

A pilot investigation of possible positive system descriptors in finishing pigs

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Abstract

In this study, pig producers were identified whose practices exceeded the basic legal requirements and government recommendations for pig welfare. This novel approach was part of a larger project investigating the feasibility and benefits of the inclusion of some animal-based welfare outcome measures into the main UK pig-farm assurance schemes. A set of pig-keeping-system descriptor scores were devised through consultation with stakeholders, whereby a finishing pig farm would be classified on a scale of 1 (legislation compliance) to 5 (highest level of welfare provision) for six different elements of pig husbandry which can influence pig welfare (environmental enrichment, foraging behaviour, thermal comfort, physical comfort, tail docking and floor space provision). Animal-based observations were used to assess the welfare of a sample of between 67 and 220 pigs on 15 UK finishing pig farms, which were also classified according to the system descriptors. Scores achieved when assessing the environmental enrichment and physical comfort elements were significantly positively correlated with a qualitative assessment of good mood of the pigs and a measure of their oral manipulation and significantly negatively correlated with the prevalence of tail lesions and swollen bursae. However, there were wide variations in the prevalence of animal-based welfare outcome measures between farms with the same system descriptor score. These system descriptors are therefore not sufficient to be used alone to provide assurances on welfare. It is suggested that a combined approach of system descriptors and animal-based welfare outcome measures may be useful for providing assurances on higher levels of welfare.

Keywords: animal welfare, farm assurance, farming system, husbandry, pig, welfare outcomes

Introduction

This study was part of a project examining the feasibility and benefits of including some welfare outcome assessments in UK pig-farm assurance (FA) schemes. Systems for assessing farm animal welfare to provide marketplace assurances have developed along different lines. Current UK pig-farm assurance standards are typically based on the legislative requirements and government recommendations for some of the factors that affect an animal's welfare, such as housing, feed and stocking density. However, it is less easy to define standards for other inputs, such as genetic make-up and stockmanship (ABP 2007; GQA 2007).

The 'Animal Needs Index' (ANI) (Bartussek 1999) is one system which aims to provide a means to regulate and promote the welfare of farm animals through providing a "simple, unequivocal and easily applicable" set of formal welfare assurance standards. It assesses the resources provided to animals in five categories: the possibility of mobility, social contact, the condition of the flooring for lying, standing and walking, the ambient climate and the quality of the human care. Points are awarded for the level of resource provision within the species-specific criteria of each category and compensation can occur between criteria.

A different approach to farm assurance is to require farms to incorporate a Hazard Analysis and Critical Control Point (HACCP) approach to try to reduce the likelihood of problems arising. This system is proposed to ensure food safety in particular (Horchner *et al* 2006) but can also be part of a welfare assurance programme (Kyriakis *et al* 2000; Noordhuizen & Metz 2005; von Borell *et al* 2007). Importantly, there is an emphasis within the HACCP framework on identifying areas where the risk of a hazard, such as a welfare problem, can be reduced. This encourages gradual improvement in procedures to reduce the risk of hazards occurring.

There are increasing calls for the farm animal welfare assurances provided by FA schemes to be improved. A report analysing the most common UK FA schemes by the Compassion in World Farming Trust concluded that the schemes provided poor levels of welfare assurance, as they permitted intensive farming situations that contravened their own 15 resource-based key welfare determinants (Lymbery 2002). The UK Farm Animal Welfare Council (FAWC) also recognised the limitations of current welfare assurance systems. One suggestion they made to improve

the monitoring of farm animal welfare was the use of welfare outcome measures. They recommended that:

“scheme owners should... achieve an increasing inclusion of welfare outcomes, so as to provide both a better reflection of the welfare of the animals within a production system and the level of stockmanship on the farm” (FAWC 2005).

They also recommended that in relation to product information: “welfare labelling... should be based predominantly on welfare outcomes” (FAWC 2006).

A major initiative to develop welfare outcome measures suitable for quality assurance of farms was funded by the European Commission in response to European consumers’ commitment to animal welfare and their desire for good welfare labelling of products (Blokhuys 2007). The Welfare Quality® project has produced standards for assessing the welfare of cattle, pigs and poultry, and a product information system primarily based on welfare outcomes (Welfare Quality® consortium 2009a,b,c).

Whilst the main focus of the current project was to identify suitable welfare outcome measures for UK pig-farm assurance schemes, the stakeholder steering group of the project also considered it desirable to be able to identify, and potentially reward, those producers who farm at levels beyond the basic requirements. The Farm Animal Welfare Council has considered that British minimum legal standards should be set such that the animals experience “a life worth living” and it recognises that if producers go beyond these requirements the animals will be more likely to live “a good life” (FAWC 2009). Current UK pig-farm assurance standards incorporate a ‘housekeeping score’, where a farm may score at one of four different levels of general farm tidiness and order (ABP 2007; GQA 2007). This paper describes a similar approach for welfare-focused ‘pig-keeping scores’ and the pilot testing of this approach, including validation with some welfare-outcome measures, on UK finishing pig farms.

Materials and methods

Development of the welfare outcome measures and pig-keeping scores

The pig-keeping scores were developed by identifying the basic requirements of UK legislation (The Mutilations [Permitted Procedures] [England] Regulations 2007; The Welfare of Farmed Animals [England] Regulations 2007) and government welfare recommendations for those keeping pigs (Defra 2003) relating to six elements of pig husbandry that affect their welfare:

- environmental enrichment;
- floor space allowance;
- foraging behaviour;
- tail docking;
- physical comfort;
- thermal comfort.

These elements were not designed to be exhaustive when assessing pig welfare but rather to identify some areas of particular welfare or political relevance. Compliance with government codes of practice is not a legal requirement, however, if a farmer is prosecuted for a welfare offence their compliance or otherwise with the code of practice would be taken into consideration by the court (Defra 2003). Compliance with both the legislation and government codes of practice are requirements of current UK Farm Assurance schemes (ABP 2007; GQA 2007) and so three further possible levels that would identify producers whose practices exceed these requirements were added for each element and named ‘welfare+, welfare++ and welfare+++’ (see Table 1). In order to determine additional criteria that equated to higher levels of welfare, the concept of animal welfare was taken to primarily relate to the subjective experience of the pig, but also to include their physical fitness and integrity. The desire of the project stakeholder group to develop a system that could eventually reward producers for good management meant that it was appropriate to assess the actions of producers — ie the resource provided, linked wherever possible to a beneficial outcome for the pigs. Categorisation of each farm for the elements of the pig-keeping score started with a consideration of whether all pens examined on the farm complied with the stated legislation. A farm could only then be considered for the next category up if all pens assessed on the farm fulfilled the criteria required by the previous category.

Animal-based measures for assessing welfare were developed following formal consultations with pig farmers (Mullan *et al* 2010) and veterinary surgeons. Whilst the authors were stakeholders in the development of both the pig-keeping scores and the welfare outcome measures there was ongoing dialogue with other stakeholders from the pig industry, Farm Assurance schemes, certification bodies, veterinary surgeons and pig farmers to further refine the animal-based welfare outcome measures. Five ‘core’ welfare outcome measures were identified through this process:

- tail lesions;
- body lesions;
- lameness;
- manipulative oral behaviour;
- pigs requiring hospitalisation.

In addition, a qualitative behavioural assessment (QBA) and an assessment of dirtiness and swollen bursae were considered useful to assess pig welfare. A key requirement of the stakeholder group for the animal-based measures was that they should not duplicate measures conducted by other agents. For this reason, health and productivity measures that were presumed to be already under close observation by farmers and/or their veterinary surgeon were excluded. The welfare outcome measures were not chosen to specifically validate the pig-keeping scores.

Table 1 The number of farms achieving each score as their maximum for the six elements of the pig-keeping score (n = 15 farms).

	Definition of each category	Number of farms achieving each category as their maximum score
<i>Environmental enrichment</i>		
Score 1 (Compliant with legislation)	All pigs must have permanent access to a sufficient quantity of material (such as straw, hay, wood, sawdust, mushroom compost, peat) to enable proper investigation and manipulation activities	9* (manipulable object only)
Score 2 (Compliant with welfare code)	As above, but if this material is solely in the form of a toy or novel object then evidence must be provided that it is changed weekly	0
Score 3 (Welfare +)	A manipulable material available simultaneously to all pigs is provided to a depth of up to 1 cm or in a rack in addition to any toys available	0
Score 4 (Welfare ++)	A manipulable material available simultaneously to all pigs is provided to a depth of more than 1 cm in addition to any toys available	3
Score 5 (Welfare +++)	As above plus material or toy is replenished daily	3
<i>Tail docking</i>		
Score 1 (compliant with legislation)	Legislative requirements relating to tail docking only apply to breeding farms. All finishing pig farms start at assessment against score 2 requirements	
Score 2 (compliant with welfare code)	Evidence is provided to the breeding suppliers quantifying any tail biting and environmental and management improvements taken to reduce the problem	5+7**
Score 3 (Welfare +)	Some (any) pigs are not tail docked and long-tailed pigs have not received treatment or been culled in the last 3 months	3†
Score 4 (Welfare ++)	The majority (> 50%) of pigs are not tail docked and long-tailed pigs have not received treatment or been culled in the last 3 months	0
Score 5 (Welfare +++)	No pigs are tail docked and long-tailed pigs have not received treatment or been culled in the last 3 months	0‡
<i>Space</i>		
Score 1 (compliant with legislation)	All pigs have enough space to stand up, lie down and rest without difficulty and allow all animals to lie down at same time	11
Score 2 (compliant with welfare code)	As above but the pigs have access to a lying area, excluding the dunging and exercise areas, which is large enough to allow all pigs to lie on their sides simultaneously	3
Score 3 (Welfare +)	As above plus the lying area does not obstruct passageways between exercise, feeding and dunging areas	0
Score 4 (Welfare ++)	As above, plus the lying area required for all pigs to lie on their sides simultaneously is 2/3 to 1/2 of the total space allowance	1
Score 5 (Welfare +++)	As above plus the lying area is < 1/2 of the total space	0

On-farm assessments

The only criteria for selection of farms were that the study should contain some farms with straw and some farms without straw. On each farm, resource provision and welfare outcome data were collected from a number of pens containing growing (~35–60 kg live weight) or finishing pigs (~60 kg+) proportionate to the number of pigs in each housing type. These observations were undertaken by the same observer on all farms. The pens were chosen at random but the aim was to assess at least 100 pigs from at least five different pens on each farm, unless there were less than five pens in total on the farm, in which case multiple observations from these large pens were required. In order to assess each farm with respect to

the pig-keeping scores, input data collected on each pen related to the dimensions (total pen area, lying area as defined by the pen and also the area taken up by the pigs if they were lying); proportion of flooring that was slatted; feeding trough (length, individual places and presence of faecal material in the trough); manipulable substrate if present (type, depth and availability to all pigs); type of manipulable object if present; bedding (type, depth), wallow if present (material forming the basis of the wallow, cleanliness). In addition, the producer was asked to provide information about elements that could not be directly assessed (replenishment frequency of manipulable material, replacement interval of manipulable object, ventilation control, provision of cooling mechanisms, treatment

Table 1 cont

	Definition of each category	Number of farms achieving each category as their maximum score
<i>Thermal comfort</i>		
Score 1 (Compliant with legislation)	Accommodation allows each pig to maintain comfortable temperature and temperature within limits that do not cause harm. Outdoor systems where necessary and possible. Animals shall be given protection from adverse weather conditions	0
Score 2 (Compliant with welfare code)	Ventilation system designed to avoid draughts in pigs' living space and avoid wild fluctuations in temperature. If cooling methods are employed in hot weather there is always some dry living areas available, as a matter of choice. Outdoor systems should protect animals from sun in summer and wallows should be provided for breeding stock	14
Score 3 (Welfare +)	As above, but when temperatures exceed the upper limit stated in the welfare code, pigs have access to shade and either a non-faecal wallow, non-urine wet floor or sprinkler	1
Score 4 (Welfare ++)	As above, plus when temperatures are below the lower limit in the welfare code, bedding > 5 cm deep is provided	0
Score 5 (Welfare +++)	As above, plus when temperatures are below the lower limit in the welfare code, bedding > 10 cm deep is provided	0
<i>Foraging behaviour</i>		
Score 1 (compliant with legislation)	Wholesome food is fed to maintain pigs in good health as well as promoting a positive state of well-being	12
Score 2 (compliant with welfare code)	The welfare code does not detail anything further about foraging behaviour beyond the legislative requirements. Farms fulfilling score 1 (all farms) could progress to assessment against score 3 requirements	
Score 3 (Welfare +)	As above, plus a high fibre food (including straw) is available clean each day in addition to any concentrates	3
Score 4 (Welfare ++)	As above, plus a widely scattered food on a rootable substrate OR an additional food type is available weekly	0
Score 5 (Welfare +++)	As above, plus either the scattered food OR the additional food type is available daily	0
<i>Physical comfort</i>		
Score 1 (compliant with legislation)	Simultaneous access to a clean, comfortable and adequately drained lying space. When provided, bedding must be clean, dry and not harmful	0
Score 2 (compliant with welfare code)	The lying area is kept dry and the pen floor, including the dunging area, is drained effectively. Where bedding is provided it must be regularly topped up or changed. Outdoor systems should have bedding in arcs and huts	6
Score 3 (Welfare +)	The lying area required for all pigs to lie down at the same time on their sides is of solid construction	5
Score 4 (Welfare ++)	As above, plus bedding to a depth of < 10 cm	1
Score 5 (Welfare +++)	As above, plus bedding to a depth of > 10 cm	3

* Due to ambiguity in government guidance, all farms were able to progress to assessment against 'score 2'.

** Information was not provided on this but there were 5 breeder-finisher units which may be assumed to have a flow of information about tail biting between stages of production. The other 10 farms may or may not have reported tail lesions to their breeder supplier. All farms were allowed to progress to assessment against 'score 3'.

† An additional 5 farms had some long-tailed pigs but did not provide information about their tail outcomes.

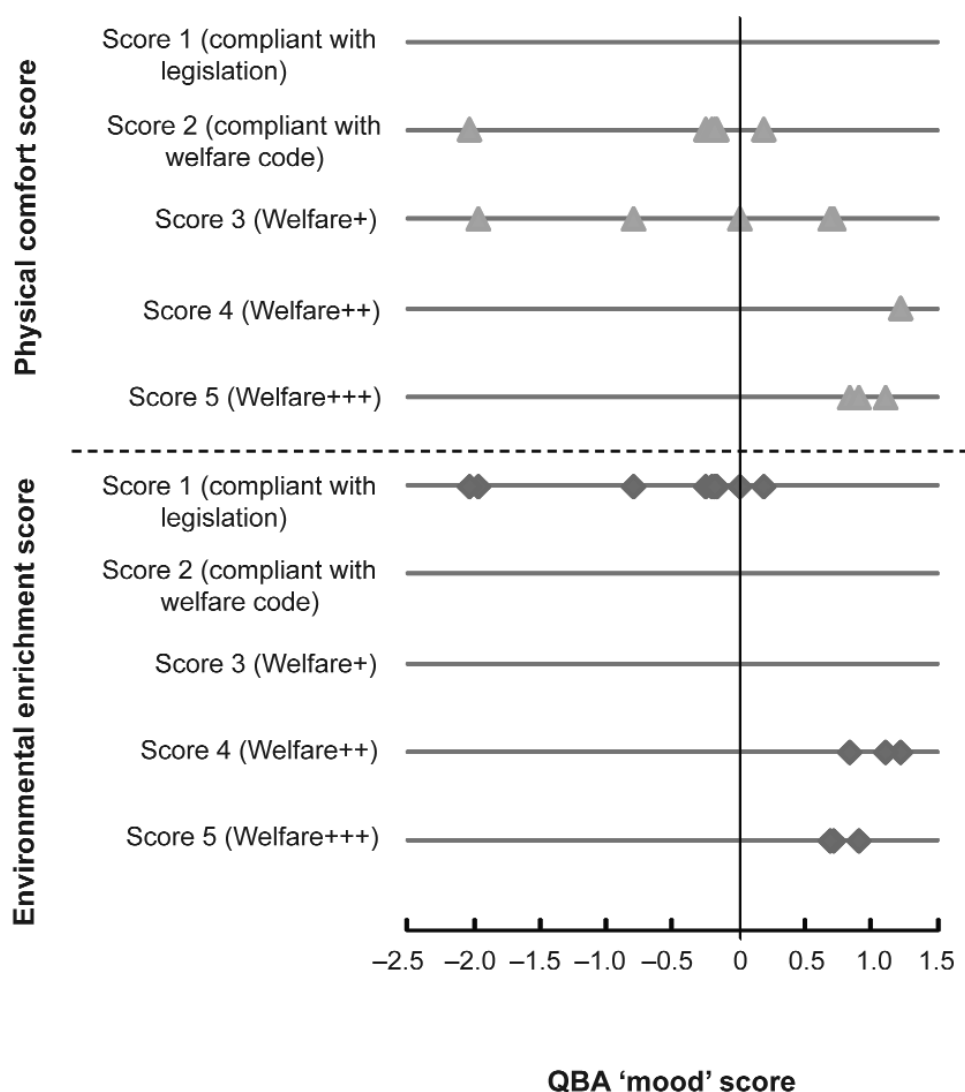
‡ One farm had 100% long-tailed pigs but did not provide information about their tail outcomes.

and/or culling of long-tailed pigs for tail biting over the previous 3 months, food types and feeding methods).

The number of pigs in the pen was recorded and, if the pen contained 20 or fewer pigs, all pigs were assessed. For pens containing more than 20 pigs, a total of 20 were assessed

in a systematic sampling strategy such as observing every fifth pig, or 5 pigs from 4 regions of the pen as appropriate. Each observed pig was assessed for presence or absence of dirtiness (one side of a pig was assessed for at least a hand-sized area of faecal material or diffuse soiling), body

Figure 1

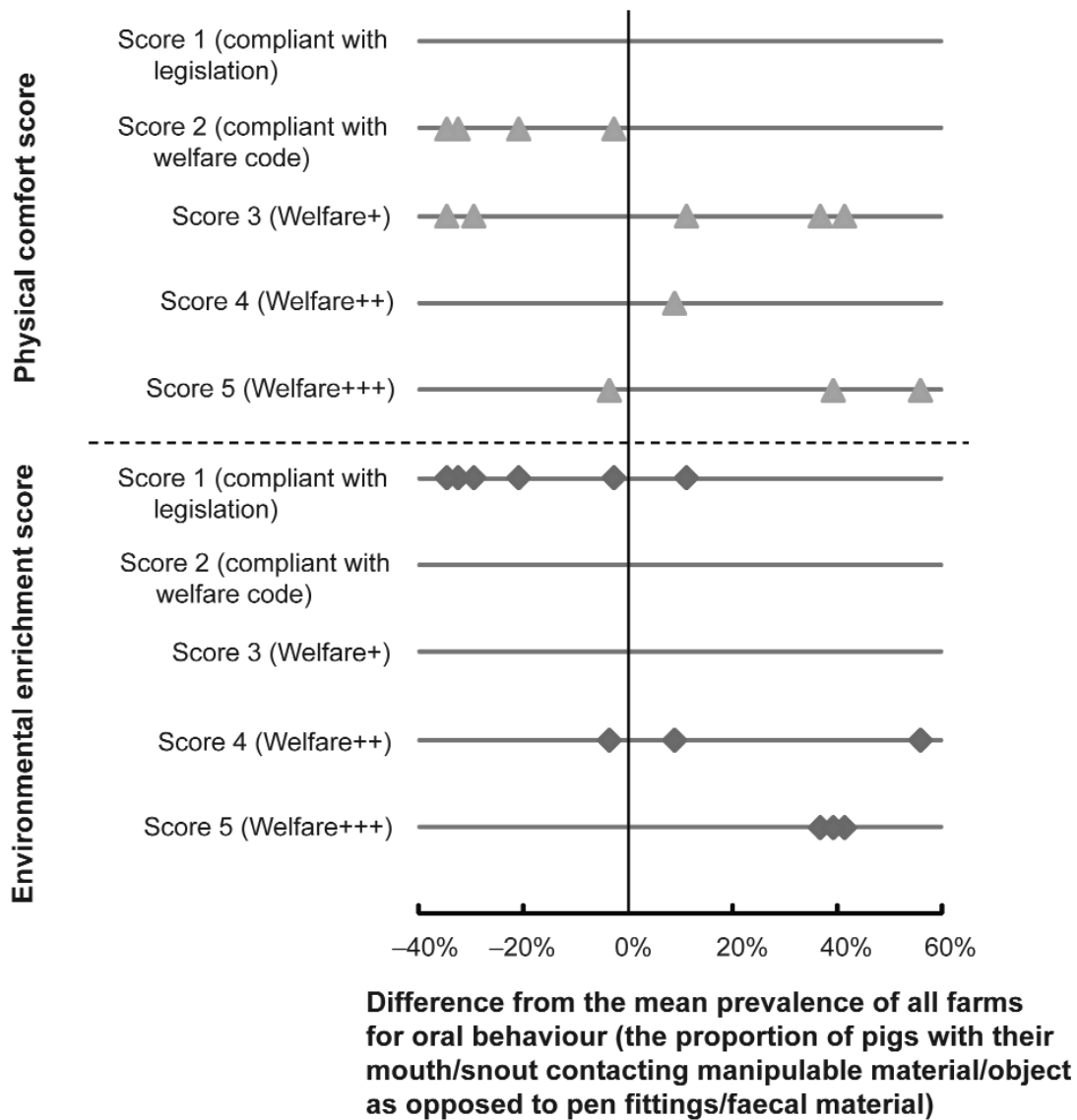


The QBA 'mood' score and the environmental enrichment and physical comfort element pig-keeping scores for 15 farms.

lesions (one side of a pig assessed for presence or absence of a > 3 cm linear skin wound or a > 1 cm diameter circular wound), tail lesions (presence or absence of a skin wound on any part of the tail) and swollen bursae (presence or absence of a walnut-sized swelling or ulceration on a limb on one side of the body). During these assessments, all pigs were encouraged to stand and move and the numbers of pigs with lameness score 3 or more (any pig that "when standing has at least an uneven posture, will not bear full weight on the affected limb and appears to be standing on its toes; when moving there is a shortened stride with minimum weight-bearing on the affected limb but will still trot and gallop" as per Main *et al* 2000) and pigs requiring hospitalisation (any sick or injured pigs that would benefit from being "temporarily isolated in suitable accommodation with dry comfortable bedding" (The Welfare of

Farmed Animals [England] Regulations 2007) in the pen were recorded. After a pen of pigs was scored for physical measures, a behavioural assessment was made. During a single-scan sample of standing and sitting pigs in each pen, the numbers of pigs with their mouth/snout in contact with: (i) a manipulable material (eg straw) or object (eg a chain), or (ii) with pen fittings or faecal material were recorded. During the course of the inspection visit, a qualitative behavioural assessment (QBA) of pigs was carried out according to the protocol described by Wemelsfelder and Millard (2009). In this regard, observations of how pigs behaved were made for a total of 20 min divided between up to 8 observation points around the farm. After the final observation, a mark was made on each visual analogue scale (VAS) corresponding to 20 adjectives such as 'active', 'playful', 'calm' and 'tense'.

Figure 2



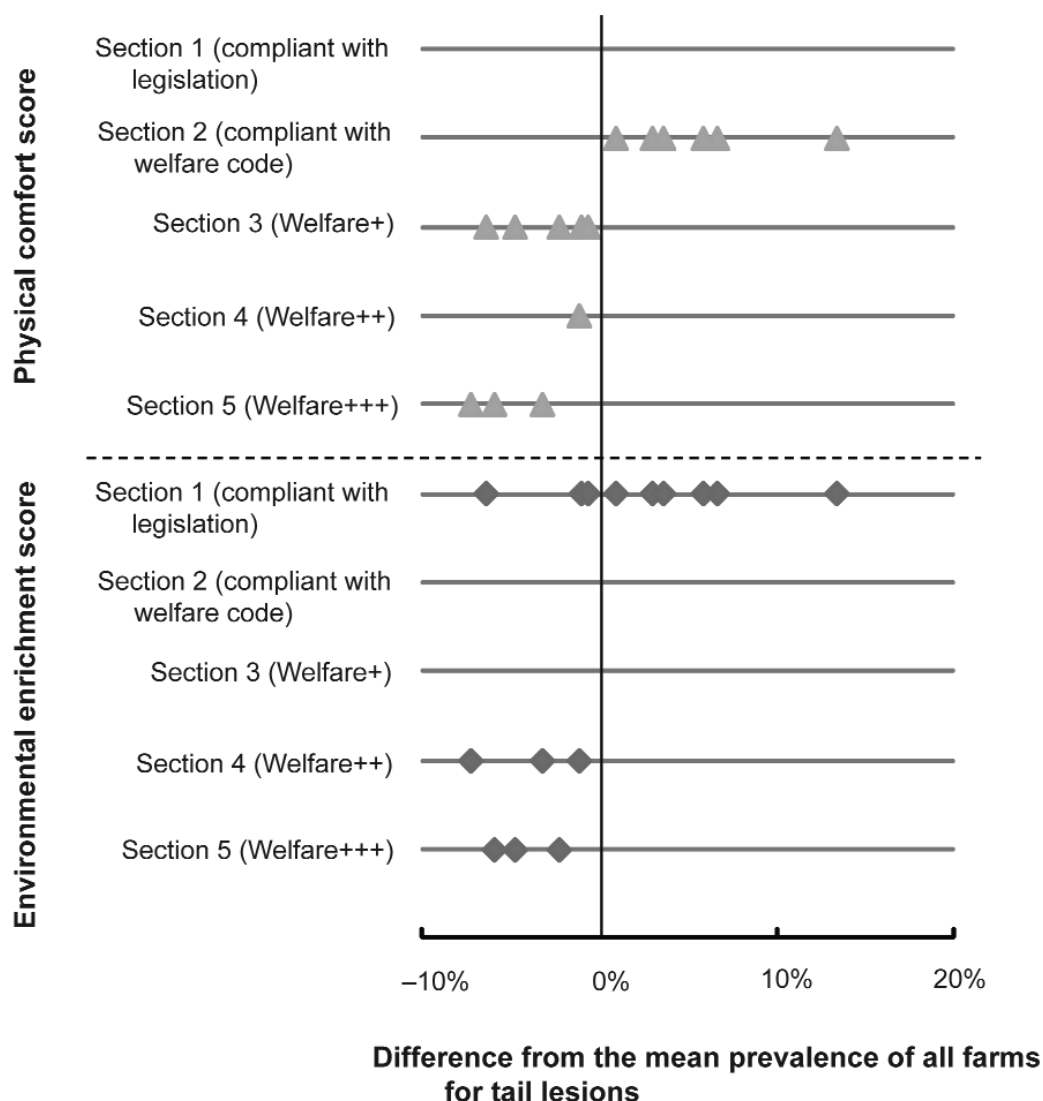
The oral behaviour (proportion of pigs with their mouth/snout contacting manipulable material/object as opposed to pen fittings/faecal material) and the environmental enrichment and physical comfort element pig-keeping scores for 15 farms.

Data analysis

Data were analysed using SPSS version 14. An ‘oral manipulation index’ was calculated as the proportion of pigs contacting a manipulable material/object out of the total number of pigs contacting either a manipulable material/object or pen fittings/faecal material. Analysis of the pig-keeping scores used the score for each farm corresponding to the highest category that they fulfilled for each element, ranging from meeting legislative requirements only (score 1) through to the highest welfare level (score 5). Spearman’s rank correlation coefficients between the pig-keeping scores and welfare outcome measures for each farm were identified.

The ‘space’ element was assessed using a calculation of the space requirements specified in the legislation (The Welfare of Farmed Animals [England] Regulations 2007) or for a pig to lie down on its side ($0.047 \times \text{liveweight}^{0.67}$, as per English *et al* 1988). The calculations were made based on an average weight of a ‘grower’ or ‘finisher’ pig in the building under evaluation. The VAS scores of the 20 adjectives of the QBA were analysed using a Principal Component Analysis without rotation. The first component, termed ‘mood’, was used for further analysis. It explained 55% of the variance and its highest loading adjectives were ‘sociable’ (0.959), ‘happy’ (0.947) and ‘positively occupied’ (0.914). There were no adjectives with negative loadings.

Figure 3



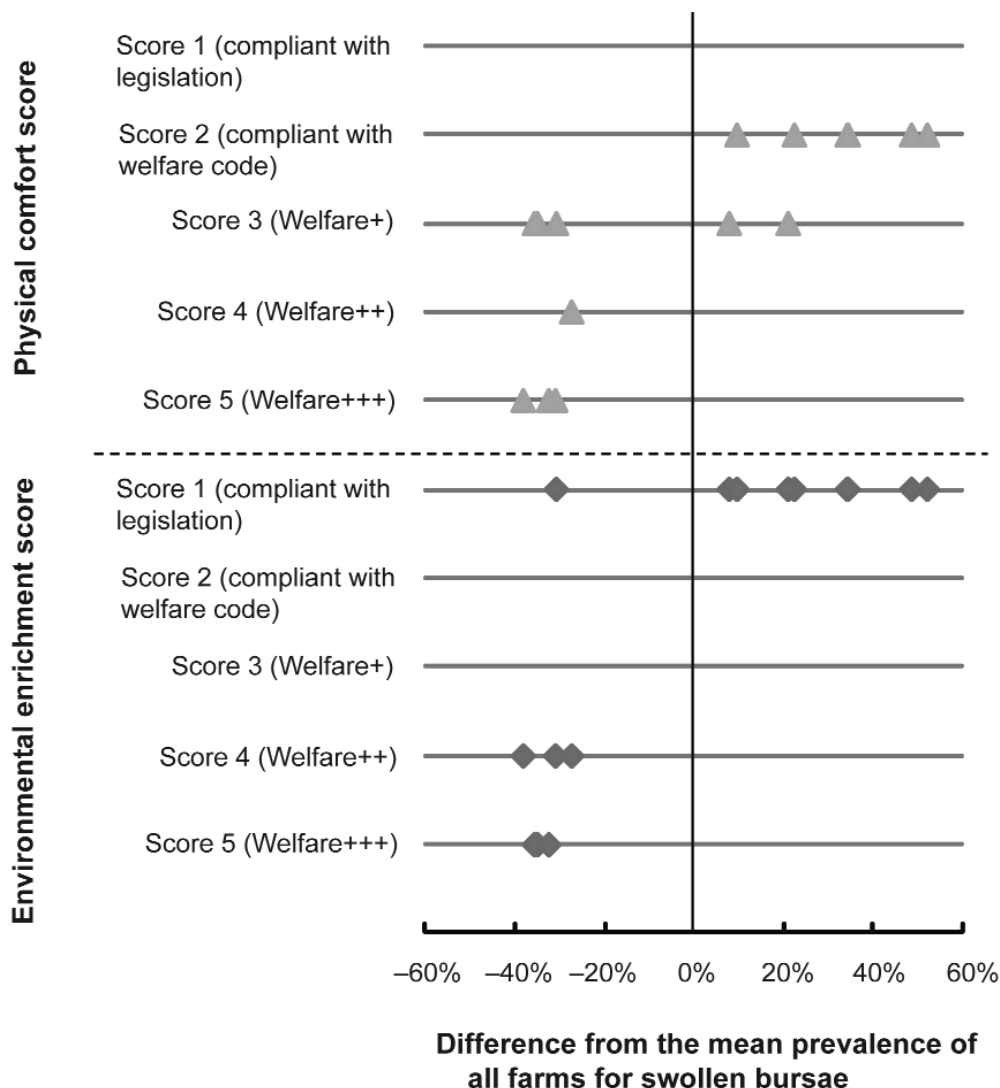
The prevalence of tail lesions and the environmental enrichment and physical comfort element pig-keeping scores for 15 farms.

Results

Fifteen farm-assured finishing farms were visited between April and December 2008. The farms ranged from 950 to 6,500 growing and finishing pigs and five farms were attached to a breeding unit. The total number of pigs assessed was 2,194 from 128 pens and on each farm the number of pigs assessed ranged from 67 to 220 from between 3 and 15 pens. The number of farms achieving each level of the pig-keeping scores as their maximum is shown in Table 1. All farms complied with the legislation for all the husbandry elements where applicable except possibly environmental enrichment (see *Discussion*). All elements had at least one farm that achieved a score 3 but the highest level, score 5, was only achieved by some farms for environmental enrichment and physical comfort.

Fourteen farms had pigs with docked tails, usually two-thirds of the tail was removed, and on 12 farms > 90% of the pigs observed were tail docked. The prevalence range between farms was largest for the prevalence of dirty pigs (16–92%, mean 49%), pigs with body lesions (40–96%, mean 72%) and pigs with swollen bursae (1–91%, mean 39%). The prevalence of pigs with tail lesions ranged between 1.7 and 22.4% with a mean of 9%. The prevalence of lame pigs in the observed pens and of pigs which required hospitalisation were low (range 0–5.7%, mean 1.5% and 0–4.2%, mean 1.3%, respectively). The oral manipulation index varied from 0% (3 farms) to 91% (mean 35%). The small number of farms and the small sample of pigs on each farm mean that these data do not necessarily reflect national industry prevalence.

Figure 4



The prevalence of swollen bursae and the environmental enrichment and physical element pig-keeping scores for 15 farms.

Correlations between measures

The relationship between the score achieved by the pilot farms for each element of the pig-keeping scores (apart from ‘tail docking’ due to insufficiently robust data) and the welfare outcome prevalence and scores for each farm were analysed. There were no significant correlations between any of the welfare outcome measures and the space, thermal comfort or foraging behaviour elements of the pig-keeping scores. The only significant correlations were for the scores achieved for the environmental enrichment and physical comfort elements. These were both significantly positively correlated with the QBA ‘mood’ component ($r_s = 0.781, P = 0.001$ and $r_s = 0.695, P = 0.004$, respectively) (see Figure 1) and the oral manipulation index ($r_s = 0.771, P = 0.001$ and $r_s = 0.625, P = 0.017$, respectively) (see Figure 2). They were significantly negatively correlated

with the prevalence of tail lesions ($r_s = -0.659, P = 0.008$ and $r_s = -0.850, P < 0.001$) (see Figure 3) and swollen bursae ($r_s = -0.807, P < 0.001$ and $r_s = 0.625, P = 0.017$, respectively) (see Figure 4).

Discussion

This study investigated the use of a novel scoring system for providing welfare assurance to the marketplace and aimed to validate this approach through comparisons with welfare outcome measures on finishing pig farms. The farms assessed represent a range of indoor finishing systems in the UK. These included farms with small and large group and pen sizes, a variety of floor types and ventilation systems, pens with or without manipulable material of various depths and wet and dry feeding systems. The farms volunteered for the study and it may be that these are the better farms, even within the Farm Assurance schemes.

This pilot study looked at a small sample of fifteen finishing-pig farms. These farms were not selected to provide a representative sample of the national pig industry and therefore the results do not represent the national prevalence of management practices and welfare outcome measures. All the welfare outcome measures showed a good range across this sample of farms. In particular, body lesions, oral behaviour, dirtiness and the QBA mood component had wide ranges which could potentially allow easy differentiation between farms. The small number of farms in total, small range in some prevalence measures, and lack of range of pig-keeping scores achieved by farms for some elements limited the potential for significant correlations. The welfare outcome measures were not chosen to specifically validate the pig-keeping scores but rather to reflect areas that were considered generally important to pig welfare by the project stakeholder steering group. Therefore, some elements of the pig-keeping scores, for example thermal comfort, were not validated against their most relevant welfare outcome measure. In addition, the small sample size on each farm, especially for measures with a low prevalence, such as lameness, may result in large confidence intervals for the measure when using it to estimate overall prevalence on a farm (Mullan *et al* 2009). These data cannot therefore be extrapolated to estimate national industry prevalences for welfare outcome measures.

The data collected on each pen were used to classify each farm with respect to whether it met the legislation, welfare code or additional welfare requirements for six pig-keeping elements. There were some difficulties in interpreting these data for the ‘environmental enrichment’ and ‘tail-docking’ elements. There is an apparent discrepancy between the UK legislation and welfare code requirements for environmental enrichment. The legislation states that:

To enable proper investigation and manipulation activities, all pigs must have permanent access to a sufficient quantity of material such as straw, hay, wood, sawdust, mushroom compost, peat or a mixture of such which does not adversely affect the health of the animals (The Welfare of Farmed Animals [England] Regulations 2007).

The welfare code (Defra 2003) goes on to explain that “environmental enrichment provides pigs with the opportunity to root, investigate, chew and play” and that “straw is an excellent material for environmental enrichment as it can satisfy many of the pigs’ behavioural and physical needs”. Interpretation of the legislation appears to imply that a manipulable object alone would be unsatisfactory however the guidance given by the code about the use of objects appears to weaken this by stating that:

Objects such as footballs and chains can satisfy some of the pigs’ behavioural needs, but can quickly lose their novelty factor. The long-term use of such items is not, therefore, recommended unless they are used in conjunction with materials such as those listed above, or are changed on a weekly basis (Defra 2003).

In order to interpret this in the pig-keeping score, all farms which provided a manipulable object alone were noted and then allowed to progress to check their compliance with the

welfare code as regards the changing of these objects weekly. Of the nine farms that only provided a manipulable object, none stated that they did this.

Another element of the pig-keeping score that was difficult to interpret was the requirement relating to ‘tail docking’. The legislation is clear that:

The procedure may only be carried out where measures to improve environmental conditions or management systems have first been taken to prevent tail-biting, but there is still evidence to show that injury to pigs’ tails by biting has occurred (The Mutilations [Permitted Procedures] [England] Regulations 2007).

It follows that for this to occur on breeding units there must be information provided by the finishing units about the occurrence of tail biting and management interventions to reduce it. The welfare code states that:

Routine tail docking is not permitted. Tail docking should only be used as a last resort, after improvements to the pigs’ environment and management have proved ineffectual (Defra 2003).

In addition, it describes how, in the case of a tail-biting outbreak, the problem must be quantified, possible causes identified and the health and welfare plan modified in the light of the results of any changes undertaken. Three out of the 15 farms were able to provide information about whether tail biting had occurred to any of the undocked pigs on their unit. It is not known whether this information was either not collected by the farmer or not provided for the study on the other farms.

Three farms achieved a score 3 for the ‘foraging’ element where fresh straw was provided daily which could be eaten by the pigs. These were both ‘straw-flow’ systems and deep-bedded systems which also scored at least a score 3 for ‘physical comfort’. However, the three farms that had deep bedding and were able to achieve score 5 for physical comfort did not also score a 3 for thermal comfort as there was no provision for cooling in all the pens. ‘Thermal comfort’ was an element where compliance with UK legislation and the welfare codes may not protect against potential substantial welfare compromise if pigs are exposed to heat stress. In Denmark, there is legislation requiring all new pig buildings to have sprinklers or other cooling mechanisms, to be rolled out to all pig buildings by 2015 (Danish Pig Production 2007). One farm had sprinklers in the pens for use in warm weather. Not all the farms were examined during warm weather and so it may have been possible for suitable wallows to be created in some pens. On one farm there was a clean wallow in two pens but this farm did not achieve a score 3 as this was not available in all pens. This was also true for other elements on other farms, eg space. It may be that the pig-keeping score could be applied to different stages of production or housing types or a refinement could involve only a proportion of the pens having to achieve a certain category.

The correlations between the ‘environmental enrichment’ and ‘physical comfort’ elements with the QBA ‘mood’ component and oral behaviour suggest that all of these are strongly linked to the provision of a manipulable material,

used as bedding, such as straw. One explanation for this is that observers are biased by the straw environment when conducting QBA and therefore the resource and welfare outcome measures are not independent. However, this is unlikely as Wemelsfelder and others (2009) have demonstrated that observers are minimally influenced by the environment of the animal undergoing QBA. Straw also has a protective effect on tail lesions and swollen bursae, in line with the negative correlations between these two elements and prevalence of tail lesions and bursae found in this study (Scott *et al* 2006).

It is not clear from this study whether it is more appropriate to use welfare outcome or resource measures for welfare assessment in Farm Assurance schemes. Given the time constraints of a Farm Assurance assessment, observations of both are probably required but it may be possible to replace some measures with others that are quicker to assess in order to improve the efficiency of the visit. Problems with interpretation of legislation could be overcome through clarification by legislators and using guidance notes for assessors. Another potential problem exists when relying on farmers to provide information about areas that cannot be assessed on the day. For example, health records or information about the provision of cooling mechanisms if the audit occurs on a cold day may either not be available or claims may be unverifiable. Reliance on these sources should be minimised wherever possible in order to provide an accurate assessment.

The concept of the pig-keeping scores created a large amount of discussion amongst some of the stakeholders. Firstly, the general principle of differentiation of farms above the current level of Farm Assurance may not be welcomed by all. Secondly, there was conflict between some of the practices that would score as positives in the pig-keeping score and other important considerations. For example, the practice of scatter feeding was considered a positive welfare initiative as it would usefully occupy pigs, but would conflict with veterinary advice for reducing *Salmonella* prevalence in pigs. Perhaps the most important disagreements arose out of the different emphasis on physical health, mental well-being and naturalness that stakeholders considered important for pig welfare (Bock & van Huik 2007). These difficulties need to be addressed through dialogue with stakeholders. In practice, the elements and the thresholds defining each score for each category could be specified by the Farm Assurance scheme under the principle that they were, as far as possible, scientifically valid and progressive. The principles encompassed in the development of this model for finishing pigs could also be extended to other species.

Animal welfare implications and conclusion

The pig-keeping scores could provide a mechanism for identifying farms that go beyond the legislative and welfare code requirements in current Farm Assurance standards. However, since welfare outcomes varied within the descriptors, using this score alone would provide insufficient assurances on welfare. However, for the elements of pig

husbandry covered, it may also improve the assessment of the extent to which farms comply with government guidelines as well as the legislation. Extended assessment of animal welfare during Farm Assurance audits may help to not only ensure that current standards are met but also, by providing further levels of welfare assurance, make it possible for producers to receive additional 'reward'. This could range from a risk-based reduction in scope or frequency of Farm Assurance assessment to a financial premium from customers, thereby encouraging improved welfare.

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