



Review

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CAN IMPROVING ANIMAL WELFARE CONTRIBUTE TO SUSTAINABILITY AND PRODUCTIVITY?

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Abstract

Globally we need to feed an increasingly urban and expanding population with a growing demand for meat, milk and eggs, against a background of reducing the carbon footprint of food production. Under these conditions is farm animal welfare a luxury that cannot be sustained? Animal welfare has been characterised in a number of different ways: to include aspects of the animal's biological functioning, ability to live a natural life, and affective state. The oldest conception of animal welfare is the Five Freedoms, which has been adapted to the Five welfare Needs for a suitable environment, a suitable diet, to be able to exhibit normal behaviour patterns, to be with, or apart from, other animals and to be protected from pain, injury, suffering and disease. In lowly productive extensive livestock production systems, animals are often kept in conditions of variable nutrition, and experience high mortality and morbidity from preventable disease. For these systems animal welfare can be improved through actions which will simultaneously improve productivity (e.g. vaccination against disease, education in animal hygiene and management, and provision of improved nutrition, such as improved grassland management). Under these conditions animal welfare improvements are an integral part of improving production efficiency, and can benefit humans and animals simultaneously. Highly productive, intensive systems have increasing control of nutrition and health of the animals, and high productivity but reduce the space and opportunity for animals to express highly motivated behaviour (such as dust-bathing in chickens, or exploration in pigs). Under these conditions productivity gains have been achieved with animal welfare costs. However, these systems often have high inputs, require the use of antibiotics to sustain growth, and may have detrimental impacts on the immune function, fertility and longevity of animals within these systems. Paying attention to the needs of the animal can have both welfare and production efficiency benefits, and animal welfare should be seen as an integral component in improving sustainability of livestock production.

Keywords: Animal welfare, Sustainability, Productivity, Behaviour, Health

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1. Introduction

Global food production is facing unprecedented pressure from multiple demands. An increasing human population is driving a growing requirement for food, but simultaneously having an impact on the amount of

agricultural land available to produce food. Impacts of climate change, global warming and associated extreme weather events can devastate harvests, and may reduce the amount of land suitable for agriculture even further. In addition, competing demands to maintain biodiversity and ecosystem services, to produce crops to provide

alternative biofuels and the sustainable development goals to eliminate hunger and increase food security have been termed a 'perfect storm' of pressures on food production (Foresight Report, 2011). Where does livestock production fit in these competing demands? On the one hand, livestock produce about a third of human protein sources, and can be an important source of protein in countries with high malnutrition rates. Grazing animals, particularly small ruminants, are able to make use of poor quality forage in environments where it is impossible to grow other foods for human use. However, on the other hand, livestock are a significant contributor to greenhouse gas (GHG) emissions (approximately 10% of GHG of anthropogenic origin come from agriculture), intensive production can reduce biodiversity, and they can be inefficient convertors of plant protein into animal-based proteins. Under these conditions, significant drivers promote a reduction in meat consumption, particularly in the global north and west, and 'sustainable intensification' (or producing more from less land area) of production. Where does animal welfare fit in this picture? Is welfare an expensive luxury that the world can no longer afford, or an integral and essential component of sustainable livestock production? In this paper, I will argue for the latter case, and demonstrate how animal welfare must be included in sustainable global food policy.

2. Animal Welfare

Animal welfare is about managing animals in a way that gives them what they need, taking into account species-specific requirements. It differs from animal rights, in that it accepts human use of animals, but is concerned about giving the animal the best life possible. It is also different from animal cruelty – animal welfare is concerned about the whole quality of an animal's life, and includes both the absence of suffering and the opportunity for positive welfare. Animal welfare can be seen as concerns falling into three main areas (Fraser, 2008): 1) concerns about the biological functioning of the animal: for example, is it healthy, is it growing normally and reproducing; 2) concerns about the naturalness of the environment in which it is kept: for example, is the animal able to use evolved and adaptive behavioural responses; and 3) concerns about the emotional experiences or feelings of the animal: for example is it fearful or in pain, or relaxed and content (figure 1).

Different approaches to characterising animal welfare exist, but the oldest and best known of these is the Five Freedoms (FAWC, 1979), which outlines the main criteria of relevance to animal welfare, namely freedom from hunger and thirst, from discomfort, from pain, injury and disease, from fear and distress, and the freedom to express normal behaviour. Often overlooked, but arguably more important, are the 'provisions' that accompany the freedoms, which outline the main actions that should be taken to ensure good animal welfare. These have since been re-written as welfare needs in UK legislation, which

places the onus on the actions taken to care for animals (AWA, 2006). The Freedoms have been criticised, however, and an alternative approach, the Five Domains, has been proposed (Mellor et al., 2009). This model is not vastly different from the Freedoms, but conceptualises welfare as being about four specific domains: nutrition, environment, health, and behaviour, which feed into the fifth domain, mental state. More recently, animal welfare thinking has recognised that these models focus more on the negative parts of animal welfare, and that animal welfare should extend to include positive states, with the goal of giving animals a good life (Yeates and Main, 2008; FAWC, 2009).

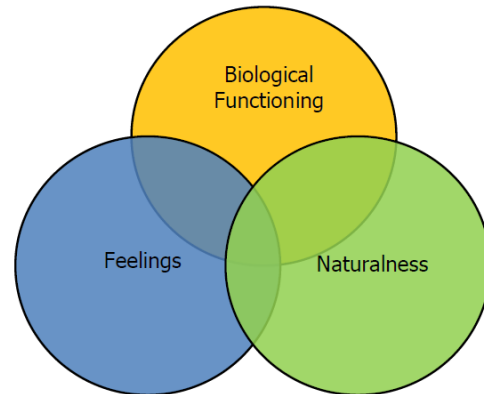


Figure 1. Representation of the three areas of welfare concern (after Fraser, 2008).

The Five Domains model has since been extended to include positive characteristics (Mellor and Beausoleil, 2015), and Webster (2016) suggests that freedom of opportunity could perhaps replace the freedom to express normal behaviour. Overall, however, there is broad agreement that animal welfare is about providing an animal with its nutritional, environmental, behavioural and social needs, whilst protecting it from pain, disease and injury. This is described most simply as addressing two questions: is it healthy and does it have what it wants (Dawkins, 2004).

3. Animal Welfare and Productivity

Much of the developments in livestock agriculture since the 1940s have been driven by a need to increase productivity. These have involved greater confinement, improvements in nutritional knowledge, genetic selection for productivity traits and improved health care, among others. The relationship between animal welfare and productivity has been theorised to follow an inverted U-curve (McInerney, 2004), where initial activities cause an increase in both productivity and welfare state, before drives to increase productivity will reduce animal welfare (Figure 2). Deciding where on this curve might be an appropriate place to balance desired productivity gains with societally determined acceptable welfare state is an ethical decision for different societies.

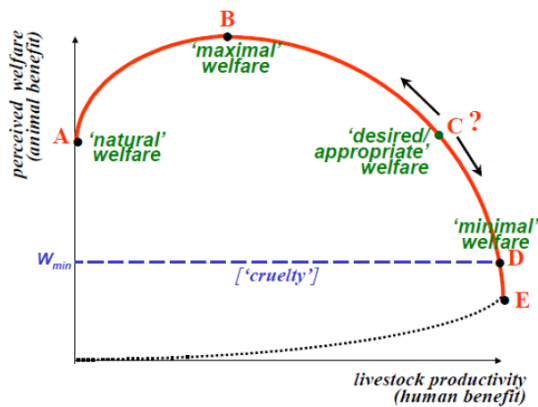


Figure 2. Theoretical representation of the relationship between welfare and livestock productivity (after McNerney, 2004).

For many Low and Middle Income Countries (LMICs), productivity is still very low and livestock may be located somewhere between A (the welfare state of wild animals) and B (the maximal welfare state). For these areas improving animal nutrition, providing better health care and hygiene practices and a better understanding of animal needs can promote both improved welfare and improved productivity. In these regions, where also the greatest food insecurity occurs, improving animal welfare will be associated with improved productivity and improved human wellbeing. For higher income Western societies, livestock agriculture is much more industrialised, with increasing confinement, often at high stocking densities, and the use of highly managed breeding strategies for narrow breeding goals. This is coupled with high inputs to ensure vaccination schedules, prophylactic treatments, nutritional precision and management complexity. Some of these impacts are of mutual livestock and human benefit (for example, improved nutrition and health care) but many others are neutral or detrimental for animal welfare (for example, loss of ability to express motivated behaviours, frequent social conflict, pain associated with the consequences of breeding for productivity or management activities, loss of choice or opportunity for agency). This suggests a conflict between improving productivity and animal welfare.

However, the impact on the animal in these production systems has also been shown to impact on livestock productivity, suggesting that the theoretical relationship shown in Figure 2 may start to breakdown, or at least impact on profitability as increasing inputs are needed to manage these highly complex systems. For example, a consequence of the selection and confinement of dairy cattle for high productivity has been escalating levels of lameness – studies in UK suggest lameness can be as high as 19-30% (Rutherford et al., 2009; Vee Randall et al., 2019). Management actions to reduce lameness, such as improved hoof care, access to pasture and reducing stocking density, appear to be at the expense of

profitability. However, the pain associated with chronic lameness impacts on milk yield, and the financial benefits of increased milk production in animals that have lower lameness can offset any costs in providing better welfare (Barnes et al., 2011). In commercial pig production, confinement of the farrowing sow in a crate is designed to reduce piglet losses from crushing and to make management routines simpler and quicker. However, these levels of extreme confinement prevent the sow from showing highly motivated nest-building behaviour before birth and cause behavioural and physiological indicators of frustration (Jarvis et al., 1997). In addition, the maternal care of the sow is impaired and she is more likely to show aberrant maternal care, such as snapping at piglets and savaging, than sows given the opportunity to express nest-building behaviour (Jarvis et al., 2004). The development of a designed farrowing system, which allows the sow to show evolved and important behaviours, but still affords the piglets some protection, has been shown to have similar piglet survival are confined systems, and greater growth rates to weaning as the sow is more likely to allow the piglets to suckle (Baxter et al., 2015). The improvements in productivity can offset the financial costs of allowing the sow more space at farrowing. These examples demonstrate that productivity does not need to be impaired by improvements in animal welfare, and profitability can be enhanced in higher welfare systems. For LMICs there are considerable opportunities for improvements in animal welfare that will also achieve improved productivity and these ‘win-win’ situations should be pursued. For more industrialised countries the consequences of achieving higher and higher productivity are now associated with negative impacts on the animals in these systems, and increasing industrialised animal productivity is also associated with considerable societal concern. This has led to an increase in vegetarianism, and particularly veganism, in these countries, and campaigns to encourage a reduction in meat consumption and greater ethical thinking around animal-based food products (#lessandbetter for example). Whether the pursuit of ever-increasing productivity is sustainable is also an issue, which I will now address.

4. Animal Welfare and Sustainability

The examples given above have shown how increasing intensification in a drive for ever greater productivity can sometimes lead to decreases in productivity when animal welfare is compromised. In addition, these systems often require increasingly sophisticated inputs, for example higher quality nutrition to sustain milk production or growth in highly selected animals, provision of antibiotics to prevent disease outbreaks in animal populations kept at high stocking density. If these also lead to food that consumers increasingly do not want to eat then this is not a sustainable food production model. In addition, with pressure to reduce antibiotic use to tackle increasing levels of antimicrobial resistance, the inputs required to sustain

production in these systems will need to be reduced. This may lead to reductions in productivity, if animal disease increases, and poorer animal health. However, studies have shown that improving animal welfare may promote better immune function that can decrease the need for antibiotic use. For example, providing enrichment (such as opportunities to play and explore) to growing pigs was associated with an improved clearance of PRSSV RNA in blood, and less histological signs of pneumonia in the lungs (van Dixhoorn et al., 2016).

The production of ruminant livestock, particularly cattle, are often seen as unsustainable as cattle are significant producers of environmental methane, for example 37% of anthropogenic methane is produced by livestock direct emission and manure (Knapp et al., 2014). For this reason, reducing consumption of red meat, and increased consumption of pig and poultry products, are often advocated. However, these are produced in the most confined systems, and where the greatest animal welfare concerns are seen (for example, tail biting in pigs, feather pecking in laying hens, lameness and mobility issues in broilers, hunger in the parent stock in both species etc. D'Eath et al., 2014; D'Eath et al., 2009; Knowles et al., 2008; Nicol et al., 1999). These systems are also greater users of antibiotics than ruminant production (van Boeckel et al., 2015), and in some countries, require the import of plant proteins, such as soya. As described above, these animals are thus fed on foodstuffs that could be consumed directly by humans, compared to ruminants that can utilise plant products that are indigestible by humans, to convert these to proteins that can form human food.

In tackling the requirements to feed an increasing global population in a sustainable way, four types of future food production models have been proposed (Figure 3, Garnett, 2015). Two possibilities directly exclude meat from livestock – suggesting either a very significant increase in veganism such that few animals are kept for human food production, or technological solutions such as the use of alternative meat resources such as in vitro meat production (Hocquette, 2018) or far greater consumption of insect-derived proteins. The other two solutions consider meat of livestock origin is still important as a human protein source. These suggest either a technological solution of increasing confinement and intensification (e.g. use of stacking systems in pig production; Driessen & Korthals, 2012), or a behaviourally driven solution of consuming less meat with this derived from the 'left-overs' or the marginal lands which cannot be farmed for other products. In reality it is likely that no one solution would be universally adopted, and a combination of all options might be the future of food production. However, the impact on animal welfare for these different scenarios is markedly different. For the meat-excluding scenarios the animal welfare impact may be positive, negative or neutral depending on future uses, or not, of animals – for example as environmental managers. For the meat including scenarios, the increasingly intensive

production systems are likely to be detrimental to animal welfare, and, as argued above, may in fact require higher and higher inputs such that they are no longer sustainable. Linked to this may be the acceptability for many in society for meat produced in this way, which might make these forms of agriculture unprofitable in the longer term. The 'livestock on leftovers' model may lead to improvements in animal welfare, particularly if management could be designed to combine good welfare and productivity (for example, driving towards B in Figure 2).

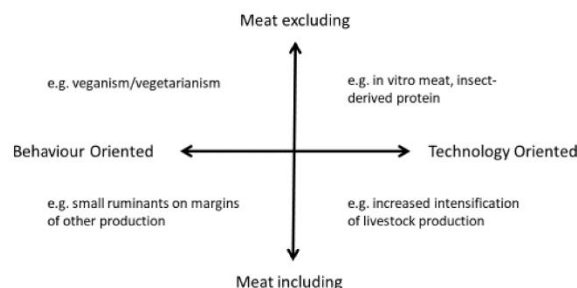


Figure 3. Potential options for food production systems (after Garnett, 2015).

5. Conclusions

Economic models of productivity suggest that animal welfare can be improved by the same drivers that lead to improved productivity when production is relatively low, but that welfare will start to decline as productivity increases. However, there are many examples that suggest that a decline in welfare can also limit productivity in very intensive systems. This, coupled with the potentially unsustainably high inputs that are required in these systems, suggest that improving animal welfare is the only viable solution to sustaining livestock productivity in a future food production scenario. I suggest, therefore, that animal welfare cannot be considered as an expensive and expendable luxury, but must be an integral part of livestock production policy and a key driver in achieving global food security.

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Conflict of interest

The author declare that there is no conflict of interest.

References

- AWA. 2006. Animal welfare act. <https://www.legislation.gov.uk/ukpga/2006/45/contents>.
- Barnes AP, Rutherford KMD, Langford FM, Haskell MJ. 2011. The effects of lameness prevention on technical efficiency at the dairy farm level: An adjusted data envelopment analysis approach. *J Dairy Sci*, 94: 5449-5457.

- Baxter EM, Adeleye OO, Jack M, Farish M, Ison SH, Edwards SA. 2015. Achieving optimum farrowing performance in a loose-housed system for sows: the effects of space and temperature. *Applied Anim Behav Sci*, 169: 9-16.
- D'Eath RB, Arnott G, Turner SM, Jensen T, Lahrmann HP, Busch ME, Niemi JK, Lawrence AB, Sandøe P. 2014. Injurious tail biting in pigs: how can it be controlled in existing systems without tail docking? *Animal*, 8(9): 1479-1497.
- D'Eath RB, Tolkamp BJ, Kyriazakis I, Lawrence AB. 2009. 'Freedom from hunger' and preventing obesity: the animal welfare implications of reducing feed quantity or quality. *Anim Behav*, 77: 275-288.
- Dawkins MJ. 2004. Using behaviour to assess animal welfare. *Anim Welfare*, 13: 3-7.
- Driessen C, Korthals M. 2012. Pig towers and in vitro meat: Disclosing moral worlds by design. *Soc Stud Sci*, 42: 797-820.
- Farm Animal Welfare Council (FAWC). 2009. Farm animal welfare in Great Britain: Past, present and future. https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/319292/Farm_Animal_Welfare_in_Great_Britain_-_Past_Present_and_Future.pdf.
- Foresight Report. 2011. The future of food and farming: Challenges and choices for Global sustainability. <https://www.foresight4food.net/2018/02/14/the-future-of-food-and-farming-challenges-and-choices-for-global-sustainability/>.
- Fraser D. 2008. Understanding animal welfare. *Acta Vet Scand*, 50(1): S1.
- Garnett T. 2015. Three perspectives on sustainable food security: efficiency, demand restraint, food system transformation. What role for life cycle assessment? *J Clean Prod*, 73: 10-18.
- Hocquette JF. 2018. In vitro meat the solution for the future? *Meat Science*, 120: 167-176.
- Jarvis S, Lawrence AB, McLean KA, Deans LA, Chirnside J, Calvert SK. 1997. The effect of environment on behavioural activity, ACTH, beta-endorphin and cortisol in pre-farrowing gilts. *Anim Sci*, 65: 465-472.
- Jarvis S, Reed BT, Lawrence AB, Calvert SK, Stephenson J. 2004. Peri-natal environmental effects on maternal behaviour, pituitary and adrenal activation and the progress of parturition in the primiparous sow. *Anim Welf*, 13: 171-181.
- Knapp JR, Laur GL, Vadas PA, Weiss WP, Tricario JM. 2014. Invited review: Enteric methane in dairy cattle production: Quantifying the opportunities and impact of reducing emissions. *J Dairy Sci*, 97: 3231-3261.
- Knowles TG, Kestin SC, Haslam SM, Brown SN, Green LE, Butterworth A, et al. 2008. Leg disorders in broiler chickens: Prevalence, risk factors and prevention. *PLoS ONE*, 3(2): e1545.
- McNerney J. 2004. Animal Welfare, Economics and Food. Defra report <http://statistics.defra.gov.uk/esg/reports/animalwelfare.pdf>.
- Mellor DJ, Beausoleil NJ. 2015. Extending the 'Five Domains' model for animal welfare assessment to incorporate positive welfare states. *Animal Welfare*, 24: 241-253.
- Mellor DJ, Patterson-Kane E, Stafford KJ. 2009. The Sciences of Animal Welfare. Wiley-Blackwell, Oxford.
- Nicol CJ, Gregory NG, Knowles TG, Parkman ID, Wilkins LJ. 1999. Differential effects of increased stocking density, mediated by increased flock size, on feather pecking and aggression in laying hens. *Applied Anim Behav Sci*, 65: 137-152.
- Rutherford KMD, Langford FM, Jack MC, Sherwood L, Lawrence AB, Haskell MJ. 2009. Lameness prevalence and risk factors in organic and non-organic dairy herds in the United Kingdom. *Vet J*, 180: 95-105.
- Van Boeckel TP, Brower C, Gilbert M, Grenfell BT, Levin SA, Robinson TP, Teillant A, Laxminarayan R. 2015. Global trends in antibiotic use in food animals. *Proceedings of the National Academy of Sciences*, 112: 5649-5654.
- van Dixhoorn IDE, Reimert I, Middelkoop J, Bolhuis JE, Wisselink HJ, Groot Koerkamp PWG, Kemp B, Stockhofe-Zurweiden N. 2016. Enriched housing reduces disease susceptibility to coinfection with Porcine Reproductive and Respiratory Virus (PRRSV) and *Actinobacillus pleuropneumoniae* in young pigs. *PLoS ONE*, 11: e0161832.
- Vee Randall L, Thomas HJ, Remnant JG, Bollard NJ, Huxley JN. 2019. Lameness prevalence in a random sample of UK dairy herds. *Vet Record*, 184(11): 350.
- Webster J. 2016. Animal Welfare: Freedoms, Dominions and "A Life Worth Living". *Animals*, 6(6): 35.
- Yeates JW, Main DCJ. 2008. Assessment of positive welfare: A review. *Vet J*, 175: 293-300.