific point of view. To complete the process, the selected indicators are currently being checked against mass data and hence tested for suitability regarding monitoring purposes. An automatic farm-specific evaluation of animal health, based on verified indicators, will provide support to farmers in fulfilling their legal requirements and in identifying weak points on the individual farms. A benchmarking system will be set up which will allow tracking the individual herd health indicators in the same farm in their course over time and compared with similar farms. These routinely provided horizontal and vertical statistics will facilitate targeted intervention and support objectified management decisions, implying that dairy farmers can benefit in several respects. In the course of the project, new tools for determining the risk of ketosis in the scope of milk recording will also be validated and implemented at national level to

enhance monitoring of this major disease complex. The results of these nationwide, systematic investigations will contribute substantially to objectifying the discussion about the health and welfare situation of dairy cows.

Introduction

Animal welfare is a multidimensional concept comprising health, behaviour and the emotional state of an animal (Fraser, 2008). In 2014, a farm-internal self-monitoring requirement has been added to the German animal welfare act. Consequently, dairy farmers are legally bound to self-assess and evaluate the welfare of their cows based on key indicators (see §11 article 8 TierSchG). Additionally, the Federal Ministry of Food and Agriculture aims at developing a national animal welfare monitoring system in order to collect animal welfare data on a regular basis (BMEL, 2019). While the legal regulations meet the consumers' and retailers' growing demands for milk production under high welfare standards, the regulations are challenging for dairy farmers, especially since there are neither definitions of suitable and reliable indicators nor appropriate documentation schemes which would safeguard legally proper implementation of monitoring routines in the dairy farms.

The aim of Q Check was the development of a set of on-farm indicators that is suitable and reliable for self-assessment of animal health and welfare based on existing data recording and analysis systems and minimizes the need for additional documentation. The intention was to identify indicators with additional value for the dairy herd health management. Furthermore, a benchmarking system (Turland & Slade, 2018) will be established in order to compare herd health status over time or between similar farms. The study design supports the transfer of anonymized individual animal welfare assessment results on an aggregate level into a national animal welfare monitoring system.

In order to cover another major disease complex, Q Check validates new tools for determining the risk of ketosis in the scope of dairy herd improvement (DHI) for the implementation on national level.

Methods and material

Q Check is based on four data recording and analysis systems, which are already established and implemented in Germany. The fully automated systems collect standardised animal related data:

1. DHI – with a coverage of up to 3.7 million cows or 89% of the German dairy cow population

2. Milk quality testing

3. National database for animal identification (HI-Tier)

4. Auditing system for quality management (QM-Milch)

Data collected by the systems above generally provide robust information. Data were pooled and cross-linked for the development of an overview with key indicators, in order to simplify the procedure of self-assessing animal welfare on-farm. Indicators had to be easily and automatically collected and supported by the dairy sector on a broad scale. A team of scientists, farmers and cattle veterinarians derived a set of

53 potentially suitable indicators from the systems mentioned above. The final selection and evaluation of the indicators has been performed following an interdisciplinary approach:

1. <u>Two-stage Delphi survey</u>: 215 Practitioners, scientists, vets and further stakeholders have been asked about their opinion on 53 preselected indicators, regarding their suitability for on farm self-assessment and/or national welfare monitoring.

2. <u>Statistical validation</u>: those indicators meeting approval from a two thirds majority of respondents in the Delphi survey have been determined using DHI mass data.

3. <u>Stakeholder analysis</u>: 51 face-to-face interviews have been conducted in order to gather differentiated points of view on the topic animal welfare.

Additionally, Q Check investigates new DHI analysis tools to detect poor metabolic adaptation syndrome, with the focus on early lactation. Based on machine learning algorithms prediction models are being applied, systematically optimized and automatized. The aim is to set up a nationwide routine analysis that enables farmers to react to metabolic malfunction at an early stage in terms of an early-warning system.

Results

On-farm self-assessment of animal health

Detailed analysis of the available data recording and analysis systems revealed the need to focus on health parameters. Q Check determined 13 relevant key indicators for describing animal health on dairy farms. Both normative and status quo based evaluation of selected indicators have been compared (see table 1). As shown in table 1, there is only a slight deviation within the two methods. In order to implement a framework for the evaluation of indicators, normative and status quo based evaluation will be aligned and further investigated.

Benchmarking system

In order to enhance the motivation of dairy farmers, the implementation of a benchmarking system is under progress. Due to major structural differences between dairy farms within Germany, all farms are classified by farm size and breed. This allows horizontal benchmarking next to vertical comparison. Access to an individual documentation and benchmarking report will be provided to every farm. The report will be published every three months and, respectively, once a year and contained a horizontal as well as a vertical comparison.

National animal welfare monitoring

Anonymized and aggregated results of the Q Check report will be used to picture the animal welfare status on national and federal state level on a yearly base. National animal welfare monitoring will reflect farm size and main breed as classified in the Q Check report.

Tool for early detection of poor metabolic adaptation

The development of a tool to detect poor metabolic adaptation at an early stage is still under progress. Results are expected until end of project in summer 2020.

Table 1. Results of welfare indicators and target values (tv) selected via Delphi survey (column one) and statistical analysis of DHI mass data (column two) for each indicator of the relevant set.

Indicator	Delphi[1] tv	Statistical Analysis[2] ++	+	Median	-
Amount of cows with SCC ? 100,000/ml milk [%]	75	71	64	56	47
Amount of cows with SCC >400,000/ml milk [%]	5	5	8	11	15
Amount of heifers with SCC >100,000/ml milk [%]	12.5	0	17	27	38
New infection rate in the dry period [%]	10	13	16	20	25
Cure rate in the dry period [%]	75	81	70	58	44
New infection rate during lactation [%]	15	8	17	29	41
Amount of cows with chronically infected udders with poor cure prospects [%]	1.4	0	2	5	10
Amount of cows with a fat-protein-ratio ? 1.5 within 100 days p.p. [%]	10	4	7	11	17
Amount of cows with a fat-protein-ratio <1.0 within 100 days p.p. [%]	7.5	2	5	9	14
Culling rate [%]	25	18	23	29	37
Mean productive life time [months]	48	56	46	38	32
Calf mortality within 12 weeks [%][3]	5				
Cow mortality [%][3]	2.6				

[1]

Conclusion

The identified indicators represent only a selection within the wide range of animal welfare indicators suitable for cattle. Q Check is not limited to these indicators. Future developments might well add additional automated evaluations to the report as well as to the national monitoring.

Q Check proactively approaches major current challenges in German dairy farming: the four existing data systems form a validated basis while the selection process described above is scientifically approved to identify indicators that are suitable to illuminate important aspects of animal health in dairy farming. Additionally, the anonymized results in form of a national animal welfare monitoring can help to objectify the debate on welfare of dairy cows.

List of references

§11 article 8 TierSchG. https://www.gesetze-im-internet.de/tierschg/__11.html

Federal Ministry of Food and Agriculture, 2019. https://www.bmel.de/SharedDocs/Downloads/Broschueren/Nutztierhaltungsstrategie.pdf?__blob=publicationFile

Fraser, D., 2008. Understanding animal welfare. Acta Veterinaria Scandinavica 50(1): S1. doi: 10.1186/1751-0147-50-S1-S1.

Turland, M. & Slade P., 2018. Farmers' Willingness to Share Data: A Study of Saskatchewan Farmers. 30 th international conference of agricultural economist, Vancouver: 1-19.