Abstracts

Welfare Quality Network Seminar 2022

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Department of Animal Health & Welfare

LIVESTOCK RESEARCH
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Definitions and concepts of animal welfare – a Dutch perspective

Speaker: Fleur Hoorweg

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Animal welfare is a term used to describe a broad concept. Various definitions are used by the general public, scientists and politicians. What definitions and underlying concepts are used? When talking about animal welfare and doing research on this topic, it is good to think about the definition you use and what goal you aim for. Some of the definitions of animal welfare are discussed. Using animal based parameters can help us to gain insight in experiences of animals to improve welfare.

This year the Welfare Quality Network seminar 2022 is held in the Netherlands. What is the political and social context of animal welfare here?

Welfair®. The trademark developed by IRTA and NEIKER for certification purposes using the Welfare Quality and the Awin protocols beyond Spain and Europe.

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In 2013 different Certification companies in Spain consulted IRTA about the possibility of jointly develop a common Animal Welfare Certification for livestock. The researchers at the Animal Welfare Program at IRTA begun what has resulted in an extremely successful pilot project with AENOR. Between 2014 and 2018 over 50 Spanish companies received the Animal Welfare Certification "based on Welfare Quality®". The increasing demand for the Animal Welfare Certification led by IRTA forced to redesign the certification in order to be able to meet it. It is with this perspective that IRTA decided to become Scheme Owner for the Animal Welfare Certification "based on Welfare Quality" in 2019. The new Scheme opened the door to other certifying bodies to operate within the Scheme Owner under the same certification scheme. In addition, Neiker, a member of the European project Awin, was incorporated to the scheme and with their help the trademark "Welfair®" was created, that incorporated the Welfare Quality and Awin protocols covering most of the production species. The certification scheme details all the conditions required to obtain the certification, such as the audit frequency, training of the auditors, traceability to achieve product labelling, supervision of the auditor's performance and many others. Currently, the label is available in Spain, Portugal and France and in a short time can arrive to The Netherlands, Germany, Chile and Brazil. The label has been highlighted in a report of the EU by being unique for being focused mainly on animal based measures and by being international, while most of the rest schemes presents in Europe are based on risk factors and are focused on a national level. In fact, NGO's and producers prefer schemes based on facilities and management adapted to the local conditions that provide different levels (or a production system classification). However, the real experience of life of the animals farm to farm are few considered in these conditions. Is Welfair® a good example of how animal-based protocols can be used at international level to refine the results obtained with the local schemes based on risk assessments?

Test-retest reliability of selected welfare indicators for rearing piglets

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Objective tools for the assessment of animal welfare are needed and therefore the 'Welfare Quality® protocols' were developed. These are based on the four welfare principles: (1) good feeding, (2) good housing, (3) good health, and (4) appropriate behavior. Although the indicators have not been tested for that age class, it is recommended to use indicators that were developed for growing pigs also for rearing pigs. Therefore, the present study aimed at testing selected indicators from different self-monitoring protocols, e.g. the Welfare Quality® protocol for pigs, with regard to test–retest reliability (TRR), i.e. consistency over time in an on-farm study on rearing pigs.
28 promising indicators were assessed weekly in the rearing period on three pig farms. Piglets were randomly selected per batch and individually marked. This procedure was repeated in three consecutive batches per farm, i.e. in total 759 rearing piglets were assessed.
Spearman's rank correlation coefficient (RS), intraclass correlation coefficient (ICC) and limits of agreement (LoA) were calculated to evaluate their TRR, especially whether the TRR is influenced by the group of assessed animals (batch) or the age of the assessed piglets. From eight pen-level indicators (PIN) three indicators had a prevalence close to zero. The indicator sneezing achieved acceptable TRR for both comparisons and the behavioral observations (BO) reached mostly good values for both comparisons (batch, age class). The values e.g. for 'positive social behavior (part of the BO) ranged in these areas (RS: 0.34 to 0.89; ICC: 0.00 to 0.90; LoA ϵ [-2.93; 7.41] to ϵ [-18.9; 11.5]). From 20 individual-level indicators (IIN) nine indicators had a prevalence below one percent which made an assumption about their reliability meaningless. Due to the missing prevalence of many indicators and consequently no meaningfulness about their reliability the four welfare principles cannot be adequately evaluated. In particular, there are problems with the welfare principles of 'good feeding', of 'good housing' and partly 'good health'. Therefore, additional promising indicators such as back posture, ear lesions, normal behavior, tail length and tail posture should be included in the Welfare Quality® protocol for pigs. These indicators can complement the previous integrated indicators with acceptable to good TRR also in rearing piglets, such as tail lesions, lameness, wounds body, Human-animal-relationship test and BO.

Using the Welfare Quality protocol to assess effects of hatching system on the welfare and behaviour of broiler chickens

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The hatching environment can affect health, resilience and welfare of broiler chickens in later life. The aim of this study was to investigate effects of recently developed hatching systems on the welfare of broiler chickens in early and later life. Therefore, a grow-out experiment on a semi-commercial farm was performed with chickens that hatched either conventionally (HH, hatchery hatched, no feed, water and light in the hatcher), in a system in which feed, water and light were provided in the hatcher (HF, hatchery fed) or on-farm (OH, on-farm hatched, where eggs were transported from the hatchery to the farm at day 18 of incubation, and where feed, water and light were available after hatch). The animals were reared in three consecutive batches, in 12 floor pens/batch (1,155 animals/pen) with a total of 12 replicates of each treatment. Several animal-based indicators were assessed following the Welfare Quality protocol: plumage cleanliness, footpad dermatitis (FPD), hock burn, skin lesion (at d21 and 35 of age), and gait score (d35). Furthermore, a set of behavioural tests was carried out: novel environment (d1 and 21), tonic immobility, novel object, and avoidance distance test (d4 and 35). Plumage cleanliness, hock burn and skin lesion were affected by age but not by hatching system, with older broilers scoring worse than younger ones ($P<0.05$). An effect of hatching system was only found for FPD, with HH chickens having more frequently and more severe lesions compared to HF and OH chickens ($P<0.05$). All responses measured in the behavioural tests were again affected by age but not by hatching system. In later life, chickens acted significantly less fearful than during the first days of life. The results indicate that conventionally hatched chickens scored significantly worse for the key welfare indicator FPD, whereas, hatching system seemed to have minor effects on other welfare and behaviour aspects of broiler chickens.

Benchmarking tail length and lesions at slaughter. Welfare at slaughter

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Around 98% of the pigs' tails in the Netherlands are docked within the first week of life. Docking is used to decrease the risk of tail biting. Routine-based docking is prohibited by law and the has been increased pressure on EU-level to completely stop docking, as is the case in Finland and Sweden.

Around half of all pigs in the Netherlands are kept under normal conditions, slightly less than half is kept under a higher welfare scheme (BLK) and a couple percent is kept under two- or three star welfare schemes (BLK** and BLK***). When pigs are kept under normal conditions, (not in welfare schemes), usually a few centimeters of tail remain at slaughter.

The focus of this project is to establish a benchmark of tail length and lesion score at slaughter and to provide a protocol to repeat these measurements over time. To collect these values, an action cam (GoPro HERO8) was used to record videos of tails at the slaughterline. These videos were collected at three slaughterhouses. A figure of a 'reference tail' is displayed next to the carcass on the video images of the slaughterline and visually scored at the office.

The videos were recorded at three slaughterhouse locations, over a period of 12 months (Oct-2021 – Oct 2022). These videos were recorded for 2 hours at a time, with 36.000 carcasses planned divided over 3 welfare concepts. The tail length is scored on a 5 classes scale and tail lesions are scored on a 3 classes scale. So far (June 2022) half of the total number of carcasses haven been scored, all slaughterhouses combined. The results will be available in the end of 2022.

The process is repeated to see progress in non-docking and to develop an automatic scoring system on an European level with an uniform scoring protocol. Current scoring systems and protocols often work on a national level and should be further developed to one general European method.

Relevant indicators of consciousness in broiler chicken after waterbath stunning

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One of the main challenges in monitoring the state of consciousness in broiler chicken after waterbath stunning is the selection of the animal-based indicators (ABI) ensuring consistency of controls. To be relevant, ABI should meet three requirements, validity, feasibility and repeatability. The validity and feasibility of ABIs have been assessed by EFSA (2013). However, what still needs doing is to assess the repeatability so that a refined and validated list can be proposed. Thus, the main goal of the study was to assess the inter-observer repeatability of the most valid and feasible ABIs for the state of consciousness after water bath stunning in broilers, both before bleeding (tonic seizure, breathing, spontaneous blinking and vocalisation) and during bleeding (wing flapping, breathing, spontaneous swallowing and head shaking) and the correlation among them. This study compared the assessment of three observers in 5,241 broilers from 19 batches of six different slaughterhouses in two EU countries. Data were analysed at individual broiler level and the combination of crude percentage of agreement (PoA) and Fleiss' kappa (k) and its interpretation according to Fleiss (2003) was used to assess the inter-observer repeatability of the outcomes of some ABIs for the state of consciousness. Before bleeding, the most repeatable ABI was vocalisation (PoA = 100%) followed by spontaneous blinking (PoA = 99.8%; k = poor), breathing (PoA = 98.9%; k = fair to good) and tonic seizure (PoA = 91.7%; k = fair to good). However, both vocalisation and spontaneous blinking were artificially highly repeatable, as they were hardly ever observed. On the other hand, absence of tonic seizure was the less repeatable and was not correlated to other ABI before bleeding, probably because tonic seizure occurred in some birds while the bird was still in the water bath. Therefore, it seems difficult to rely on the absence of tonic seizure to assess consciousness. Thus, we recommend focusing on presence of breathing as indicator of consciousness. However, presence of spontaneous blinking and vocalisation, although hardly ever observed, should not be neglected as indicators of consciousness and ineffective stunning. During bleeding, the most repeatable ABI was spontaneous swallowing (PoA = 98.84; k = poor), followed by wing flapping (PoA = 98.2%; k = fair to good), head shacking (PoA = 96.4%; k = fair to good), and breathing (PoA = 88.2%; k = fair to good). However, spontaneous swallowing is artificially repeatable as was the least observed indicator. Therefore, we recommend focus on presence of breathing, head shaking and wing flapping assessment although less repeatable. Sometimes birds showed simultaneously more than one outcome of consciousness being breathing and head shaking and breathing and wing flapping the most observed combinations. This work will serve at proposing a refined list of ABIs so that they can be used to assess the consciousness of broiler chickens in commercial slaughterhouses.

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Title: Breath analysis for disease detection in dairy cattle: where are we after three decades of research?

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Timely detection of diseases on dairy farms is critical from a health, welfare, and economic point of view. In practice, diseased cattle are often detected only when the clinical signs are apparent. Exhaled breath is a complex mixture of molecules that reflects the composition of blood volatiles. Breath can be collected non-invasively and frequently, offering an alternative to the stressful and often belated current diagnostic procedures. We performed a systematic literature review on using breath analysis for disease detection in dairy cattle. Our initial search identified 202 records from Web of Science and Scopus. After excluding duplicates and nonrelevant records, 10 papers remained for in-depth review. Our results show that research focused on cows before 2000, however, calves have been studied more frequently since then. Studies on calves focused predominantly on infectious diseases (75.0%), whereas metabolic diseases were in the spotlight of most studies on cows (80.0%). Ketosis was the most studied disease (40.0% of included papers). The median number of farms and animals were 1 and 12, respectively. The gaseous phase of the exhaled breath was analysed in 70.0%, and the exhaled breath condensate in 30.0% of the studies. Each study used a face mask or a hand-held device for sample collection, and most (70.0%) studies targeted or identified specific compounds. All studies concluded that it was possible to distinguish diseased cattle either based on specific biomarkers or by classification models. In conclusion, our knowledge about breath biomarkers of various dairy cattle diseases is still very limited. Opportunities for future research include, i.a. analysis of the alveolar fraction of breath, and conducting larger studies that allow for more robust conclusions. Once the patterns of the biomarkers are better understood via controlled sampling, we can make the next step forward to automated detection of diseased cattle using breath.

The assessment of animal-based measures at slaughterhouses for monitoring on-farm pig welfare

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Within the Farm to Fork (F2F) strategy, the European Commission is engaged in the evaluation of the legislation on animal welfare (AW), and EFSA was requested to provide a sound scientific basis for future legislative proposals on the protection of pigs on-farm.

In the mandate, a specific term of reference relates to the collection and assessment of animal-based measures (ABMs) at slaughter, to monitor the level of AW on-farm.

To address this, in the recently published scientific opinion "Welfare of pigs on farm", EFSA carried out an evaluation to propose a list of ABMs that could be useful to monitor the level of welfare on pig farms for rearing pigs and cull sows.

Following preliminary work to get information from literature, 27 ABMs (15 *ante-mortem* and 12 *post-mortem*) were identified. Information on the use of these ABMs in practice was requested from the EFSA Animal Health and Animal Welfare (AHAW) Network in 2021. The data obtained were complemented by EFSA experts' opinion, using a two-step exercise aiming to identify which ABMs are more comprehensively related to the range of important welfare consequences for the animals, their Technology Readiness Level (TRL), and current use at slaughter. Reasoning for the selection and considerations for further development were described.

For rearing pigs, the following ABMs resulted for further development: Tail lesions, carcass condemnations (excluding abattoir contamination) and lung lesions (pleuritis and pneumonia). To cull sows, the most appropriate ABMs were body condition, shoulder ulcers, vulva lesions and carcass condemnations. The TRL of the ABMs at the slaughterhouse is low, although it is most advanced for tail lesions and lung lesions. For all ABMs, it is necessary to develop unified and standardised scoring systems and protocols to monitor and benchmark the welfare of the animals across different regions/countries.

Automated phenotyping of health, welfare and performance traits in broilers

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Abstract: Health and welfare traits are of great importance in broiler breeding programs. However, the individual records that are required for adequate selection, such as gait score or walking ability, are often collected manually and there is a need for automated approaches. In earlier work, radio frequency identification (RFID) technology was implemented to track individual broiler locomotor activity throughout life, using RFID leg tags (<1 gram) and antennas in a grid underneath the pen. This setup was successfully validated for recording relative activity, and results indicated that broilers with reduced walking ability walk shorter distances in a day. Earlier work has also successfully implemented computer vision (CV) approaches to characterize walking in broilers, through pose estimation. However, up to now, both approaches have only been implemented in small groups. In the current project, similar RFID and CV technologies will be implemented, to automatically and continuously record locomotor activity and leg health in groups of 200-500 birds. A larger pen (~40 m^2) will be fitted with RFID antennas and top-view cameras to record birds' positions and movements, and with side-view cameras for key point detection for walking characterization. Using the collected data, it will be investigated how the poses correlate with manual gait scores as gold standard. Preliminary results indicate that, among other things, step height is linked to manual gait scores. Furthermore, it will be studied when gait problems arise, how these are linked to activity levels and whether we can predict the onset of gait problems, allowing for early intervention. Overall, the results of this project will aid in objective phenotypic scoring of broilers throughout life.

Automated detection methods for lameness in dairy cattle

Speaker: Ines Adriaens

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Lameness is a painful, costly, and highly prevalent condition in dairy cows impacting all aspects of sustainability, including reduced welfare and lower production efficiency. Besides prevention, timely detection of deviating locomotion onset is crucial for limiting the impact of this disease. This traditionally requires tedious visual observation of all animals in a herd. In our study, we developed an automated, camera-based gait assessment tool that allows for bi-dailmonitoring of locomotion. By detecting deviating gait features at an early stage, early intervention and treatment become possible.

Locomotion assessment is based on the following gait features calculated from 17 key points automatically detected by a deep learning algorithm (i.e., T-LEAP). This model uses, besides the classical image features, also temporal information to estimate key point location of different points on the legs, head, and back of a cow. It was shown to deal well with occlusions of e.g. the metal constructions of the walking lanes. To train the model and develop the gait features, video footage taken from the side of cows when exiting the milking parlour in an indoor farm environment was used. A dataset of 758 samples (each sample consisting of 2 successive frames) was randomly split into train (n = 22 cows, 388 samples), validation (n = 7 cows, 108 samples), and test sets (n = 15 cows, 262 samples). Validation of the model on the test set demonstrated a key point detection accuracy, expressed as the average percentage of key points correctly detected in a range of 0.2 times the head length (PCKh@0.2), of 89 ± 7%. Next, gait features relevant for assessing locomotion were calculated from the key points. These features include e.g. arching of the back, movement of the head, regularity and speed of steps, etc. Future research will assess the correlation between these features and the true gait, and their value for automated and early detection of lameness.

Validation of non-invasive sensor technologies to measure interaction with the enrichment material in weaned piglets

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Measuring animal behaviour is important in the assessment of animal welfare. In this study, novel non-invasive sensor technologies were validated for measuring the use of enrichment material (EM) in pens with weaned fattening piglets. The experiment was carried out in four pens (2.61 m2) with six weaned piglets per pen (until a bodyweight of ±25 kg) at a semicommercial farm. Pens were provided with EM (a ball and piece of wood connected to a chain) according to the standard procedures of the farm. Three different sensor technologies were tested: passive infrared detectors (PID's), tri-axial accelerometers (TAA) and a neural network model algorithm (NNMA). Per pen, a PID was placed above the EM which detected movement of body heat around the chain (ø20 cm) in Volts every second. A TAA was attached to the EM (top of the chain) and measured acceleration based on the x-, y- and z-axis every second. A video camera was placed above each pen to record video images that were used to feed the NNMA and for validation of the sensor technologies. Use of EM was manually scored per second per pig (pooled per pen afterwards) for 30 minutes of video footage per pen per week (for week one, three and five after weaning) which resulted in 21,612 observation points in total, of which 4,032 points were active use of EM (shake, carry, beak, bite, chew, root or >1 type). Manually scored interaction with the EM (gold standard) was compared with data from the PID, the TAA and the NNMA. To be more specific about the performance of the sensors, two categories were made namely only active interaction with the EM (shake, carry, nose, bite, chew, root, more than one type) and movement of EM (shake, carry, nose, bite, chew, root, more than one type, interaction with EM plus lay, interaction with EM plus body, only lay, only body, lay and body). F1 scores were calculated to measure the performance of the sensor technologies. The NNMA performed best in the category 'only active interaction with EM' (F1= 0.5542), followed by the accelerometer (X-axis (F1 = 0.4822), Y-axis (F1 = 0.5237), Z-axis (F1 = 0.4653), XYZ-avg (F1 = 0.4741)) and the PID (F1 = 0.3802). PID's overestimated active interaction with the EM which might be due to relatively small pen sizes, resulting in piglets lying under or standing/walking/running against the EM without interaction with the EM. In the category 'Movement of EM', TAA's performed best (X-axis (F1 = 0.7182), Y-axis (F1 = 0.6757), Z-axis (F1 = 0.7087), XYZ-avg (F1 = 0.6934)), followed by the PID (F1 = 0.5660) and the NNMA (F1 = 0.4888). Data filtering may result in higher performance of the TAA by removing data of acceleration after active interaction with the EM (swinging of EM). Further analysis will determine if a combination of sensor technologies, by measuring the movement of body heat (PID) and movement of the EM (TAA), will result in higher performance parameters.

EU Reference Centres for Animal Welfare support - the use of Animal Based Measures

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European Reference Centre for Animal Welfare

Animal welfare legislation in the European Union is enforced by the Competent Authorities (CAs) of the Member States. Their official inspectors regularly visit farms, are present in abattoirs and check animals before and after loading for transport to assess animal welfare. Although the majority of data they record relate to resources (resource based measures) and administrative issues, there is an increasing focus on animal based measures (ABMs). This is partly related to the many 'open norms' that the EU legislation still contains: e.g. the law requires that sufficient bedding is provided, but does not specify exactly how much. For those open norms it is up to the inspector to judge if the circumstances are adequate to protect the animal's welfare, by looking at the animal itself. It is therefore important that inspectors have the knowledge and skills to do such a welfare assessment.

The European Commission recognised this need and established three European Reference Centres for Animal Welfare (EURCAWs): for pigs (in 2018), for poultry and small farm animals (in 2020) and for ruminants and equines (in 2021). The EURCAWs provide support to the CAs through 5 activities, aimed at 1. Coordinated assistance; 2. Gaps in knowledge, 3. Animal welfare indicators, 4. Training and 5. Dissemination. The centres perform only a limited amount of experimental research. Most of the information that is presented to inspectors comes from existing sources such as research projects (e.g. Welfare Quality) and national and international risk assessment studies of e.g. the European Food Safety Authority (EFSA). Based on such information, scientific reviews or reports are prepared that summarise the data for the most relevant welfare topics that inspectors have to deal with. These scientific documents are the basis for fact sheets that describe the ABMs that can be used in the field, and how they indicate good and poor welfare.

This technical knowledge is then disseminated through training and other meetings with inspectors, as well as through the centres' websites. Supporting inspectors to recognise bad welfare should help to improve the overall welfare standards in the European Union.