



The aim of the animal welfare science update is to keep you informed of developments in animal welfare science relating to the work of the RSPCA. The update provides summaries of the most relevant scientific papers and reports received by the RSPCA Australia office in the past quarter. Email science@rspca.org.au to subscribe.

COMPANION ANIMALS

Cat semi-ownership

People who feed cats that they do not perceive they own (sometimes called semi-owners) are thought to make a considerable contribution to unwanted cat numbers because the cats they support are generally not desexed. Understanding people's perception of cat ownership and the psychology underlying cat semi-ownership could inform approaches to mitigate the negative effects of cat semi-ownership. The primary aims of this study were to investigate cat ownership perception and to examine its association with human-cat interactions and caretaking behaviours. A secondary aim was to evaluate a definition of cat semi-ownership (including an association time of 1 month and frequent feeding), revised from a previous definition proposed in the literature to distinguish cat semi-ownership from casual interactions with unowned cats.

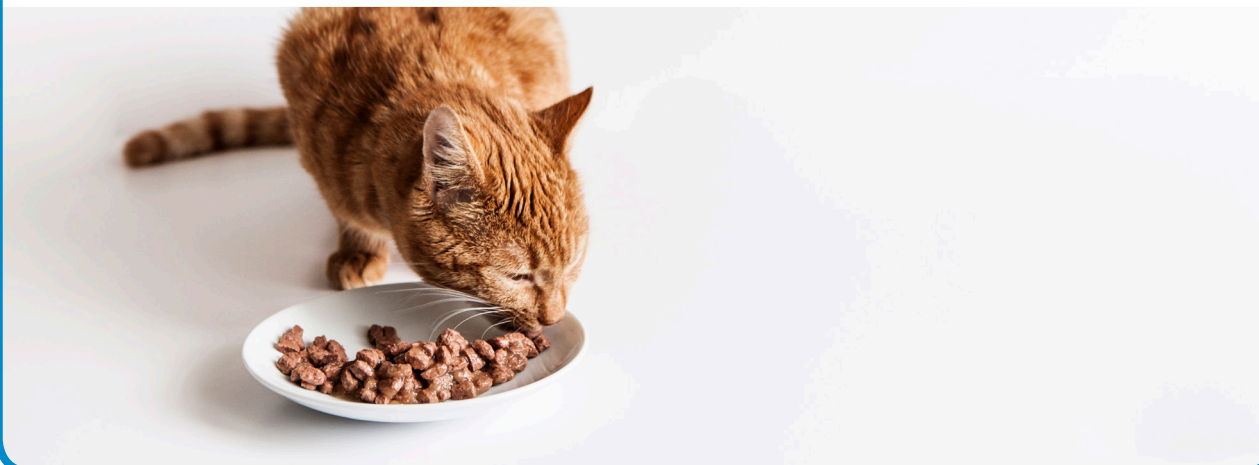
This study found that cat owners and semi-owners displayed similar types of interactions and caretaking behaviours. Nevertheless, caretaking behaviours were more commonly displayed towards owned cats than semi-owned cats, and semi-owned cats were more likely to have produced kittens. All interactions and caretaking behaviours were more likely to be displayed towards cats in semi-ownership relationships compared to casual interaction relationships. Determinants of cat ownership perception were identified and included association time, attachment, perceived cat friendliness and health,

and feelings about unowned cats, including the acceptability of feeding unowned cats.

Preventing semi-ownership behaviour entirely is difficult for a variety of psychosocial reasons, but may not be essential to achieve the goals of improving cat care/welfare and reducing the number of unwanted kittens born. Encouraging and facilitating desexing of semi-owned cats whose semi-owner cannot or will not take ownership of the cat may be an alternative and effective way to address the issues caused by cat semi-ownership such as reducing the number of unwanted kittens and could be a valuable alternative to trying to prevent semi-ownership entirely. Highly accessible semi-owner "gatekeepers" could help to deliver education messages and facilitate the provision of cat desexing services to other less accessible semi-owners. This research can inform policies and strategies aimed at mitigating the contribution of semi-owners to the unwanted cat problem, by providing a mechanism to distinguish semi-ownership from casual cat interactions, strategies to access semi-owners, and educational approaches to modify semi-ownership behaviour.

Zito S, Vankan D and Bennett P *et al* (2015) Cat ownership perception and caretaking explored in an internet survey of people associated with cats, *PLoS ONE* **10**(7): e0133293.

doi:10.1371/journal.pone.0133293.



Raw beef bones in improving dental health in dogs

Periodontal disease is the most common oral disease observed in dogs. It has been reported to occur in 50% and 88% of dogs older than 3 and 5 years respectively and affects as many as 95% of dogs older than 12 years. It is an inflammatory disease of the gums and mouth, which results in, among other symptoms, the formation of dental calculus, and potential tooth loss. Dental plaque is initially established on the tooth's enamel surface and if not removed, becomes thicker over time, resulting in a calculus. Many pet dogs are fed wet food, which does not control plaque formation as wet foods do not act in an abrasive manner within the mouth in order to keep the teeth clean. In addition, most dog owners are not willing or able to clean their dog's teeth by brushing. Dogs have a strong desire to chew raw bones and this can help to keep oral calculus low. Raw bones are a component of the wild carnivore diet and reports of wolves show that they have little dental calculus. Calculus formation may still occur in wild animals, but probably not as pronounced as in domestic dogs fed only commercial diets. Many dog owners choose to give raw bones in addition to a commercial diet; a recent study showed that one-third of dog breeders from the USA and Canada offered raw bones to their dogs on a regular basis.

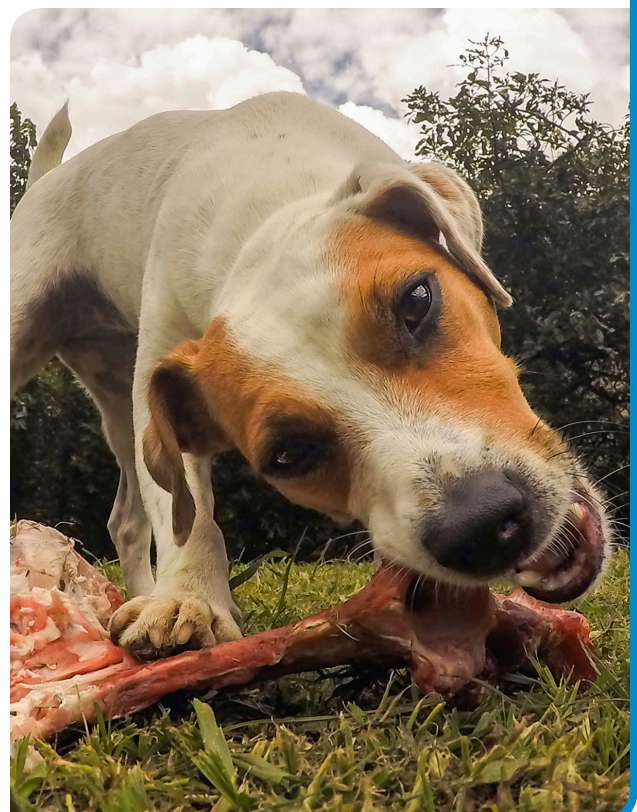
This study aimed to investigate the effects on calculus cover of chewing on bovine raw cortical or 'compact' bone (CB), compared with the chewing of bovine raw 'spongy' bone (SB) in 8 Beagle dogs.

The study was performed in two periods to allow the calculus to build up again between experiments. In the first study, the dogs were given a piece of CB daily for 12 days, and in the second study a piece of SB daily for 20 days (to examine the effects over a longer period of time). It was found that, in the first study with CB, this reduced the cover of calculus in the mouth by 35.5% after 3 days, and after 12 days, a 70.6% reduction in calculus was found. In the

second study using SB, it was found that 56.5% reduction after 3 days and 81.6 % reduction after 12 days and 87.8% reduction after 20 days. No complications such as tooth fractures, pieces of bone stuck between teeth or intestinal obstructions were observed during the studies. Bones offered must be raw (never cooked).

The CB was found to be largely intact after 24 hours of being available for the dogs to chew, but the SB was found to break down into smaller pieces or consumed within this time. This study showed that chewing raw bovine bones was an effective method of removing dental calculus in dogs and that the 'spongy bone' removed dental calculus more efficiently.

Marx FR, Machado GS, Pezzali JG *et al* (2016) Raw beef bones as chewing items to reduce dental calculus in Beagle dogs. *Australian Veterinary Journal* **94**(1-2):18-23.



Understanding public perceptions of risk regarding outdoor pet cats to inform conservation action

Free-ranging domestic cats (*Felis catus*) incur and impose risks on ecosystems and represent a complex issue of critical importance to biodiversity conservation and cat and human health globally. Prior social science research on this topic is limited and has emphasised feral cats even though owned cats often comprise a large proportion of the outdoor cat population, particularly in urban areas. To address this gap, this study examined public risk perceptions and attitudes toward outdoor pet cats across varying levels of urbanisation, including along the wildland–urban interface, in Colorado (U.S.A.), through a mail survey of 1397 residents.

The study found that residents did not view all types of risks uniformly. They viewed risks of cat predation on wildlife and carnivore predation on cats as more likely than disease-related risks (cats contracting or transmitting diseases). Additionally, risk perceptions

were related to attitudes towards risk, prior experiences with cats and cat–wildlife interactions, and cat-owner behaviour (such as current cat ownership and housing and provision of veterinary care).

These findings of this study suggest that changes in risk perceptions may result in behaviour change. Therefore, knowledge of cat-related risk perceptions and attitudes could be used to develop communication programs aimed at promoting risk-averse behaviours among cat owners and cat-management strategies that are acceptable to the public and that directly advance the conservation of native species.

Gramza A, Teel T and VandeWoude S (2016) Understanding public perceptions of risk regarding outdoor pet cats to inform conservation action. *Conservation Biology*, **30**(2):276–286.

Identifying drivers and barriers to owner cat containment

Campaigns encouraging cat owners to keep cats indoors or within the limits of the owner's property have been running in Australia for decades. Advocates for cat containment use a range of reasons to support this initiative including that it will have an effect on 1) reducing injury of cats from vehicles, dogs etc., 2) decreasing disagreements in the community over the cats 3) conservation resulting in benefits on the local wildlife populations and 4) public health with the reduction of transmission of diseases such as toxoplasmosis. However, to date these campaigns have been met with limited success. The primary aim of most cat management interventions is to convince cat-owners to modify their behaviour in some way, by informing them of the potential benefits of the modification. This study aims to identify the main factors that may encourage people to modify their behaviour and contain their cats.

In this study, 365 cat owners in northern Tasmania were interviewed and it was found that they all fell into one of four groups, 1) owners who contained their cat all the time, 2) owners who only contained their cat at night, 3) owners who sporadically contained their cat and 4) owners who made no attempt to contain their pet.

It was found that those owners who contained their cat at all times differed from other cat owners in their perceptions of behavioural control and several key cat-related beliefs. The cat owner's behaviour appeared to be influenced by a range of factors, but two were particularly important. Cat owners who only sometimes or never contain their cats, relative to those who keep their cats contained are 1) more likely to believe that cats have strong physical and emotional needs to be outdoors and are 2) less confident in their abilities to contain the cats. Any intervention strategy devised should ensure that these two key factors are taken into account. As it was found that many of the negative emotions around cat containment were associated with the cat being kept solely indoors, an intervention that was designed to encourage the use of outdoor containment options and the use of enrichment of the indoor environment may have more positive effects.

McLeod LJ, Hine DW, Bengsen AJ (2015) Born to roam? Surveying cat owners in Tasmania, Australia, to identify the drivers and barriers to cat containment. *Preventative Veterinary Medicine* **122**:339–344.

Training styles of stock dog handlers in Australia

'Dogmanship' describes the ability of humans to interact effectively with dogs and is particularly important in situations which require dogs to perform complex tasks, such as working on farms. In this context dogs are frequently required to perform behaviours from a distance away from the handlers and occasionally, out of sight of the handler. Good dogmanship should produce correct and quick behavioural responses from the dog in response to a handler's command. Working dog handlers are a population of dog handlers, therefore, with exceptional skills sets. The effect that the personality of the handler and their perception of their dogs and how they consider that their dogs should be handled has not yet been investigated, and so the authors aimed to address that here.

This study used a questionnaire administered to Australian herding dog handlers. 806 questionnaires were completed and analysed. The questionnaire consisted of demographic questions, as well as questions around dog workload and training methods, owner attributes and owner personality. It was found that handlers scoring high for the personality trait of 'agreeableness' were less likely to use verbal correction than other handlers. It is thought that this may be due to this group of handlers preferring to cooperate, rather than clash, with their dogs. Handlers with a high personality trait of 'conscientiousness' were associated with having a higher understanding of their training techniques, and be more diligent in their use. They were also more likely to understand that providing the dog with the ability to work with the stock is a self-rewarding behaviour for the dogs. This group of handlers were therefore more likely to take a collaborative approach with the dog to achieve the best working goals.

Handlers with high 'extraversion' scores i.e. extraverts were more likely to use training behaviours based on personal experience, without necessarily understanding dog behaviour. The co-occurrences between handler personality and dog management styles outlined in this paper may form the groundwork for further exploration into dogmanship in working dog handler populations. The study did highlight some inconsistencies between handlers' understanding of dog behaviour or training and the interaction style they adopt, which suggests that dogmanship could be improved in the herding sector.

Payne EM, Arnott ER, Early JB *et al* Dogmanship on the farm: Analysis of personality dimensions and training styles of stock dog handlers in Australia. *Journal of Veterinary Behavior* **10**:471-478.



Dachshunds at greater risk of spinal disease

Intervertebral disc disease (IVDD) is the most common spinal disease in dogs. Chondrodystrophic dogs (e.g. Dachshunds and Basset Hounds) which have disproportionably short and curved limbs, are predisposed to IVDD. Of these, the miniature Dachshund is over represented, is more likely to be presented at an earlier age and is at greater risk of a severe spinal cord injury. The tendency for IVDD in Dachshunds is inherited. Chondrodystrophic dogs have abnormal cartilage with a deficiency in a particular type of normal cartilage cells. This causes chondrodystrophic dogs to suffer early degenerative changes in the intervertebral disc and along with other concomitant changes to the cells and content of the disc, make the discs likely to herniate.

Furthermore, chondrodystrophic dogs may have increased risk of IVDD if they have a more extreme conformation e.g. Dachshunds that have a longer back and shorter limbs are more at risk and breeds with a comparatively heavy head such as the Basset Hound may be more at risk of cervical disc disease.

Rusbridge C (2015) Canine chondrodystrophic intervertebral disc disease (Hansen type I disc disease), *BMC Musculoskeletal Disorders*. 2015; **16**(Suppl 1): S11. A presentation from Musculoskeletal Health in the 21st Century Guildford, UK. 30 June - 1 July 2015 doi: 10.1186/1471-2474-16-S1-S11.

Canine cuteness and the human-dog relationship quality

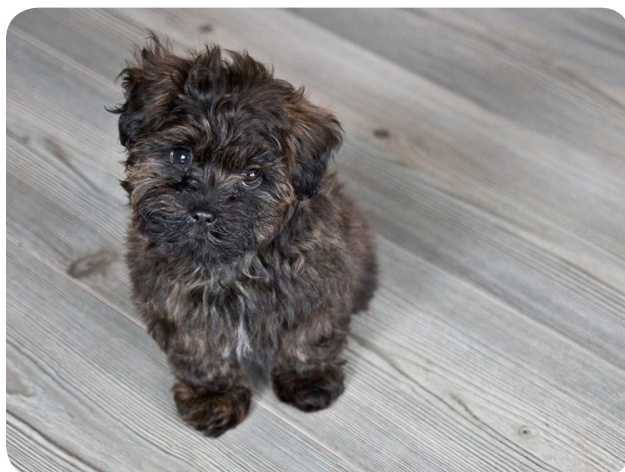
Dogs are the most commonly kept pets in Australia and research has shown that a close bond with a dog can have beneficial psychological, physical and social health effects. However, dogs all have individual differences in behaviour and personality, which is likely to have a significant effect on the success or failure of the human-dog relationship. Recent evidence has shown that most people do not choose dogs based on their function, but instead fashion, popularity or the physical characteristics of the dog and their 'cuteness'. Little is known about whether owners perceptions of their dogs cuteness affects the relationship that they have with the dog, and so this study (performed in 2 parts) aimed to examine this in more detail, assessing 1) if owner perceived cuteness is associated with human-dog relationship quality and whether this is a stronger predictor than canine personality factors and 2) whether owner ratings of cuteness matched ratings from non-owners and whether perceived cuteness affected the perception of personality in unfamiliar dogs.

872 Australian dog's owners provided information on 668 dogs for this study. They responded to questions and provided ratings on how attached they are to their dog, the relationship that they have with the dog, the personality of their dog and how cute they perceived it to be.

It was found that, overall, owners rated their dog as being cuter than did strangers, and this bias was not influenced by owner or dog characteristics or by the

quality of the relationship that the owner has with the dog. It was found that, in study 1, canine cuteness was associated with various measures of dog-human relationship quality, and so owners had a tendency to have a stronger relationship with dogs that they perceived to be cute. In study 2, it was found that owners rated their own dog as being cuter than did a group of strangers and stranger ratings of cuteness was associated with their estimates of some aspects of the dog's personality. This study emphasises the importance of a dogs physical appearance and how cute it is perceived to be and the effect that this has on the dog-human relationship quality.

Thorn P, Howell TJ, Brown C *et al* (2016) The canine cuteness effect: Owner-perceived cuteness as a predictor of human-dog relationship quality. *Anthrozoös* **28**(4):569-585.



Interaction with a dog reduces distress

In 2013, 11% of the population in the United States experienced serious psychological distress, involving problems with anxiety and mood and which is associated with increased risk for health problems and a reduced life expectancy. College and university students are particularly susceptible to experiencing this type of distress with two thirds of medical students noted to be experiencing depression and one in three having suicidal ideation. To help address this problem, many universities have initiated animal visitation programmes (AVPs), which provide the opportunity for the students to interact with animals (usually dogs) to help alleviate stress. At the current time, there are over 925 AVPs at colleges and universities in the US, but little effort has been made to determine if these programmes are effective. This study aimed to examine this, and examined the influence of a single, brief interaction with a dog on 67 medical students at a university in the US.

The study examined the effects of the interaction (7-10 minutes) with a dog, compared with viewing (but not

interacting with) the dog, compared with the effect of no-treatment control (no viewing or interacting with the dog). It was found that interacting with the dog reduced anxiety and negative mood and increased positive mood, when compared to the control condition. These effects were not related to simply taking a break from work and engaging in some other activity, nor were they limited to those with experience of dogs, or people having greater expectations regarding the effectiveness of the AVP.

The study therefore supports the use of AVPs in colleges and universities, as well as other places such as nursing homes and hospitals. The authors suggest that further research be performed in order to determine the timing of when the AVP can have the most effects on the people interacting with the dog to maximise the benefits of these programmes.

Crossman MK, Kazdin AE, Knudson K (2016) Brief unstructured interaction with a dog reduces distress. *Anthrozoös* **28**(4):649-659.

FARM ANIMALS

Improving neonatal survival in small ruminants

Mortality of neonatal livestock has effects on farm profitability, animal welfare, and farmer morale. Animals are most vulnerable on the day that they are born, with up to 50% pre-weaning mortality occurring on this day in sheep and goats. This paper examines the reason for lamb and kid mortality on farm. Neonatal mortality is thought to be due to 1) birth trauma following a difficult delivery during birth, 2) development of a poor bond between ewe and lamb that causes hypothermia, starvation and death, 3) infectious disease, 4) other causes such as malformation, predation and accident. Lamb behaviour following birth is also crucial in determining its survival, and the lamb needs to find the udder to suckle rapidly after birth to ensure that it received adequate nutrition and colostrum to survive.

This paper provides a comprehensive review of the large body of available literature on this subject. It is suggested that the scientific information may not have been translated sufficiently well to farmers and the uptake of social science methods could help to facilitate the transfer of information to be used in

practical solutions on farm. The authors also note that experimental studies have a tendency to only investigate one single causal factor at a time, but in reality, the on-farm data suggest that these single issues may be the ones that are the most important. In addition, there may be farm specific issues that are the main contributors to mortality, and so single issue solutions may be most important in this case.

Neonatal survival in lambs and kids can be improved on farm, and the large between-farm variation in lamb survival reported in many studies suggests that this is achievable. Education and training for advisers around the biological reasons for mortality, in addition to better record keeping on farm, and advisory support for farmers in developing solutions that will work within their own farm systems, are key to achieving improved lamb survival.

Dwyer CM, Conington J, Corbiere F *et al* (2016) Invited review: Improving neonatal survival in small ruminants: science into practice. *Animal* **10**(3):449-459.

On-farm evaluation of the Salmon Welfare Index Model (SWIM 1.0) for farmed fish

Norway and the European Union have laws that require farmed fish to be provided with a good standard of welfare, as this is thought to be central to the production of good quality end products. Many customers select salmon products on the basis of not only price or quality, but how the fish was farmed and its welfare. A standardised and validated test to compare the welfare of fish at different farms - the Salmon Welfare Index Model - was developed for this purpose. This tool includes a number of different welfare indicators which affect salmon welfare at both the individual and group level to which different weighted scores are attributed so as to calculate overall scores and determine which welfare needs are compromised and which are met.

This study consisted of testing this model in the field on spring smolts (young salmon transferred from freshwater tanks to marine pens) which ten different Atlantic salmon farmers perceived as their best and worst batches at two different time points (second visit 2-3 months following the first) to determine if the different welfare indicators could be assessed effectively and the farm visit could be performed within an acceptable time period. The applied welfare indicators were water temperature, salinity, stocking density, lighting disturbance, daily mortality rate, appetite, sea lice infestation, condition, emaciation,

vertebral deformation, maturity, smoltification state, and fin and skin condition.

The results of the study showed that the welfare evaluation for each farm took around 1.5 hours, and there were some marked changes in the fish between visits, with larger proportions of emaciated fish noted on the first visit compared to the second visit, and more skin and fin damage noted on the second visit. The overall welfare index scores generally concurred with the farmers' ranking of their best and worst sea pens. The result of this study indicated that the SWIM model had the potential to work effectively and could be used as the first step towards standardised monitoring and assessment of salmon welfare over the salmon marine production cycle. As the model is flexible regarding the welfare indicators included in the assessment, it can be updated as scientific knowledge becomes available and as feedback is obtained from users. The authors also encourage that this tool be further developed for use by veterinary health professionals and researchers.

Folkedal O, Pettersen JM, Bracke MBM, *et al* (2016) On-farm evaluation of the Salmon Welfare Index Model (SWIM 1.0): theoretical and practical considerations. *Animal Welfare* **25**:135-149.

Keel bone fractures in laying hens

Keel bone damage, including deviations of the bone and fractures, are common in laying hens, especially in non-cage systems and when they occur, affect the welfare of the birds. It is thought that keel bone damage could occur as a result of birds colliding when descending from perches, or alternatively, may also occur as a result of the pressure the perches exert on the foot of the birds. It has also been suggested that demineralised bone, as a result of the high rate of egg laying, may influence the development of keel bone fractures.

This study, performed in Switzerland, aimed to determine if there were links between egg production and the presence of keel bone fractures. The productivity of 80 white and 80 brown hens was monitored using Radio Frequency Identification from production until depopulation at 65 weeks of age. Each bird was examined 43 times during the study between the ages of 18 and 65 weeks to determine the occurrence of keel bone deviations, fractures using a four point scoring system (4=normal keel bones, 3=slight deviation, 2=moderate fracture, 1=severe fracture) and their behaviour was examined throughout the study. The birds were also

examined for the presence of bumblefoot twice during the study, at 43 and 64 weeks of age.

It was found that approximately 62% of birds had sustained a fracture by the end of the study and new fractures were found more frequently in keel bones that had previously been scored as deformed. The occurrence of fractures was linked to egg laying and most fractures occurred at the peak of egg production, and not when hens were housed in a new barn (when it would be expected most bird collisions and accidents would occur). All birds with bumblefoot on both feet had a fracture at depopulation, and this may be because these birds may be more likely to lose grip on perches and fall. Birds with fractures were also found to spend longer in the nests during egg laying, which may indicate that egg laying caused them pain, and there was some evidence that birds sustaining fractures tended to hide in the nest boxes to avoid interaction with other hens. The results displayed in this paper support the notion that keel bone fractures are likely to be painful for the birds.

Gebhardt-Henrich SG, Fröhlich EKF (2015) Early onset of laying and bumblefoot favour keel bone fractures. *Animals* **5**:1192-1206.

Economic feasibility of animal welfare improvements in Dutch intensive livestock production

Increasing public concern in recent decades about animal welfare in livestock production has led to higher legal requirements in many European countries. In the Netherlands, several market initiatives were introduced which set standards of animal welfare higher than the minimum legal requirements. Three market segments can be distinguished: 1) conventional, which complies with the minimum legal standards; 2) a middle-market segment, which supplies products which go beyond conventional standards and 3) a top-market segment, which supplies organic products or products of a similar animal welfare standard. Farmers can choose to supply products with the higher animal welfare standards, but this decision will predominantly depend on financial factors (perceived economic viability of a system, levels of income the farmer can potentially attract as a result of the changes, and the certainty of this income). In this regard, the degree of reversibility of any changes made to the production system is also relevant as it influences the riskiness of the investment. This study aimed to compare the economic feasibility of alternative production systems with higher levels of animal welfare for broiler, laying hen and fattening pig farms, with particular regard to the reversibility of the investment.

It was found that the economic impacts of improving animal welfare differed in the three livestock production sectors. It was found that for the broiler sector, improving animal welfare can lead to economic benefits without making large investments, and hence this industry had the best perspective for developing the market in the short to medium term. In the laying hen sector however, the farm needs to make substantial investments for any improvement in animal welfare, and this industry had the worst prospects for improving animal welfare in the short to medium term. In the fattening pig sector, the majority of animal welfare improvements do not result in considerable economic advantage for the farmer compared to the conventional system, and so conversion options should be made more financially attractive, for example by increasing price premiums or providing conversion subsidies. Hence, different approaches should be followed in the different sectors to further develop the market for products with higher levels of animal welfare.

Gocsik É, Oude Lansink AGJM, Voermans G *et al* (2015) Economic feasibility of animal welfare improvements in Dutch intensive livestock production: A comparison between broiler, laying hen, and fattening pig sectors. *Livestock Science* **182**:38-53.

Factors affecting feather pecking in non-cage laying hens

Severe feather pecking is a behaviour where birds peck and pull at the feathers of other birds. It is a significant welfare risk within the egg industry, and has been shown to have many factors which influence its development, but at the current time is largely managed using measures such as beak trimming and reducing the lighting. However, these methods do not address the cause of the behaviour. This paper reviews some of the literature examining the risk factors for feather pecking in hens.

The authors firstly distinguish gentle feather pecking from severe feather pecking. They then examine the effect of foraging behaviour and the re-directed pecking theory, where if foraging and food searching behaviours are restricted, the birds may redirect the motivation to perform these behaviours towards pecking other birds. The authors also examine the rearing period, the effect of early life experiences and environmental enrichment provided to the young chicks and the effect that these aspects have on the bird's behaviour in later life. The authors outline the literature related to feather-eating, which it is thought may be related to dietary deficiencies and may also be

a causal factor for the development of severe feather pecking. The paper showed that individual variation between the birds is important to consider in relation to the tendency for the birds to interact with their environment and other members of the flock, and their feeding requirements, and hence potential to effect the amount of feather pecking they perform towards other birds.

The authors suggest that further research needs to comprise of an integrated approach incorporating examination of environmental enrichment, feather eating and individual bird variation. It is suggested that this type of integrated approach may result in birds with lower genetic predisposition to perform severe feather pecking, housed in environments that provide for their behavioural needs, thereby reducing the risk of severe feather pecking.

Hartcher KM, Wilkinson SJ, Hemsworth PH *et al* (2016) Severe feather-pecking in non-cage laying hens and some associated predisposing factors: a review. *World's Poultry Science Journal* **72**:103-114.

Effect of a topical anaesthetic during castration of beef calves

Castration of male beef calves is routinely performed to prevent unwanted breeding, improve meat quality and reduce unwanted behaviours such as aggression and mounting behaviours in the adult animal. This procedure, although known to cause pain, is routinely performed on the animal without pain relief as the practicality and cost-effectiveness of pain management strategies on-farm are a major limitation to their routine use. In order to address these issues, a farmer-applied spray on topical anaesthetic (TA) containing lidocaine, bupivacaine, adrenalin and cetrimide was formulated. This study aimed to investigate the effects of the application of this TA on the cortisol response to surgical castration of 24 beef calves.

In this Australian study, the calves were allocated to the following treatment groups 1) surgical castration, 2) surgical castration with the post-operative application of topical anaesthetic and 3) sham castration (control). Calves were habituated to handling prior to the treatments and blood cortisol levels taken at defined time periods both before and following the application of the treatments (-0.5h, 0h and +0.5, 1, 1.5, 2, 4 and 6h).

It was found that there was a significant effect of cortisol levels across all treatment groups ($P < 0.01$) with the lowest cortisol concentrations at -0.5 and 6 h, and the peak concentration at 0.5 hours (after castration was performed) being significantly higher than the response at 0h (prior to castration). It was found that there was no significant effect of treatment ($P = 0.077$), but there was a trend for the control calves to display lower cortisol concentrations than castrated calves and those castrated with topical anaesthetic, and calves castrated with topical anaesthetic to display lower cortisol concentrations than those castrated without.

The authors suggest that more research should be performed to further investigate the effect of topical anaesthetic on reducing pain during the performance of painful procedures such as castration in cattle.

McCarthy D, Lomax S, Windsor PA *et al* (2016) Effect of a topical anaesthetic formulation on the cortisol response to surgical castration of unweaned beef calves. *Animal* **10**(1):150-156.

Frequency of tail lesions and risk factors for tail biting in pig production

Tail biting between pigs is an abnormal behaviour on farm that affects the pig's welfare and can have negative economic effects for the farmer. Understanding the causes for the development of tail biting behaviour is challenging due to its sporadic and unpredictable occurrence and because it appears to have multi-factorial origins. Outbreaks of tail-biting under commercial farm conditions has led to the widespread docking of pigs' tails, but this only addresses the signs of the problem without addressing the underlying motivations for performing this behaviour.

In order to gain a better understanding of what influences the development of tail biting, this study analysed data from a sample of 67 commercial farms in Italy using an on-farm visit and an interview with the farmer in charge of each facility. Data was obtained around farm hygiene, herd health, prevention, management, climate control and production traits.

It was found that, in the weaning phase, tail biting was increased by a factor of 16.64 when the tails were tipped (only half the tail removed), compared to those pigs with short docked tails. In addition, it was found that tail biting was increased by a factor of 68.09 when the observer noted poor air quality and by a factor of 14.44 when the feeding time was variable.

The prevalence of tail lesions in pigs in fattening units was, in contrast, affected more by environmental and managerial factors, such as drinker location in the lying area and the presence of air turnover. There was also tendency to observe an increase in tail biting when the stocking density was high. Many of the risk factors identified in this study could be easily managed to reduce the risk of tail biting and occurrence tail lesions through evaluation and control of stocking density, climate and feed and water management.

Scollo A, Contiero B, Gottardo F (2016) Frequency of tail lesions and risk factors for tail biting in heavy pig production from weaning to 170 kg live weight. *The Veterinary Journal* **207**:92-98.



Metabolic disorders in dairy cattle

Dairy cattle are required to adapt to the intensive housing environment in which they live as a milk-producing animal. However, individual animals differ in their ability to adapt. Adaptability can be assessed in the long run by measuring longevity, but in the short term, signs of metabolic and fertility disorders as well as signs of disease can indicate varying degrees of adaptability. In recent decades, the dairy industry has focused on increasing milk yield, but farmers are also interested in healthy cattle that can serve as long-term milk-producing animals. The transition phase, which is the period between three weeks before to three weeks following birth of a calf is the most critical and challenging period to the dairy cow's health status, and a time at which major physiological, nutritional, metabolic, and immunological changes occur as the cow moves from a state of gestation to the onset of milk production. Cows need to adjust metabolically to the increase in energy and nutrient requirements needed for milk production. Little is currently known about the limitations of dairy cattle in their ability to adapt to the various disturbances in their living conditions and the main purpose of this

paper was to look at the nutritional and physiological process occurring as a dairy cow adapts to the living conditions, and what makes a successful adaptation which avoids metabolic disorders during the transition period.

The author suggests that one of the major factors to help dairy cows to succeed in adapting and avoiding dysfunctional processes in the transition period is ensuring that they are provided with sufficient nutrients to enable them to meet production requirements. The author also suggests that attempts to reduce metabolic disorders and production diseases on farm should rely on a system of continuous monitoring. Emphasis should also be placed on the incidence of low disease levels as a beneficial factor in dairy farming, in addition to the emphasis currently placed on high productivity.

Sundrum A (2015) Metabolic disorders in the transition period indicate that the dairy cows' ability to adapt is overstressed. *Animals* **5**:978-1020.

Societal views and animal welfare science

Many innovations that are developed by scientists working in the world of animal welfare are not adopted into practice. One example of this is the modified cage for laying hens, which is a scientific solution that took into account the research on many welfare aspects for laying hens to engineer another cage environment. However, during the development of this solution to meet the welfare needs of laying hens, it seems that there was no investment in exploring what the general public wanted and what they considered essential for housing systems for birds. This now leaves a market where people are less willing to support a production system based on cages, even if they are labelled 'modified' or 'enriched'. This paper discusses the reasons for which some solutions which are developed by animal welfare scientists fail to gain traction. The authors suggest that this is because 1) the solutions do not adequately address the societal concerns that motivated the original research and 2) do not adequately address the perceived constraints within the industry.

The authors use tail docking of cattle as an example and discuss the continuation of this practice by some farmers due to the perceived notion that the docking contributes to cleanliness in cattle. The authors suggest that if new efforts of proven effectiveness for

cleanliness on dairy farms were directed at farmers, it may help to reduce this practice. The authors also discuss the ongoing perception that the provision of pain relief during dehorning also has little effect on the calf, and so some producers do not choose to use it. Directing information at farmers that can show that the calf is experiencing pain during this procedure may influence the farmer's actions in the future.

These examples and others are discussed and show how social science can be used to influence the views of stakeholders to ensure that the proposed solutions to problems associated with animal welfare align with societal views. An approach using social science can also determine those areas where gaps in knowledge exist and help to determine the barriers in implementing changes to allow ideas to be adopted with greater ease into the future.

Weary DM, Ventura BA, von Keyserlingk MAG (2016) Societal views and animal welfare science: understanding why the modified cage may fail and other stories. *Animal* **10**(2):309-317.

The effect of early human handling on play and exploratory behaviour in pigs

Play and exploratory behaviour are thought to be associated with an animal experiencing a positive state of mind. It can therefore be argued that any management procedure that results in an increase in the performance of this play and exploratory behaviour is promoting a positive state in the animal. It is known that tactile stimulation during early life can modify brain plasticity in some species including the rat and human, resulting in an increase of dendrite connections in the brain which enhance the motor and cognitive skills. However, to date, there is no evidence on how early tactile stimulation effects the brain and influences play and exploratory behaviours in pigs.

This study, performed in Sweden, aimed to assess this by subjecting piglets from 13 litters to one of three handling treatments from 5 to 35 days of age 1) all piglets handled (stroking on the back for 2 minutes each day), 2) none of the piglets handled or 3) half of the piglets in the litter handled. At 42 days of age the behaviour of the pigs was examined by placing them in pairs in a novel pen with a toy tug rope. It

was found that more locomotor play was performed by pigs from litters where all or half of the piglets had been handled, whereas social exploratory behaviour was seen more in pigs from litters where half of them had been handled, rather than where none or, in some cases, all had been handled. This suggests that there is something about handling half of the piglets that had consequences relating to social exploration for the whole litter.

The results of the study suggest that the piglets from litters where all or half of the piglets were handled before weaning may experience, or at least have the potential to experience, more positive states after weaning and thus have improved welfare compared with other pigs housed under the same environmental conditions.

Zupan M, Rehn T, de Oliveira D *et al* (2016) Promoting positive states: the effect of early human handling on play and exploratory behaviour in pigs. *Animal* **10**(1):135-141.

HUMANE KILLING

Animal welfare aspects of stunning methods for poultry

Stunning animals to produce unconsciousness prior to slaughter (neck cutting) is practiced worldwide. Most guidelines and regulations relating to the welfare of animals at slaughterhouses include a list of stunning methods applicable to different species of animals and methods to produce unconsciousness which will be sustained until death by bleed out. In Europe, the welfare of poultry is protected under Regulation (EC) 1099/2009 which allows the use of the penetrating and non-penetrating captive bolt, firearms, head-only electrical stunning, head-to-body electrical stunning, electrical water bath, carbon dioxide in two phases, carbon dioxide associated with inert gases, and inert gases only. Individual member states are able to retain national legislation if the standards offer greater protection for the welfare of poultry at slaughter, but it is also generally acknowledged that the existing methods may be refined or replaced in order to improve animal welfare and/or meat quality.

This review outlines the mode of action for existing methods for poultry in the EU, but the authors emphasise that they also have relevance to other parts of the world. The authors then go on to discuss

two potential new stunning methods, transcranial magnetic stimulation and the use of microwave energy.

The authors conclude that all currently available stunning methods have both advantages and disadvantages in relation to animal welfare, product quality and associated costs. At the present time, the electrical water bath stunning remains the most commonly used method for stunning poultry prior to slaughter, but controlled atmosphere stunning methods are becoming increasingly common, especially at the larger slaughterhouses. As new stunning methods are developed and introduced, it is important to ensure that these technologies can provide a reliable stun quality and that they have the required effectiveness to induce and maintain unconsciousness to avoid unnecessary suffering in the birds.

Berg C, Raj M (2015) A review of different stunning methods for poultry – Animal welfare aspects (stunning methods for poultry). *Animals* **5**:1207-1219.

Aversion and unconsciousness during exposure of lambs to carbon dioxide

At the current time, the most widely used methods for stunning lambs in commercial slaughterhouses are electrical and mechanical stunning. Electrical stunning is achieved by passing electrical current through the brain, with loss of brain function. However, this type of stunning produces an increase in muscle activity which can cause haemorrhages and bone fractures in the carcase, affecting meat quality. The use of carbon dioxide (CO₂) has been used previously to stun pigs and decreases the incidence of haemorrhages in the meat. The use of gas to stun also has other welfare advantages in that it can negate the need for animal restraint and handling stress. However, loss of consciousness is not immediate in pigs and they show signs of aversion to the gas, and so the system has been criticised. The aim of this study was to assess the effectiveness of a progressive exposure of lambs to 90% CO₂ and examine both the behavioural and

physiological effects of exposing them to this gas, as well as assessing the duration of unconsciousness.

14 lambs were individually progressively exposed to 90% CO₂ in a deep cage with a gas concentration gradient for 66 seconds. Loss of consciousness occurred, on average, 48s after exposure. During this time, lambs exhibited head shaking and sneezing, gasping and increased respiration. Exposure to CO₂ at high concentration induced effective stunning for 124s. However, loss of consciousness is not immediate and the behaviours exhibited by the lambs suggest that the gas was aversive and they may have experienced fear, pain and/or distress.

Rodriguez P, Dalmau A, Manteca X *et al* (2016) Assessment of aversion and unconsciousness during exposure to carbon dioxide at high concentration in lambs. *Animal Welfare* 25:73-82.



MISCELLANEOUS

Moving beyond the Five Freedoms to a life worth living

The Five Freedoms were formulated in the early 1990s and are recognised as highly influential in the area of animal welfare. However, developments in the field in recent years now show that the Five Freedoms do not capture the breadth or depth of current knowledge around animal welfare and its management. Some negative experiences such as thirst, hunger, pain, nausea, dizziness, weakness and sickness, can never be eliminated and are, in fact, vital for the survival of the animal. The negativity creates a sense of urgency to which the animal must respond in order to survive. Other negative experiences occur as a result of the environment in which the animal exists. These can be improved to replace the negative experiences with positive ones to enable an animal to have a 'life worth living'. The author suggests that animal welfare management should aim to reduce the intensity of survival-related negative effects to a tolerable level (but

which still elicit the required behaviours), and provide opportunities for animals to behave in ways that they find rewarding.

Ideas evolve in animal welfare science, as in all other disciplines, so the author suggests that the current definitions around animal welfare will need updating at some point. He provides a suggested alternative characterisation of the features of animal welfare which incorporate the key messages from this paper. The observations made in this paper may have implications for updating the minimum standards in codes of welfare or practice to ensure that animals are given the opportunity to experience positive welfare states and a life worth living.

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