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Programme

10.00 Opening and introduction of the ISAE (Benelux)

Session 1: Early life
Chair: Bas Kemp

10.15 Pre-weaning dietary iron deficiency impairs spatial learning and memory in the cognitive holeboard task in piglets
***Antonides A**, Schoonderwoerd AC, Scholz G, Berg BM, Nordquist RE and Van der Staay FJ*

10.30 No guts, no glory: effects of early-life microbiota on behavioural development in layer chicks
***Rodenburg TB**, Lammers A, Naguib M and Beerda B*

10.45 The effect of litter size on the emotional reactivity and the spatial learning and memory of pigs
***Fijn L**, Antonides A, Van der Staay FJ and Nordquist R*

11.00 Weaning age in parrots: relations with species characteristics
Koene P

11.15 Coffee break

Session 2: Group housing of farm and lab animals
Chair: Christel Moons

11.45 Incidence of lameness in sows housed in dynamic or static groups
***Bos E**, Van Riet MMJ, Maes D, Millet S, Ampe B, Janssens GPJ and Tuyttens FAM*

12.00 Governing farm animal welfare, governing stockmanship: a sociological analysis of the formulation and on-farm implementation of the EU group sow housing legislation
De Krom MPMM

12.15 Safeguarding the welfare of the laboratory horse: guidelines on the management of horses kept in research facilities
***Jonckheer-Sheehy V** and Houpt KA*

12.30 Semi-group housing - do commercial breeding rabbits benefit from the presumed advantages?
***Buijs S**, Maertens L and Tuyttens FAM*

12.45 Lunch

Session 3: Resources and enrichment
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13.30 Effect of heat load on shade use and panting score in Holstein dairy and Belgian Blue beef cattle on pasture
***Van laer E**, Moons C, Ampe B, Sonck B, Vandaele L and Tuyttens FAM*

13.45 Broilers' free range use is affected by vertical panels, age at first outdoor access, and weather conditions
*Stadig L, Ampe B, De Smet S and **Tuyttens FAM***

14.00 Straw blocks affect the behaviour of fattening pigs
***Bulens A**, Van Beirendonck S, Van Thielen J, Buys N and Driessen B*

14.15 Pushing it to the limit: workaholic ferrets
***Reijgwart ML**, Vinke CM, Hendriksen CFM, Van der Meer M, Schoemaker NJ and Van Zeeland YRA*

14.30 Tour

15.00 Coffee break

Session 4: Development and evaluation of tools and protocols
Chair: Frank Tuyttens

15.30 Analysis of six spatiotemporal variables derived from pressure mat measurements: exploring their use as discriminative diagnostic tool for detecting piglet lameness
***Poen MJ**, Meijer E, Flipse I and Van der Staay FJ*

15.45 The use of accelerometers to detect lameness in weaned piglets
***Van de Reep L**, Meier E, Vriends L and Van der Staay FJ*

16.00 Sound analysis of dairy cows
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16.15 Monitoring welfare in practice on Dutch dairy farms
***Van Eerdenburg F**, Hulsen J, Snel B and Stegeman A*

16.30 Virtual Electric Fencing tool for optimizing dairy cow welfare
***Hogewerf P**, Ipema B, Van Reenen C, De Vries C, Van Erp-van der Kooij E and De Kort M*

16.45 Closing

16.50 Drinks & student presentation award announcement

17.45 Dinner

Posters

Grouping and ingestive behaviour of Merino-sheep at high altitude
***Vervaecke H**, Waumans S and Vicca J*

Calculation of an appropriate sample interval for scan sampling in dairy goat welfare research
*Vicca J, Roelant E and **Vervaecke H***

Pre-weaning dietary iron deficiency impairs spatial learning and memory in the cognitive holeboard task in piglets

Antonides, Alexandra[1,2], Schoonderwoerd, Anne C.[1,2], Scholz, Gabi[3], Berg, Brian M.[4], Nordquist, Rebecca E.[1,2] and Van der Staay, Franz Josef[1,2]

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Iron deficiency (ID) is the most common nutritional deficiency in humans, affecting more than two billion people. Iron is an essential nutrient, required for many biological functions. ID in early life can lead to irreversible deficits in learning and memory. The pig represents a promising animal model for studying such deficits, because of its similarities to humans during early development. We investigated long-term effects of pre-weaning iron deficiency on cognitive performance in a spatial cognitive holeboard task. Ten piglets were fed an iron deficient milk diet (10 mg iron/kg) and ten siblings a control diet (100 mg iron/kg) for four weeks. Then, all piglets were fed a fully balanced commercial pig diet (190-240 mg iron/kg). Starting at 7 weeks of age, piglets were tested in the holeboard task in which 4 of 16 holes contained a food reward. This task allows measuring working memory (WM, rewarded site visits/total number of visits to rewarded set of holes; short-term memory) and reference memory (RM, visits to rewarded set of holes/total number of visits; long-term memory) simultaneously. All piglets received 40-60 acquisition trials. Then, they were trained with a different set of baited holes (reversal phase). A mixed-model repeated measures ANOVA (SAS PROC MIXED) revealed that ID piglets showed retarded RM learning during the acquisition (LSM±SEM=0.52±0.03 vs. 0.67±0.03, $F_{1,14}$=8.66, p=0.011) and a larger drop in the transition from acquisition to reversal phase (ΔLSM±SEM=0.072±0.014 vs. 0.033±0.015; $F_{1,14}$=4.83, p=0.045). Correlation analysis within the ID group revealed that hippocampal CA3 and subiculum iron staining correlated positively with RM performance during reversal (both r=0.74, p=0.04) at necropsy (12 weeks). Our results support the hypothesis that early ID leads to lasting cognitive deficits. The piglet as animal model, tested in the holeboard, can be useful in future research assessing long-term cognitive effects of dietary supplements or deficiencies.

No guts, no glory: effects of early-life microbiota on behavioural development in layer chicks

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There is increasing evidence that composition of the gut microbiota during early life affects behavioural development of animals. In rodents, individuals raised in a germ-free environment were shown to be less anxious than control individuals. To date, these mechanisms have hardly been studied in laying hens, yet hold great promise from the perspective of optimizing early-life conditions to favour behavioural development. The aim of this study was to investigate the effect of the early-life microbiota on fearfulness and sociality in layer chicks.

Fourteen pens of 12 LSL layer chicks were used for the experiment. Antibiotics were used to manipulate the microbiota. Seven pens received a cocktail of antibiotics through their drinking water during the first three weeks of life, seven pens received drinking water without antibiotics. Birds were subjected to a novel object test and an open-field test to measure fearfulness and a density related permanence test to measure sociality. At the end of week 3, faecal samples were collected to quantify the effect of the antibiotics treatment on microbiota. Data were analysed using a mixed model with treatment as fixed factor and pen nested in treatment as a random factor.

No effects of antibiotics treatment were found on response to the novel object or behaviour in the open-field, providing no evidence that the antibiotics treatment affected fearfulness. However, antibiotics-treated birds received higher scores in the density related permanence test (0.91 ± 0.52 versus -0.55 ± 0.49; $P<0.05$), indicating that they were more social. Furthermore, treatment with antibiotics resulted in a lower amount of microbiota compared with the control treatment ($0.98*10^5$ cfu/g versus $4.0*10^5$ cfu/g; $P<0.001$), as expected. In conclusion, manipulation of the gut microbiota was successful, but seemed to affect sociality rather than fearfulness in layer chicks. More research is needed to elucidate the exact mechanisms.

The effect of litter size on the emotional reactivity and the spatial learning and memory of pigs

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In the pig industry, litter size has steadily increased over the past decades, leading to an increased incidence of low-birth weight piglets with reduced piglet viability. The aim of this study was to see whether litter size affected emotion and cognition. Ten piglets from relatively large litters (≥18) were compared with ten piglets from relatively small litters (≤13). Every selected piglet was taken from a different litter and was the male closest to the average birth weight within their litter. The piglets were purchased in two batches, per batch from a different breeder, because only few litter sizes had a size smaller than 13. Emotionality of the piglets was assessed in an open field and novel object test at 5 weeks old. The animals were isolated from the group for the first time and spent 10 minutes in the open field where a novel object was introduced after 5 minutes. Between the two groups, no differences were found in salivary cortisol measures or behavioural activity scores. Spatial learning and memory was assessed in hippocampus-dependent holeboard task when the pigs were between 9 and 14 weeks old. Pigs from the relatively large litters displayed similar spatial learning and memory performance in this task to pigs from relatively small litters. Interestingly, significant differences for both emotionality and spatial learning and memory were found between the two batches. Measures of emotionality: baseline salivary cortisol (nmol.L-1: supplier1 3.16±0.309; supplier2 7.122±0.520; $F_{1,16}$=40.64, p<0.0001), and attempted escapes during the open field test (supplier1 8.20±2.38; supplier2 2.3±0.79; $F_{1,16}$=5.64, p<0.0304). Because it remains unclear whether the differences found are associated with differences in genetics, early environment or an interaction between both factors, we conclude that results from testing emotionality or spatial learning and memory in pigs with regard to litter size cannot be generalized across breeds and/or suppliers.

Weaning age in parrots: relations with species characteristics

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According to recent Dutch rules parrot babies should be raised by their parents and stay with their parents until they are independently eating, i.e. without parent support. Many species of parrots exists (ca. 387) of which many (ca. 200) are kept as pets. To set limits on weaning ages per species a method is developed to predict weaning age for each species. Data on weaning and many other characteristics of parrot species were collected. Weaning ages correlated strongly with many species characteristics, i.e. length (R_s = 0.69**), weight (R_s = 0.81**), clutch size (R_s = -0.62**) and even lifespan (R_s = 0.69**). Weaning ages of parrot species are estimated based on differences in size, number of eggs laid, incubation duration, fledging age and genetic relations. A model (using AML: Automatic Linear Modeling, IBM SPSS version 22) will be presented to show the phylogenetic relationships and the base of species and genus differences. Subsequent questions are asked about the functionality of species differences. Variation in the data found may reflect adaptation(s) of species to environmental and social conditions, for instance food, partner or nest demands. Therefore, additional data on parrot characteristics are collected from literature and correlated with the weaning age. One of the hypotheses investigated is that more intelligent parrot species need longer learning experience with their parents and have a later weaning age. In addition, specialist species may also have later weaning ages. Based on these hypothesis differences in adaptability to new environments such as the captive environment may occur and may cause differences in welfare between parrot species in captivity.

Incidence of lameness in sows housed in dynamic or static groups

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The level of aggression in group housed sows may affect lameness and thereby sow welfare and performance. There is more agonistic behaviour in dynamic groups, where individuals are regularly replaced, compared to static groups where group composition remains stable during gestation. Therefore, it can be expected that the incidence of lameness is higher in dynamic group housing systems. The aim of this study was to compare the incidence of lameness in static versus dynamic group housed sows at different stages of the reproduction cycle. On 10 farms (5 static and 5 dynamic), a total of 250 group housed sows were monitored during three reproductive cycles. Sows were visually assessed for lameness 3 times per cycle: at the end of the insemination period, three days after grouping and at the end of the group housing period (one week prior to farrowing). Using a general linear model with method of grouping (static vs. dynamic) as fixed effect, the mean incidence of lameness per phase in the reproductive cycle was estimated. Mean incidence of lameness during three reproductive cycles peaked three days after grouping with 24.0% in dynamic groups and 19.1% in static groups. There were no significant differences between static and dynamic groups (P=0.31), nor between successive reproductive cycles (P=0.15). The high variation among farms might have limited the power to detect significant differences. Preliminary results suggest that gestating sows have a huge risk to become lame at the first days after moving to group houses, however, no differences were shown between static and dynamic groups. Therefore individual sows will be studied in future analyses.

Governing farm animal welfare, governing stockmanship: a sociological analysis of the formulation and on-farm implementation of the EU group sow housing legislation

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EU pig welfare legislation required European pig farmers to shift from individual to group housing of pregnant sows by 1 January 2013. This requirement was principally designed to meet the sows' needs for locomotion and interaction with conspecifics. This paper explored how the legislation affected everyday sow-farmer interaction, which influences farm animal welfare to an important degree. We started by analysing conceptualisations of sow welfare and sow-farmer relations as implicated in the EU Directive and the scientific advice that informed it. Contending that these conceptualisations largely overlooked co-developments in sow housing systems and sow-farmer relations, we subsequently introduced an alternative analytical framework that builds on sociological, practice-oriented theories. We then applied this framework to analyse 19 qualitative interviews with pig farmers from Belgium on the on-farm introduction of group sow housing, and observations in these farmers' group housing systems. We found that farmers' practical, experience-based understandings of good animal-stockperson relations informed farmers' choices for particular group housing systems to an important degree. Furthermore, we discerned that the effect of these choices on everyday sow-farmer relations differed, in the longer run, in at least three analytically distinct (negative, neutral to moderately positive, and positive) ways – according to if and to what degree the novel infrastructure allowed and motivated sows to portray, and farmers to perceive and act upon subjective and individual sow behaviour and needs. When failing to anticipate on this dynamic integration of legislation in on-farm contexts, opportunities are being missed to work towards preventing negative and promoting positive animal-farmer relations and concomitant animal welfare impacts when designing animal welfare policy. Most fundamentally, then, our study underlines a need to rethink the current focus in animal welfare science and policy on infrastructural criteria without attending to emergent co-developments in barn infrastructures, animal-farmer relations, and the well-being of animals and farmers.

Safeguarding the welfare of the laboratory horse: guidelines on the management of horses kept in research facilities

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Horses and ponies used for research are typically housed in individual stalls with little or no opportunity for social contact with conspecifics. This type of management system severely compromises the welfare of horses as isolated subjects show behavioural and physiological stress reactions that may also negatively influence experimental data collected from them.

Group-housing horses is well recognised as the best method to fulfill the physical and behavioural, especially the social, needs of horses, as well as having a positive influence on horse–human interactions during training. Furthermore, some feel that it is not morally acceptable to house horses individually.

There are various methods of group housing horses such as in communal barns, individually tethered with no partitions between them in large sheds, at pasture or in multi-functional area group housing systems which have different functional areas including an exercise area that simulate the activity of horses within a group by careful spatial organisation of the roughage and concentrate feeding areas, the watering station, the rest area, the rolling spot and the exercise area. Examples of these multifunctional group housing systems include the Paddock Paradise system and the computerised, automated Hit Active Stable®. Aggression is often a concern; however, in correctly set up systems this is not a major problem. The advantages and disadvantages of different types of group housing systems will be discussed with guidelines on how to set up the optimal equine housing system in the research setting.

Semi-group housing - do commercial breeding rabbits benefit from the presumed advantages?

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Group housing of rabbit does (the mothers of meat rabbits) has been suggested to improve welfare by increasing possibilities for positive social interactions and locomotion. However, it is unknown whether does actually take advantage of such opportunities. We compared the time-budget of does housed in 8 semi-group systems (4 does + litters housed together per system between 18 and 30 days post-partum) and 16 single-doe cages (1 doe + litter/cage). Does were observed at daytime and night-time on the day of grouping ("D1", "N1") and 4 and 12 days thereafter. Treatment differences were evaluated within time period using Kruskal-Wallis tests. During D1 hopping was more common in semi-group systems than in single-doe cages ($P \leq 0.01$, semi-group: 4.3%(3.8-5.0), single-doe: 0.7%(0.6-0.8)). A similar effect was found for hopping during all nights, although treatment differences were small (2.6, 1.8 and 0.6% for N1, N4 and N12, respectively, $P<0.05$). Social sniffing/allogrooming (the latter being very rare and never reciprocal) took up <2% of the time in semi-group systems during all time periods. It was absent in single-doe cages, although theoretically possible due to wire cage walls. Surprisingly, bodily contact between does was more common in single-doe cages than in semi-group systems during D1 and N1 ($P<0.01$, D1: 12(11-15) vs. 1.6%(0.7-3.1), N1:11(8.9-14.0) vs. 0.6%(0-3.0)) and did not differ between systems afterwards ($P>0.10$). In semi-group systems agonistic behaviour took up 7.0%(6.3-9.5) of the time during D1 but declined to 0.7%(0.3-1.7) on N1 and remained below 0.3% afterwards. Agonistic behaviour was absent in single-doe cages. In summary, the limited differences in the time-budget provide little evidence that rabbit does actually benefit from the increased total space allowance and social options offered by our semi-group system. However, even small changes can be valued highly and further research is needed to elucidate how important these differences are to rabbit does.

Effect of heat load on shade use and panting score in Holstein dairy and Belgian Blue beef cattle on pasture

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We evaluated the effect of heat load on shade use and (preliminarily) the effect of heat load and shade on visual indications of heat-stress, for Holstein dairy cows (HD) and adult (ABB) and juvenile (JBB) Belgian Blue cattle on pasture. During the summer of 2012, no shade was available (NS). During the summers of 2011 (HD, ABB, JBB) and 2013 (AHD, ABB; no JBB in trial) each herd was divided into a group with (S) and a group without (NS) access to a fenced shade-area (with trees and shade-cloth). The Panting Score (PS), range 0-5, assesses heat stress based on the degree of panting and drooling. On several days during the three summers (ADH: ntotal=35, ABB: ntotal=41, JBB: ntotal=20), it was scored hourly (10h-15h) for individuals inside and outside shade. During the same days, individual shade use was determined per 15min. Mixed logistic regressions evaluated the effect of six different climatic heat-stress-indices (combining temperature, humidity, solar radiation and wind speed) on shade use. Increasing Heat Load Index (HLI; range 45-90) was the best predictor for increasing shade use ($P<0.0001$ for HD, ABB, JBB). In 2011, there was a high threshold for shade use, probably due to high motivation for herd cohesion. At HLI=90, shade use probability reached 17%, 27% and 25% for HD, ABB and JBB, respectively. In 2013, (at HLI=90) shade use probability reached 48% for HD and 41% for ABB. When all data were pooled, in hot conditions, shade use reduced the prevalence of PS≥2 for HD and ABB (Chi^2-test, $P<0.001$). For JBB it eliminated PS≥2 and reduced the prevalence of PS≥1 (Chi^2-test, $P<0.001$). These results indicate that, even in Belgium, heat load may evoke thermal discomfort (shade use increases despite the apparent 'cost' of leaving the group) and that shade use lessens visual indications of heat-stress (PS).

Broilers' free range use is affected by vertical panels, age at first outdoor access, and weather conditions

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In chickens with free-range access, often only part of the animals go outdoors and they usually stay close to the barn. The aims of this study were to investigate the effects of vertical panels, age at first outdoor access and weather conditions on free-range use of slow-growing broilers. Chickens were housed in mobile stables starting from one week before they were allowed outdoor access (n=100 per stable, four stables in total). Each stable was placed centrally on a plot of which two quadrants consisted of open grassland and two of grassland with 30 parallel-placed vertical wooden panels (lxh: 2.5x0.6m). In each round (n=3; Feb-May, April-July, July-Oct), chickens of two stables were given outdoor access at 4 weeks of age, the other two at 5 weeks, both until 10 weeks. Temperature, relative humidity (RH), precipitation, wind speed and solar radiation were recorded. The number of chickens outdoor and their location were scored two days per week (morning and evening) by live observations. The effect of these factors on outdoor use was analysed using logistic mixed-effects-models with a random effect for stable. On average, 16.3% of the chickens were located outdoor at any given moment (range: 0-63.2%). Chickens used the free range less with increasing wind speed ($P<0.001$), RH ($P<0.001$), precipitation ($P<0.001$) and solar radiation ($P<0.001$). The distance separating the chickens from the stable increased with age (mean: 7 cm/day; $P<0.001$). This increase was more pronounced if outdoor access was given at 4 instead of 5 weeks of age ($P=0.042$). Broilers preferred quadrants with vertical panels as compared to open grassland (56.2% vs. 43.8%; $P<0.001$). This preference was not significantly influenced by climatic parameters. In conclusion, several weather conditions decreased outdoor use by broilers, while early outdoor access and vertical panels increased the use of the free range.

Straw blocks affect the behaviour of fattening pigs

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Directive 2008/120/EC states that pigs should be provided with enrichment materials, to enable investigation and manipulation activities. However, the use of slatted floors in intensive housing systems inhibits the use of large quantities of enrichment materials. Consequently, there is a need for alternative enrichment strategies which provide pigs with smaller quantities. These enrichment strategies however, must be effective and prevent the development of abnormal behaviour such as tail or ear biting. The present study investigates the effects of the provision of compressed straw blocks to pigs, offered in a vertical cylinder (MIK Toy, MIK International AG, Germany). A total of 252 pigs were followed from the start of the fattening phase (25kg) until slaughter (120kg). They were housed on two commercial farms in fully slatted pens. At each farm, half of the pens had ad libitum access to straw blocks (treatment; 2 or 3 MIK TOYs per pen) and the other half of the pens had access to only a chain as enrichment (control). Individual pig behaviour was recorded once a week during the afternoon using direct observation. Each pig was observed 10 times per observation day, equalling a total of 140 observations per pig. Data were analysed using a logistic mixed model. Preliminary analysis of the behavioural observations reveals some effects. A lower frequency of behaviour directed towards ears ($P=0.0418$; mean frequency per minute: 0.013 ± 0.000872 vs. 0.0162 ± 0.000978), tails ($P<0.0001$; 0.00109 ± 0.000229 vs. 0.00346 ± 0.000426) and other body parts (paws, head, side) ($P=0.0132$; 0.00582 ± 0.00058 vs. 0.00826 ± 0.000678) is seen in treatment groups compared to control groups. However, behaviour related to aggression such as biting, mounting and head-butting seemed to occur more in groups with access to straw blocks compared to control groups ($P=0.0045$; 0.0122 ± 0.00088 vs. 0.00675 ± 0.000618). Manipulation of pen fittings did not differ between groups ($P>0.05$).

Pushing it to the limit: workaholic ferrets

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We designed a two-chamber consumer demand study and tested whether it can be used to assess the value of different enrichments for ferrets in the future. Twelve female ferrets (*Mustela putorius furo*) were permanently housed in a home cage from where they could push a weighted door to get to an experimental chamber. The ferrets' motivation to reach food was determined by making food available only in the experimental chamber and increasing the door's weight on a daily basis. The maximum price paid (MPP) for food is as a benchmark and regarded as the maximum push capacity (MPC) for that ferret. MPP for an empty chamber was measured in four different setups as a control. Next to that, four different set-ups were used to assess the attractiveness of different aspects of the test environment. Results revealed there was a significant difference between MPC (1343±201 g) and MPP-control (89±13%; 66±12%; 70±15%; 75±11% of MPC) in two out of four setups ($p=0.000$; $p=0.031$; $p=0.073$; $p=0.055$), but all differences were too small to identify how different enrichments are valued by ferrets in the future. The additional tests suggest that ferrets have a high motivation to manipulate items, which complicates the execution and design of a consumer demand study. This pilot study has shown that the presented setups cannot be used to quantify the value of specific enrichments items for ferrets and that ferret should be provided with items to manipulate to ensure their welfare.

Analysis of six spatiotemporal variables derived from pressure mat measurements: exploring their use as discriminative diagnostic tool for detecting piglet lameness

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Lameness is one of the main problems in modern pig industry. Apart from economic losses due to lower productivity and survivability, lameness severely impairs the animals' welfare. Lameness in pigs is often underdiagnosed due to the limited time spent observing individual animals and the absence of a fast, sensitive and appropriate diagnostic tool. Recent studies show promising results using different limb pressure measures obtained by a pressure mat. In the present study pressure mat analysis has provided data on six variables: stance duration, step duration, step length, stride duration, stride length and stance percentage. After training sound control (n=21) and lame piglets (n=9) to trot over the pressure mat, the obtained data were analysed using the purpose build program Pawlabeling. Average left/right asymmetry indices (ASI) for each of the six variables for the fore- and hind limbs were analysed in a Mixed Model using IBM SPSS 21 with piglet as random factor. Significantly higher log10ASIs were found in both the affected and non-affected side (front/hind) of lame piglets compared to the controls for stance duration (est.=+0.277, CI95%=0.06-0.492, p=0.013; est.=+0.371, CI95%=0.175-0.567, p=0.001), step duration (est.=+0.380, CI95%=0.120-0.640, p=0.006; est.=+0.482, CI95%=0.245-0.718, p=0.000) and stance percentage (est.= +0.338, CI95%=0.185-0.591, p=0.000; est.=+0.553, CI95%=0.368-0.739, p=0.000). No differences were found for the ASIs of step length, stride duration and stride length. Remarkably, the non-affected side of lame piglets showed the highest ASI in all six variables in comparison with the ASIs of the control piglets. A possible explanation might be the less adequate compensation between ipsilateral compared to contralateral limbs. Although three of the six pressure mat variables appear to be able to discriminate between lame and sound piglets, the practical applicability is poor due to the complexity of data analysis and lack of reference values.

The use of accelerometers to detect lameness in weaned piglets

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Lameness in pigs is a highly prevailing health and welfare problem that causes economic losses in pig farming. Despite its high prevalence, lameness in pigs is difficult to detect. Behavioural observations are subjective and time consuming. An additional problem is that pigs are usually housed in large groups, making observation of individual pigs difficult. Objective methods that enable easy and reliable detection of lameness are urgently needed. These methods can help developing better evidence-based treatment of lameness in pigs. The aim of this study was to assess the usefulness of accelerometers as a non-invasive method for detecting lameness in group-housed weaned piglets. We hypothesised that lameness decreases the pig's activity and that this drop in activity enables distinguishing sound from lame pigs.

First, we analysed the behaviour of the piglets with and without the accelerometers, because it is conceivable that attaching and wearing an accelerometer may affect the pig's normal behaviour. The behaviour of 4 pigs in their home pen was videotaped and scored using JWatcher. Then, we compared the activity of 14 lame and 16 non-lame piglets. Finally, the effects of the nonsteroidal anti-inflammatory drug (NSAID) Meloxicam on activity of 12 lame piglets were assessed.

Following a 24h habituation period, the piglets' behaviour was unaffected by wearing accelerometers. However, the pen mates stayed interested in the accelerometers and harnesses. The activity intensities of lame (mean±SEM, 4.77±0.03) and sound piglets (4.73±0.02; $t28=-0.278$, $P=0.688$) were similar. The average activity intensity was unaffected by treatment with the analgesic Meloxicam (untreated, 4.17±0.63; treated, 4.35±0.65; $t12=0.645$, $P=0.950$).

Our study does not support the hypothesis that monitoring of activity using an accelerometer provides a useful diagnostic tool for detecting lameness in weaned piglets. Other methods recently under development for easy and reliable detection of lameness in pig, such as pressure mats, may be more promising.

Sound analysis of dairy cows

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To achieve a productive, healthy and happy livestock, there is a growing demand for information about the individual animal as well as the group. However, the growing number of livestock per farm has reduced the time available per animal. Precision Livestock Farming (PLF) supports the farmer in giving each individual animal sufficient attention, using sensors to continuously monitor health, behaviour and possibly sound.

If certain noises and behaviours are associated, sound analysis can be used as an early warning tool, for example to detect anxiety or positive welfare. We therefore investigated whether behaviour can be predicted by vocalisations, recording sound and behaviour at a dairy farm in Herwijnen, the Netherlands. Three cameras and microphones recorded dairy cows while one recorded heifers. During 5 days the technical installation was tested and noise reducing dampers were installed. Next, recordings were made for 17 days, 10 hours/day. Two days of recordings were discarded due to technical problems, 15 days of synchronised audio and video recordings were analysed.

After filtering of background noise, calls of cows were traced and linked with simultaneously expressed behaviour, divided into the behavioural groups resting and ruminating, feed related behaviour, social interaction, sexual related behaviour, stress related behaviour and remaining behaviour, using a Repeated Measures Anova model. Video analysis was conducted using The Observer XT 11.5 and calls were classified based on frequency, amplitude and wavelength using UltraVox 3.0 (Noldus IT).

Adult cows mooed lower than heifers (223.05±9.217 Hz versus 333.51±10.869 Hz; $P<0.001$). Cows made a low humming sound when lying and ruminating, lower than during other behaviours (79.63±4.271 Hz versus 300.42±8.019 Hz; $P<0.001$). This study is a first step towards using sound analysis as a tool for dairy cattle management. Lying and ruminating is positive behaviour for dairy cows and might be used as a welfare indicator.

Monitoring welfare in practice on Dutch dairy farms

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The Welfare Quality protocol® (2009) (WQ) takes a day to assess a farm. Other protocols, i.e. Welzijnswijzer (=Welfare Indicator), Koekompas (=Cow Compass) and the Continue welzijns monitor (=Continuous Welfare Monitor), do not require a full day and these have been compared with WQ. Randomly, 60 dairy farms were selected in the Netherlands in such a way that there were 20 good, 20 average and 20 bad farms, based on the availability of good quality food & water, quality of housing, health and behaviour. Correlations with WQ were calculated at the level of the end score, but also at principle, criteria and indicator level. The results for WQ were: 3 farms Not Classified, 52 Acceptable and 5 Enhanced. This implies that WQ does not have a proper discriminative capacity. Correlations with the other protocols were low and not statistically significant ($p > 0.50$). Mainly the principles Feeding and Behaviour were determining the WQ end score. The original WQ was adapted in 3 ways: Drinking water & Integument alterations were calculated differently and the QBA was omitted. This resulted in 22 farms Not Classified, 31 Acceptable and 7 Enhanced. Now all 4 WQ-principles influenced the end result. Correlations with the other protocols were still low and not statistically significant at end result level. For some parameters there was a high correlation between the animal based and environmental measures. A shorter protocol was constructed, with a Pearson correlation of 0.88 with the adapted WQ. Measured parameters are: body condition score, water supply, freestall dimensions, softness of the bedding, cleanliness of the cows, access to pasture, cows lying outside the freestall, locomotion score, skin lesions, mastitis, other diseases, and avoidance distance at the feed rack. Execution of this new welfare monitor takes approximately 1.5 h for a farm with 100 dairy cows.

Virtual Electric Fencing tool for optimizing dairy cow grazing

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There is a growing demand for products produced in 'natural' production systems. On dairy farms, cows should have the possibility to graze during a significant part of the day. Current grazing systems are labour intensive and inefficient, resulting in a growing number of farmers that keep cows inside throughout the year. Tools for improving grazing efficiency and reducing the labour-intensity are needed to reverse this trend. In the Amazing Grazing project (www.amazinggrazing.eu) the possibility of optimizing grazing behaviour by controlling cow movement with Virtual Electric Fencing was evaluated. In various groups in total fourteen cows were provided with a collar which had two sensors: one for measuring the position in the field and the other for passing signals to the cow. Signals were given on the basis of the position and direction of movement of the animal. The field was divided in a 'grazing zone', a 'tolerate zone' and a 'no-go zone'. Animals that moved from the grazing zone into the tolerance zone received a sound signal, animals that continued to move in the wrong direction received continuous signals. When entering the no-go zone the sound signal was combined with a correction signal (a low current electric stimulus). Animal behavioural responses were recorded using direct focal observations, and heart rate profiles were registered as well (Polar RC3 gps Equine). First results indicate that after receiving a few correction signals, animals start linking the sound to the correction and stay within the grazing zone. Heart rate increased after a sound or sound + correction signal (e.g. to values above 100 beats per minute), but the increase lasted only for a short period.

Grouping and ingestive behaviour of Merino-sheep at high altitude

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Grouping behaviour is the result of a trade-off between resource competition and anti-predator strategies. We looked at one aspect in this trade-off by investigating group sizes and the effect of group size on rumination and grazing quality of Merino sheep at high altitude. In the summer of 2014 a herd of 323 sheep is led in the Parc des Ecrins (France) at an altitude of 2.400m to 3.000m. The area is accessible by a steep single track only. The valley is surrounded by mountains, with slopes of various inclination, mostly steep, with minimal flat areas and frequent rock-fall. The valley is 524 hectare large of which 200 hectares covered with vegetation. Observations were carried out over eight consecutive days to score group sizes, rumination and grazing quality. Average group size was 40 individuals (2-153). Of all observed groups about an equal number was small (<11 individuals, n=8), medium (11-40, n=10) and large (>40 up to 153 individuals, n=10). The average distance to a nearest neighbour per focal animal in small groups was 3.05m (0-12), in medium groups 2.09 (0-10) and in large groups 1.13 (0-5). Rumination quality expressed as the average time spent chewing on five consecutive boli, slightly increased with increasing group size (Pearson $r=0.293$, $n=62$, $p<0.021$). The same held for the average number of bites per bolus (Pearson $r=0.253$, $n=62$, $p<0.047$). Average time spent chewing was 43s with 64 bites per bolus. The increase in rumination quality with increasing group size was strongest in young sheep. It is hypothesized that large groups make the sheep feel safer, resulting in increased rumination quality. An effect of group size on grazing quality was not observed. Knowledge on grouping patterns of free-ranging sheep may help farmers to understand the complexity of causes underlying the variation in the performance of individuals.

Calculation of an appropriate sample interval for scan sampling in dairy goat welfare research

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We aimed to develop a welfare protocol that can be easily applied by dairy goat farmers to evaluate and increase on-farm welfare, including a behavioural assessment by instantaneous scan sampling in a part of the herd. In order to obtain representative behavioural samples, an adequate sampling interval is needed. Appropriate intervals between two succeeding scans should not be too long to avoid wasting time and inaccurate results. On the other hand, time intervals should not be too short to avoid reduced observers' alertness and reliability and to avoid dependence between successive data-points.

Based on Engel (Behav. Proc. 38: 11, 1996), fifteen goats were randomly selected in one farm. For 75 focals of 900 seconds with continuous scoring (on average each goat was scanned 5 times), a data entry was made every second on locomotor and ingestive behaviour states, consumed food type, environment manipulation and positive social behaviour. From this protocol several instantaneous pseudo-protocols were derived, each one with a longer sample interval than its predecessor. Spearman rank correlations were calculated to measure the association between the relative frequency of the behavioural pattern under investigation in the continuous protocol and the pseudo-protocol for all focals. The one-tailed runs test was used to determine the mean probability of sampling the behaviour statistically independent. The optimum sample interval was found by making a graph of both correlations and p-values in function of the time to decide on the ideal interval giving best association with the continuous protocol but keeping independence.

The compromise for the optimal interval of locomotion was 29 seconds, for ingestion 35 seconds, consumed food type 46 seconds, manipulation of the environment 30 seconds and positive social behaviour 21 seconds. Scan sampling every 30 seconds is a minimum to obtain an appropriate sample interval to score dairy goat activity budget.

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