

Baseline report: 2013-2016
Measuring welfare outcomes in pigs

Real Welfare

Baseline report: 2013-2016

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Introduction

I have great pleasure in recommending this first Real Welfare Stakeholder's report to the Production Industry, the wider Food Industry, Policymakers and interested consumers.

The British pig industry has always taken a proactive approach to animal welfare improvement. The industry was an early adopter of Farm Assurance covering the life of the pig on farm, during transport and in the abattoir. The high frequency of inspection of health and welfare by veterinarians through the Red Tractor Scheme has provided reassurance to customers as the scheme has grown to cover 95% of production. In measuring welfare, farm assurance has evaluated inputs to a production system, and in recent years, there has been a growing awareness of the benefit of also assessing animal based outcome measures. The Real Welfare project gathers standardised information on a mix of 'iceberg indicators' of health and welfare to provide a pragmatic, evidence based approach to assess welfare from an animal's perspective.

These welfare outcome measures give a 'snapshot' of current and recent welfare related events, measurable through a mix of health indicators, lesions and behaviour recording. They provide an indication of the levels of stockmanship on farm, the outcome of social interactions (both positive and negative) between pigs and the use of pen enrichment.

Since the start of the scheme, over 5 million pigs have been assessed to provide a credible benchmarked level of welfare at an industry and individual farm level. No other pig industry in the world undertakes welfare outcome measurements to this degree, which demonstrates the commitment of the British pig industry to improving animal welfare.

The collection of these data has been funded by farmers, and would not have been possible without the support of the specialist veterinary community, who are the trained and trusted assessors on farm. The regular interface between veterinarian and client is the most important relationship to encourage positive health and welfare improvements, and the industry is grateful for their ongoing contribution. The British consumer has an enviable choice of purchasing options based on production systems. This scheme will provide them with further assurance of the high welfare standards across all systems on British farms and the industry drive for continual improvement.



Meryl Ward MBE
Chair
AHDB Pork

I am pleased to welcome the publication of the first Real Welfare report. A range of stakeholders take an interest in pig welfare and seek reassurance on the standard of animal welfare in food production.

This report is a positive industry initiative and one which will provide a practical way of monitoring changes and promoting welfare improvements over time, as well as supporting the industry in demonstrating welfare standards to consumers and retailers.

The scale of the Real Welfare assessment scheme is unique and the significant amount of baseline data generated will aid farmers' understanding of where to target their efforts to make welfare improvements. This includes the need to provide suitable environmental enrichment, to reduce the amount of tail docking and prevent tail biting. It is only with continued collaborative effort that farmers, the wider pig industry and veterinarians will be able to deliver welfare benefits for pigs and provide assurance of better welfare to the consumer.

Progress is essential to remain competitive. I hope measuring and monitoring welfare using the Real Welfare Scheme protocol will help the industry remain strong and contribute to continuing to raise the bar for animal welfare.

I would like to thank and congratulate everyone who has contributed to the Real Welfare Scheme and look forward to seeing the pig industry build on this in the future.



Nigel Gibbens CBE
Chief Veterinary Officer
for the UK

Overview

The British pig industry prides itself on being a leader in pig welfare. Group housing for pregnant sows has been a requirement in the UK since 1998 and surgical castration is not allowed by the major farm assurance schemes, which cover 95% of all commercially-raised pigs in England. Now the industry has another worldwide first in supporting its welfare commitments: Real Welfare.

The Real Welfare scheme is a unique, self-funded partnership approach between farmers and veterinarians. It was developed in response to the pig industry's need and desire for science-based evidence to show where its husbandry standards were strong and to identify opportunities for continuous improvement.

The Real Welfare scheme involves on-farm assessments of finisher pig welfare, using a set of five objective and repeatable measures. These measures are known as 'welfare outcomes', which are animal-based, meaning that they are obtained from observing the animals themselves, rather than from their environment and are thus irrespective of their husbandry environment. They are carried out on a representative sample of the finisher pigs. Assessments are carried out by veterinarians on a regular and systematic basis, allowing results to be comparable between farms and over time.

The British pig industry already takes pig welfare very seriously and there are existing industry standards requiring sick or injured pigs to receive prompt attention. Pens that exclusively hold sick or injured pigs ('hospital pens') are not included in Real Welfare assessments, as these pigs already receive extra attention. The Real Welfare assessments therefore report on welfare levels in the 'mainstream' finisher herd on farm and the outcomes provide an additional tool to inform the farmers' documented plans to safeguard pig welfare on their individual farm. On an industry level, put together, this is the largest database of its kind anywhere in the world and is truly unique. It provides evidence of welfare standards and a valuable source of information for future risk assessments to help drive further improvements in the industry.

Aims of Real Welfare

Farm

- Record indicators of pig welfare
- Monitor changes
- Help identify areas for welfare improvements

Industry

- Provide evidence of welfare standards
- Demonstrate standards to the consumer
- Drive continuous improvement

Five measures

Four measures are routinely assessed on pigs over 50 kg. The fifth measure is optional.

1. Hospital pigs
2. Lameness
3. Tail damage
4. Body marks
5. Environmental enrichment

Real Welfare is also used to collect information on other variables, such as feeding practice, pen variables and whether tails are docked or undocked.

Trained and trusted assessors

Real Welfare assessments are carried out by veterinary surgeons who are members of the Pig Veterinary Society. The assessments are usually carried out as part of the quarterly veterinary visits. As the veterinarian knows the unit, they can immediately give advice, where and when needed. Any agreed course of action is recorded in the farm's Veterinary Health Plan and becomes auditable by the Farm Assurance auditors.

How many pigs are assessed?

Real Welfare assessments take place between 2-4 times a year, depending on how the farm operates. A sample of pigs, from a range of pens is assessed on each visit. The total number assessed per year depends on how many finisher places a farm has. The smallest farms have a minimum of 300 pigs assessed each year; the largest at least 900.

Who gets assessed?

Real Welfare assessments are mandatory for all those who finish pigs under the Red Tractor Farm Assurance Pigs Standard. From August 2016 onwards, Real Welfare assessments were also required for those farms that finish pigs under the Quality Meat Scotland (QMS) Pigs Assurance Scheme, bringing its coverage to around 95% of all pigs produced in the UK.

Moving the industry forward

Real Welfare outcomes are reported back to the producers as a rolling total, combining all assessments from the previous 365 days. This means Real Welfare reports on the general welfare status and welfare management of finisher pigs on farm and means that variation between batches, for instance through disease or extreme weather, is evened out. Such fluctuations are inevitable and do not necessarily reflect the normal situation on that farm. This is why the rolling average is useful.

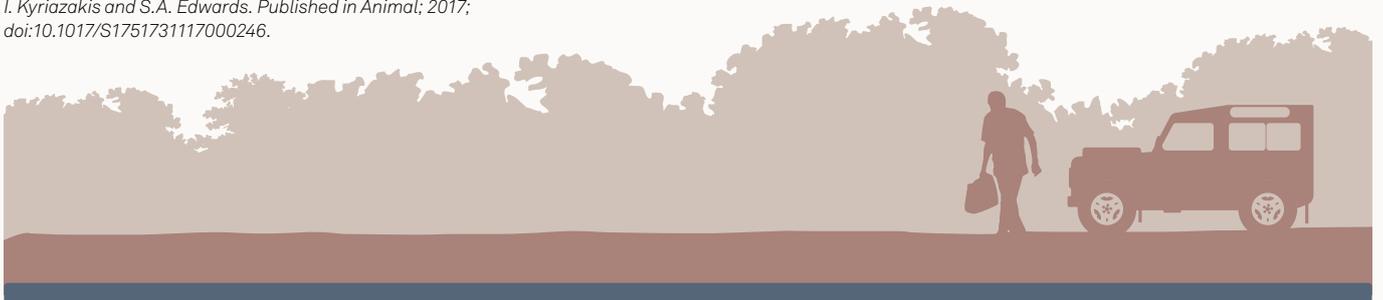
Assessment outcomes are discussed between the veterinarian and farmer, which enables individual opportunities for improvement to be identified and acted upon. Real Welfare also allows farmers to benchmark their welfare outcomes against their peers. This identification of relative performance enables greater understanding of the range of welfare outcomes from farm to farm.

Where there is scope for improvement, approaches to address the issue are discussed and agreed between the veterinarian and farmer and recorded in the farm's Veterinary Health Plan. Execution of these recommendations is audited annually. In this way, Real Welfare provides an in-built improvement method to help move the industry forward continuously.



The “Real Welfare” initiative is a unique national industry scheme, designed to benchmark welfare outcomes on finishing pig farms, promote welfare improvement and demonstrate good management.

Quote from peer-reviewed, scientific paper 'The Real Welfare Scheme: benchmarking welfare outcomes for commercially farmed pigs', by F. Pandolfi, K. Stoddart, N. Wainwright, I. Kyriazakis and S.A. Edwards. Published in Animal; 2017; doi:10.1017/S1751731117000246.

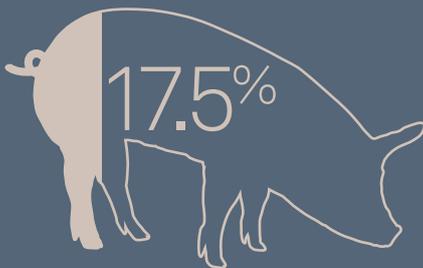


Vital statistics

5,463,348

pigs were assessed individually over the first three years of the scheme using the Real Welfare protocol.

This represents

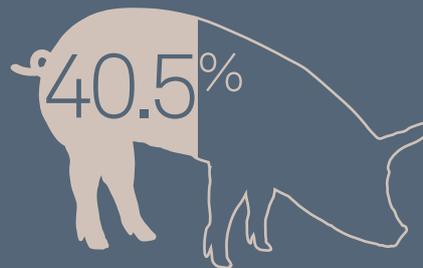


of all pigs slaughtered in England, Wales and Northern Ireland.

Covering all Red Tractor farms that raise pigs for slaughter. This equates to



of all commercially raised pigs in England, Wales and Northern Ireland.



of all pigs present on these farms on the day of the assessment were seen individually by veterinarians from

89

different vet practices.



Welfare outcomes

The following pages describe the welfare outcomes, as measured since the scheme's inception in 2013.

Since its introduction, the protocol has undergone a number of modifications to enhance its application and usefulness on farm. The project was piloted on commercial farms, but upscaling the project to include over 1,500 pig farms was not without its challenges. Thanks to the hard work of a group of dedicated stakeholders, especially members of the Real Welfare Steering group and the veterinary community, the Real Welfare assessment scheme has morphed into a scheme that is workable and useful on farm. Now in 2017, the scheme is accepted as a useful component of farm assurance.



Generating a large database will be a valuable source of information for future risk assessment investigations.

Quote from peer-reviewed, scientific paper 'The Real Welfare Scheme: benchmarking welfare outcomes for commercially farmed pigs', by F. Pandolfi, K. Stoddart, N. Wainwright, I. Kyriazakis and S.A. Edwards. Published in Animal; 2017; doi:10.1017/S1751731117000246.

While welfare outcome scores are reported back to producers, fulfilling the aim of helping support them on farm, a second aim is for Real Welfare to be used as a tool to publicly demonstrate the welfare commitments of the industry and drive continuous improvements.

This is the first report publicising the data and provides a baseline. It summarises assessment data from three assessment years (2013-2016) and therefore refers to all farms that finish pigs under Red Tractor Farm Assurance Pigs Standard. All farms that have had one or more assessment during that time are included. The data were analysed by statisticians and described in detail in a peer-reviewed scientific article in the academic journal 'Animal'[†], underlying the scientific and objective nature of the assessment scheme. This publication forms the origin of the figures in this baseline report and is where more in-depth information and background to figures can be found.

[†] *The Real Welfare Scheme: benchmarking welfare outcomes for commercially farmed pigs', by F. Pandolfi, K. Stoddart, N. Wainwright, I. Kyriazakis and S.A. Edwards. Published in Animal; 2017; doi:10.1017/S1751731117000246.*

1

Hospital pigs

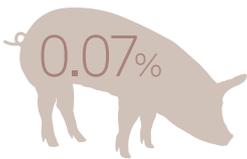
Scope:

This measure is assessed on all pigs in a representative number of pens, excluding those pens designated as 'hospital pens'.

Definition:

Any pig that would benefit from removal to hospital accommodation.

Of those pigs not already in hospital pens:



On average
7 out of 10,000
pigs needed hospitalisation



On more than 75% of farms
no pigs needed
hospitalisation



Trends

The percentage of pigs that benefited from being in a hospital pen, but weren't already, was significantly lower every year compared to the first year.



Seasonal variation

Summer and autumn saw fewer pigs in need of hospitalisation than spring.



Conclusion

The figures underline that farmers deal with sick or injured pigs appropriately.

What this measure highlights:

A sick or injured pig has compromised welfare, which good farmers will alleviate when necessary through treatment in a dry, comfortably bedded hospital pen or, if necessary, euthanasia.

At individual pig level, maintenance of good health is the fundamental requirement affecting the welfare of the pig.

A pig that requires hospitalisation, but which has not yet been transferred to a hospital pen, may be experiencing a poor welfare outcome, which could, and should be alleviated by the farmer taking appropriate action.

At herd level, the prevalence of pigs requiring hospitalisation within mainstream pens gives an indication of the stockman's management of these pigs. This measure is independent of disease prevalence – the proportion of pigs in the hospital pens does not form part of the Real Welfare assessments.

In production terms, sick and injured pigs take up time and cost money to treat. Pigs that are euthanised on farm generally cannot be sold for human consumption due to the strict legislation surrounding meat hygiene and welfare regulations. However, good management can prevent further production losses and improve recovery rates as well as improving staff morale.

2

Lameness

Scope:

This measure is assessed on all pigs in a representative number of pens, excluding those pens designated as 'hospital pens'.

Definition:

Any pig that when standing will not bear full weight on the affected limb and/or appears to be standing on its toes. When moving, there is a shortened stride with minimum or no weight-bearing on the affected limb and a swagger of the hind quarters. The pig may still be able to trot and gallop. This does not include pigs that are only showing stiffness or uneven gait.

What this measure highlights:

Lameness in any animal is usually a sign that they are in pain. It may be due to injury or infection in the foot or joints, or to longer term skeletal and joint problems such as osteochondrosis.

At individual pig level lameness affects an animal's welfare, as well as its performance and production.

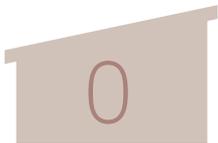
At herd level, if a significant percentage of pigs show severe lameness, this can be a sign of disease, poor floor maintenance, incorrect nutrition or poor overall welfare standards within the herd.

In terms of production, lame pigs have poorer weight gain.

When a pig is lame it does not automatically mean the animal needs to be moved to a hospital pen. It can in fact be beneficial to keep the pig in its stable group and monitor or treat it accordingly. However, if the lameness is of such a nature that the pig would benefit from being moved into a hospital pen, this pig would also be scored as a hospital pig.



On average
18 out of 10,000
non-hospitalised pigs were lame



On more than 75% of farms there were
no non-hospitalised
lame pigs



Trends

The percentage of lame pigs that weren't already in a hospital pen was significantly lower every year compared to the first year.



Seasonal variation

Like with pigs requiring hospitalisation, there were some seasonal influences, with fewer lame pigs in summer and autumn compared to spring.



Conclusion

The low levels of lame pigs shows that either levels of lameness on farms are low or that farmers deal well and promptly with lame pigs.

3

Tail damage

Scope:

This measure is assessed on a sample of pigs, in a representative number of pens, excluding those pens designated as 'hospital pens'. Recording of mild tail damage is optional (since November 2013).

Definition:

Severe tail damage

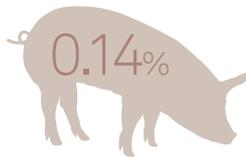
Recorded as severe if at least a proportion of the tail has been removed (by biting), tail is swollen or held oddly, scab covering whole tip. By definition, severe marks can never be obscured by dirt.

Mild tail damage

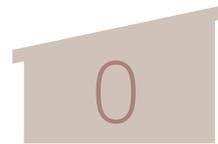
Scored as mild if there are any linear lesions extending 1cm or more eg scratches and scrapes, or if scabs or lesions greater than 0.5cm diameter are present or if swelling is visible on any part of the tail. Fresh blood and scabs contribute to lesion scoring, scarred tissue is not recorded. Also record dirtiness of animal around tail area if this affects ability to observe tail lesions.

2,952,561

non-hospitalised pigs were assessed for severe tail damage



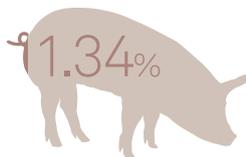
On average, 14 out of 10,000 pigs had severe tail damage



More than 75% of farms had no pigs with severe tail damage

768,456

non-hospitalised pigs were assessed for mild tail damage



134 out of 10,000 had visible tail damage



More than 50% of farms had no pigs with visible mild tail damage

24%

At least 24% of pigs had undocked tails

70%

70% of pigs had their tails docked

6%

The remaining 6% of pigs were kept in pens with mixed tail lengths

The number of pens holding pigs with undocked tails increased since the start of the Real Welfare scheme.



Trends

There was an increase in the percentage of assessed pigs with severe tail damage in 2014 and 2015, although there is some evidence that this increase is not sustained in 2016.



Seasonal variation

There was no obvious seasonal influence, though there was a tendency for fewer pigs with severe tail lesions in summer.

Collection of mild lesion scores was voluntary and there was a preference for collection of severe damage only. This was due to the balance between the time taken to collect this information and the perceived usefulness of this information. Collection of mild tail damage scores takes more time as tails need to be seen in more detail and lesions can easily be obscured by dirt. In contrast, severe damage is more easily seen and therefore this information can be collected quicker.

Tail biting outbreaks can be localised (ie only in one or some pens) and sporadic (at different time points), which makes it difficult to capture accurately in assessments on a random sample of pigs.



Conclusion

Pig farmers evidently deal with pigs with tail damage well. Although absolute levels are relatively low, the trends in the annual figures highlight that addressing tail damage must remain a priority for the industry. Being able to understand and address the underlying causes of this multifactorial issue requires a large data set to be able to untangle potentially influencing factors. For this the data collected as part of the Real Welfare plays an invaluable role.

What this measure highlights:

At an individual level, pigs sustaining mild damage to their tails appear not to be adversely affected at first instance, but those pigs whose tails have been injured or are severely damaged are likely to be.

Mild damage is likely to have minimal effect (although underlying bruising is common); severe damage causes pain.

At herd level, a high percentage of pigs with mild damage is considered to be evidence of restriction of opportunities to perform normal behaviour or increased risk of a clinical outbreak. A high percentage of pigs with severe damage can have a severe production and welfare impact.

In terms of production, tail injuries can lead to pathological changes which may be associated with reduced growth rate and full or partial carcass condemnation; production costs can be increased due to medication, staff time and reduced feed efficiency. In addition, there can be disruption to pig flow.

4

Body marks

Scope:

This measure is assessed on a sample of pigs, in a representative number of pens, excluding those pens designated as 'hospital pens'. Recording of mild body marks is optional (since November 2013)

Definition:

Severe body marks

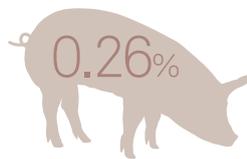
Record as severe if a mark is larger than 5x5cm diameter, if the mark extends into deeper layers of skin or if marks over a large percentage (>25%) of the skin.

Mild body marks

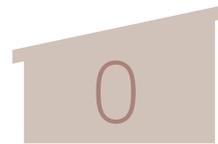
Record as mild if the mark is longer than 10cm, or if there are 3 or more 3cm marks or a circular area larger than 1cm diameter. Marks include raised, reddened areas, (likely to scab), grazed/broken skin, fresh (ie bleeding) wounds and healing lesions (scabs). Scar tissue does not count. Also record if animals within the sample have more than one hand-size piece of dirt on their side, making assessment of mild marks difficult. If a pig has both mild and severe body marks, it is recorded as severe only.

2,952,561

non-hospitalised pigs were assessed for severe body marks



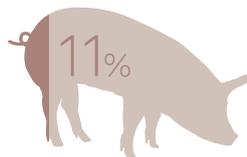
On average, 26 out of 10,000 pigs had severe body marks



More than 75% of farms had no pigs with severe body marks

748,232

non-hospitalised pigs were assessed for mild body marks



On average, 11 out of 100 pigs had mild body marks



50% of farms had fewer than 7 out of 100 pigs with mild body marks



Trends

Following an increase in the percentage of non-hospitalised pigs with severe body marks in 2014, data from 2015 and 2016 shows a significant decrease in this welfare outcome.



Seasonal variation

The number of pigs with severe body marks reduced in autumn and winter compared to spring.

As with mild tail lesions, there was a preference for collection of severe body marks only. This was due to the balance between the time taken to collect this information and its perceived usefulness. Collection of mild body marks takes more time as pigs need to be looked at in more detail and because mild marks can easily be obscured by dirt. In contrast, assessing severe body marks allows veterinarians to look by exception. It is worth noting that body marks were recorded even if they had been treated.



Conclusion

The overall low levels of severe body marks indicate that the physical and social environment is in order and farmers deal with pigs with severe body marks well.

What this measure highlights:

At individual pig level, single mild body marks probably have little impact on the pig, whereas increased numbers of marks or more severe lesions are likely to be painful and can cause distress. Mild marks are likely to have fewer effects; severe or numerous lesions can indicate pain.

At herd level, body marks can be acquired either by aggressive, stressful interactions between pigs or from sharp pen fittings or collisions with pen fittings. Marks may also occur when pigs tread on each other to access resources or to avoid other pigs. A high percentage of pigs with mild marks can be evidence of unrest or poor housing maintenance. Where body marks are thought to be the result of positive encounters between pigs, eg play, the focus is then whether play can be made less risky – eg improved floor grip, reducing or deflecting active pigs past obstacles.

In terms of production, marks to the skin provide a route for infection into the body. The time and energy expended by pigs during aggressive interactions can result in poorer food conversion efficiency. Marks caused by treading on one another can indicate poor pen layout or high density regions of pigs in the pen.

5

Environmental enrichment

Scope:

This measure is assessed on all pigs in a representative number of pens, excluding those pens designated as 'hospital pens'. This measure has been optional since October 2013.

Definition:

Type of environmental enrichment

The type of environmental enrichment was reported as substrate ('straw' or 'other substrate') and/or object ('chain', 'plastic' or 'other object'). The quantity of straw was further classified as restricted, low, medium or deep. Where no enrichment was seen on farm at the time of the assessment, it was recorded as 'none seen'.

Assessment of use of environmental enrichment

The enrichment use is expressed as a ratio and is calculated as:

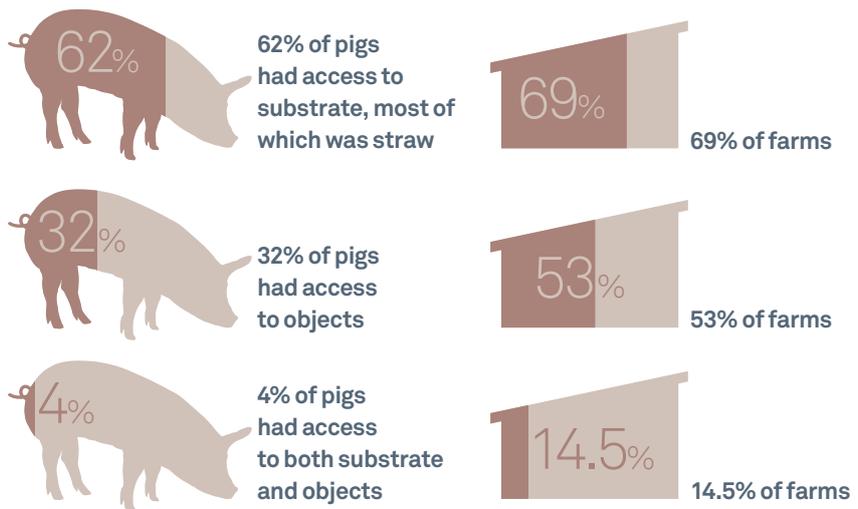
$$\frac{A}{A+B}$$

Where:

A = Number of standing or sitting pigs investigating a manipulable material, ie substrate or toy provided as enrichment.

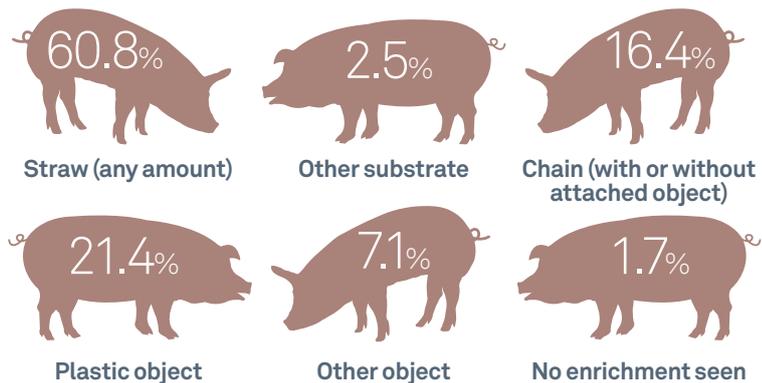
B = Number of standing or sitting pigs manipulating other pigs, pen fittings, pen floor or muck. Include if the snout/mouth is in contact with any part of another pig.

The average enrichment ratio per pen was 0.5



(This excludes assessments digitised by third parties where no enrichment was recorded on the assessment form)

Percentage of pigs that had access to at least one of the following (based on a sub-sample of pigs):





Trends

Over time, the enrichment ratios increased, meaning that the provided enrichment was perceived as becoming more attractive in the latter years than 2013.



Seasonal variation

Seasonally, the enrichment use ratios were higher in autumn and winter compared to spring.



Conclusion

Although all figures are going up over time, the average ratio of 0.5 means there is scope for improvement, as it indicates that the provided environmental enrichment is on average equal in preference to pen mates and fittings at the time of the assessment. Provision of effective environmental enrichment remains important for the industry and it is noteworthy that both provision of substrate and object enrichment has increased significantly in the latter years compared to the situation in 2013.

What this measure highlights:

At individual pig level, the pig has retained the evolutionary need to perform exploratory oral behaviour, even in the absence of food rewards. Pigs will work hard for access to desirable manipulable materials. Sustained exploration of alternatives, such as pen fittings, is a less desirable redirection of the pig's natural behaviour.

At herd level, good levels of oral behaviour directed towards suitable manipulable materials have shown protective effects against abnormal pen-mate directed behaviours, such as tail and ear biting, and aggression.

On a production level, tail biting and aggression are both costly to the producer in terms of time, medication and performance; destruction of pen fittings is also costly in terms of time and replacing pen equipment. These costs could be reduced by increasing appropriate oral behaviour.

This is the first time data on enrichment items have been collected and quantified on such a large scale. It highlights that many producers use straw, either as a bedding material, or in lower quantities as smaller scale environmental enrichment. This reflects the high number of finishers on straw in the British pig industry.

The measure of enrichment use is optional pending the outcome of further research into the measure.

Making progress

The Real Welfare database is unique and the biggest of its kind anywhere in the world. The outcomes provide evidence of high levels of welfare and stockmanship in the British industry. They confirm that farmers look after their animals well and deal with pigs that need extra attention to safeguard their well-being.

The Real Welfare outcomes help pig farmers to assess whether pigs' needs are adequately fulfilled. The five measures were chosen because they are indicators that something in the pigs' surroundings, be that their immediate environment, feed or health, might need extra attention. Although farmers already have high standards of animal husbandry, the systematic and repeatable nature of the Real Welfare assessments allows them to build up a picture over time and a baseline from which to measure change. This value is particularly evident where scores are not overtly bad, but where others consistently do better. There have been other scientific studies in the area of welfare outcomes for pigs, although none on the scale of Real Welfare. A comparison shows that the welfare outcomes demonstrated so far by Real Welfare are similar to, or better than, those shown in other studies.

The Real Welfare figures clearly show that where issues are found during an assessment, they are localised and not uniform across a farm. They also change over time. In fact, farms changed their relative ranking over time, which shows that there was a change in welfare outcomes on their farms. This was most pronounced for the measure of tail biting, while, for instance, the percentage of lame pigs over successive years was less variable. It suggests that effecting change in some of the measures might be achievable more quickly than for others. However, looking specifically at those farms that performed comparatively as the 'worst' in the first year of the scheme, all mean welfare outcome scores improved over the subsequent years. This demonstrates the value of the scheme in driving 'continuous improvement'.

The percentage of pigs that are tail docked in the UK population is lower than the percentage found in most other European countries where tail docking is permitted. This suggests that a considerable proportion of British producers have been successful in their attempts to manage the risk of tail biting by management techniques other than tail docking. It is also noteworthy that the number of pens holding pigs with undocked tails has increased since the start of the scheme. However, this does not mean the industry should be complacent and reducing the risk of tail biting must continue to remain a priority. The issue is a complex, multi-factorial one that needs a large amount of information to entangle its interwoven risk-factors. The Real Welfare assessments are for the first time building a tailored and large enough data set to allow the industry to make further progress in this area.

Overall, all measures of physical injuries, except tail damage, decreased over the years Real Welfare has been operation. This may be a consequence of greater attention being paid to these outcomes and motivation to improve, or it may be because farmers are getting better at moving pigs to hospital pens when needed. However, regardless of the underlying reason, the figures demonstrate an improvement to the welfare of individual animals in the British pig herd. The increased use of some forms of enrichment equally may have had an influence, although it is too early to draw conclusions about the relationship between the two.

The Real Welfare assessment scheme builds on the partnership between farmers and veterinarians, providing an excellent basis from which to drive, and evidence, the British industry's commitment and achievements in continuous improvement in pig welfare.



The results from the first three years of the scheme demonstrate a reduction of the prevalence of animal-based measures. Further research is needed to understand if this is attributable to better management of sick or injured pigs that have been moved to hospital pens or better attention to animal welfare. However, the baseline data provided highlight the value of this initiative.

Quote from peer-reviewed, scientific paper 'The Real Welfare Scheme: benchmarking welfare outcomes for commercially farmed pigs', by F. Pandolfi, K. Stoddart, N. Wainwright, I. Kyriazakis and S.A. Edwards. Published in Animal; 2017; doi:10.1017/S1751731117000246.

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