



# Production diseases and their control: what do the public think?

## Results of a European public survey looking at intensive animal production systems and production diseases

The public are an important stakeholder at the end of the food chain. Yet they are largely unfamiliar with how the food they eat is produced, including products from modern animal production systems. Previous research has demonstrated that the public have concerns in relation to farm animal welfare. PROHEALTH identified that there is little research into attitudes towards production diseases, and specifically the interventions to control these diseases. To establish the acceptance and long term use of animal production systems and disease mitigation strategies, it is important to recognise how the public think about them. Last spring, the PROHEALTH team conducted a survey across five European countries (Finland, Germany, Poland, Spain and the UK) to explore this further.

### **The public have little knowledge of modern farming**

The majority of respondents in all countries were unfamiliar with farming practices, with most respondents also either unsure, or disagreeing, that they purchased foods produced from intensive animal production systems. This could be due to respondents being unclear as to how the food they purchase has been produced. This highlights a disconnection between consumers and modern agriculture.

### **The public have some concerns over intensive production systems**

Several benefits of intensive production systems were acknowledged by the public, mainly in relation to resource and cost efficiency. However, respondents frequently viewed these systems also unfavourably, especially in relation to increased animal stress, increased risks of animal diseases and it being thought of as an unnatural production system.

When asked to rate their agreement to how concerned they were about various aspects of intensive animal production, the most frequently mentioned concerns were related to whether minimum welfare standards were being achieved, antibiotic use leading to antibiotic resistance, antibiotic residues and food safety. Specific concerns were raised about prophylactic antibiotic usage, despite that the survey emphasised that this is banned within the EU.

### **The public's concerns are reflected in the disease mitigation strategies they prefer**

Respondents were asked to rate the acceptability of ways to mitigate diseases. The least preferred interventions (see Table 1) reflect the above concerns, with these interventions involving use of medicines, vaccination, genetic selection and food supplements, although most of these received scores equating to 'neither unacceptable or acceptable'. Doing

nothing and the preventative use of veterinary drugs, were the two statements to be consistently unacceptable across all countries. The most preferred interventions involved changes to housing design, enhanced hygiene, reducing stocking densities and providing enrichment materials. These could generally be perceived as more natural and less invasive interventions than the other interventions proposed.

### **The public prefer proactive strategies**

The results of the survey further emphasise the need for effective communication and assurance regarding the regulations and measures to ensure the safety of the animal products. The results suggest that antibiotic usage and food safety are inextricably linked in the minds of consumers.

Existing communication has predominantly been in relation to disease epidemics or crises and therefore has been more reactive

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### **Key Facts**

22 European partners:  
12 industry, 10 academic  
Project duration:  
01/12/2013 – 30/11/2018  
Project coordinator:  
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in nature, such as with as foot and mouth disease or avian influenza. In light of this, individuals may relate part of their concerns to the epidemic disease outbreaks that have gained more attention in the media compared to production diseases. Care should therefore be taken when communicating about production diseases to clearly differentiate them from epidemic disease. Given the wider associations of higher welfare, with product quality and safety, adopting a more proactive stance, such as presenting the more proactive management measures taken to mitigate production diseases, is therefore an important part of ensuring this. This will also help to ensure that the policies used align with societal preferences, and highlights the benefits of ongoing societal discussions in building consumer trust through transparency. Best practice examples of this that could be used include the work already being done by the UK poultry sector to reduce the amount of antimicrobials used within production systems.

Table 1. Respondent ranking of the acceptability of interventions to control production diseases in broiler chickens, laying hens and pigs

Intervention	Broilers	Laying hens	Pigs
Enhanced hygiene and disease prevention measures	1	1	4
Providing materials and an environment where animals can perform natural behaviours	2	3	1
Housing that allows birds greater freedom to move	3	2	-
Efficient monitoring of pigs and pig housing conditions	-	-	3
Reducing the number of animals in a given area	4	4	6
Improvements in housing design	5	5	6
Enhanced maintenance of the quality of the bedding	6	6	-
Housing that protects the animals from adverse natural conditions	7	7	9
Enhanced control of air movement in the houses	8	8	4
Providing farmers with a price premium that encourages enhanced animal health	9	8	8
Adjustments to feed or diet composition	10	10	2
Changes in the amount and time of light provision	11	11	-
The use of vaccination	12	13	11
Adjustments to the quantity of feed available	13	12	10
Using antibiotics and medicines to treat sick animals	14	14	12
Breeding for genetically tougher or more resilient pigs	-	-	13
Use of feed supplements e.g. probiotics	15	15	14
The preventative use of veterinary drugs including antibiotics	16	16	15
Doing nothing	17	17	16

## Dodging the bullets

### How Coccidia evade the immune response of broilers

Coccidiosis in broilers due to infection with parasitic *Eimeria* remains a significant cause of economic loss. *Eimeria* have a complex life-cycle beginning when a bird ingests an oocyst (a parasite egg) which contains 8 individual parasites. Once the oocyst is ruptured by digestive acid in the bird, the 8 parasites (termed schizonts) invade the intestinal cells and multiply. Eventually this multiplication ruptures the intestinal cells, releasing many more parasites (known as merozoites) which invade new

cells. This (asexual) division causes severe damage to the intestinal cells resulting in poor feed conversion and in some cases death. During this process, new oocysts will be formed which when passed out in bird faeces can infect more chickens if ingested. Therefore, chickens can quickly acquire clinical infection from ingesting relatively few infectious oocysts.

#### The immune response to Coccidiosis

To prevent disease, the immune system must (1) Attack the parasite

inside of the intestinal cells (2) Prevent the large numbers of parasites which emerge from ruptured cells from invading new cells and (3) Prevent infection from establishing the next time the chicken ingests parasite eggs. To do this, different types of immune cell are required (shown in Figure 1).

#### New findings from PROHEALTH

PROHEALTH researchers at Nottingham University have used gene microarray technologies to study the immune gene profile in the

Table 3. The effect of clinical Coccidiosis on immune genes in broilers

Cell type	Genes affected by Coccidiosis
CTL	Genes which are required for expression of common CTL receptor and functional regions required for CTL interaction with target cells are significantly inhibited
NK cells	Gene required for expression of common NK cell receptor is significantly decreased
Th cells	Expression of common gene marker for Th cells is significantly decreased
B lymphocytes	Expression of genes required for B lymphocyte receptor expression and genes required for B lymphocyte/T lymphocyte interaction are significantly decreased
Macrophages and Dendritic cells	Specific dendritic cell marker genes and genes required for dendritic cells and macrophages to present lipid antigens to lymphocytes are significantly decreased. Genes required to produce a protein which inhibits macrophage activation is significantly increased

intestines of broiler chickens with clinically diagnosed Coccidiosis. To validate our results these genes were also analysed using a quantitative polymerase chain reaction to measure fold changes in these genes compared to chickens showing no clinical signs in the same flock.

Our results show that many different immune genes are down-regulated in chickens with clinically diagnosed Coccidiosis. These include genes found in lymphocytes which

influence recognition of, and reaction to, antigens and genes which influence the activity of antigen presenting cells, such as macrophages and dendritic cells. The function of the immune cells in which some of these genes are down-regulated are shown in Table 3.

**Conclusion**

The PROHEALTH study shows that in field conditions Coccidiosis may induce significant immune

suppression of both the innate and adaptive immune responses. The effect of this may be to increase the duration of Eimeria survival in chickens, thus making clinical disease more likely. However, immune suppression would also provide a less hostile environment for the colonisation of other pathogenic organisms. Thus, initiating poly-infections which could have an even greater pathological effect on these chickens and which would impact more severely on production loss.

To prevent disease when chickens next ingest the same strain of Eimeria, macrophages and dendritic cells present parasite proteins (antigens) to T and B lymphocytes. Some of these lymphocytes will take part in the ongoing immune response while others (memory cells) lie dormant until the chicken is infected again in which they are immediately activated to prevent disease.

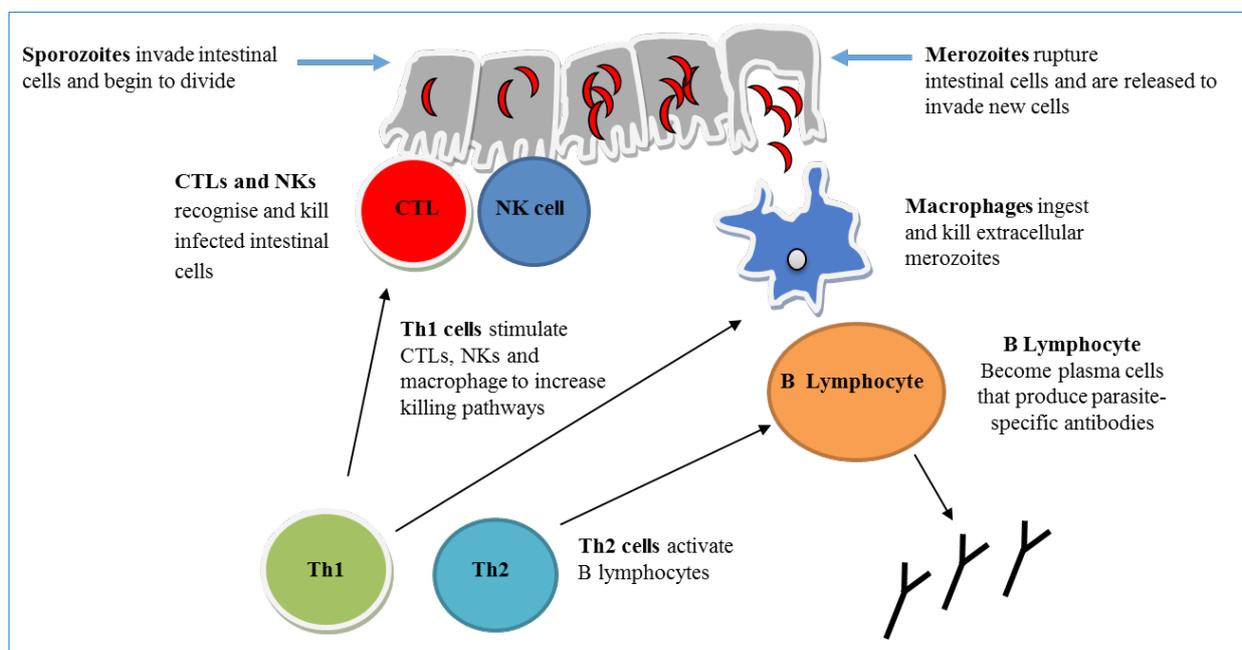


Figure 1. Cytotoxic T lymphocytes (CTLs) and Natural Killer cells (NKs) kill cells infected with parasites. T helper lymphocyte type 1 (Th1) cells produce proteins which activate CTLs, NKs and macrophages. T helper lymphocyte type 2 (Th2) cells produce proteins which activate B lymphocytes to develop into cells which produce parasite-specific antibodies that prevent merozoite invasion of new cells.

# Will environmental enrichment improve leg health in broilers?

## A systematic review

Improvements in leg health in broilers have the potential for improving overall broiler welfare markedly. One of the few realistic possibilities for the individual farmer to do this is to add enrichment to the rearing environment. Environmental enrichment is here defined as any physical change in the environment that is expected to lead to an improvement in leg health and welfare. Several enrichment alternatives and their effect on leg health have been investigated through a systematic review by PROHEALTH.

Six types of enrichment were assessed in the review: light program, light intensity, stocking density, perches, separation of resources (food/water) and straw bales. The review included 62 studies and a list of different leg health measures was assessed in these studies, with gait score, foot pad- and hock dermatitis

and tibial dyschondroplasia being the most frequently assessed measures. The results for these four measures are presented in Table 2.

Light program and stocking density are well-studied areas with 24 studies fit for inclusion each. Light program, i.e. implementing an intermittent light schedule, was especially effective in improving gait scores (Table 2). A lowered stocking density mostly affected foot pad and hock dermatitis, possibly through an increased litter quality at the lower stocking densities.

The results for provision of perches (9 included studies) and light intensity (7 included studies) did not show a clear effect of enrichment on leg health. However, an increased intensity of light did reduce foot pad dermatitis in 3 out of 4 studies. For straw bales (1 included study) and separation of resources (5 included

studies) the amount of literature was limited. However, the existing literature did suggest an effect of enrichment on gait scores.

While some of the enrichment types are clearly costly (e.g. lowering the stocking density), others can probably be introduced with no or a minor cost (e.g. intermittent light schedules). All in all, light program and stocking density are well-studied types of enrichment that can improve gait score and contact dermatitis, respectively. Intensity of light and perches do not appear effective in improving leg health. For straw bales and separation of resources the number of studies is low and caution should therefore be taken with recommending these. However, both types of enrichment show potential for improving leg health and merit further investigation.

Table 2. Summary of research on the effect of six types of environmental enrichment on gait score, foot pad- and hock dermatitis and tibial dyschondroplasia.

	Gait score	Foot pad dermatitis	Hock dermatitis	Tibial dyschondroplasia
Light program Effective/Total <sup>a</sup>	6/7	2/3	0/2	3/10
Stocking density Effective/Total <sup>a</sup>	4/11	9/18	7/17	0/4
Perches Effective/Total <sup>a</sup>	0/4	2/6	2/6	0/3
Intensity of light Effective/Total <sup>a</sup>	1/6	3/4	1/2	0/1
Separation of resources Effective/Total <sup>a</sup>	2/4	1/2	0/1	0/1
Straw bales Effective/Total <sup>a</sup>	1/1	0/1	0/1	0/0

<sup>a</sup>. "Effective" is the number of studies finding an effect of enrichment on the leg health measure. "Total" is the number of studies that included the measure within each type of enrichment.

# PROHEALTH 2017

## A successful year in science communication

As PROHEALTH has been approaching its final stages, the dissemination activities have been intensifying in order to showcase the exciting outcomes and results coming through from the ongoing research carried out by the consortium. In total, the consortium members have already made more than 100 appearances at scientific conferences, workshops and industry events and in 2017 the project has had very significant contributions to a variety of events across Europe.

### Third PROHEALTH National Technical Conference in Poland

May saw the hosting of the 3rd National Technical Conference which took place in Warsaw, Poland on the 26th and 27th of May 2017. The theme of the conference was ‘Sustainable poultry production in the post antibiotics era - practical alternatives for antimicrobials. The aim of the conference was to highlight the work done in this area and the presentations were well received by the audience, more than 250 poultry diseases specialists. The conference included five poultry focused sessions where invited speakers were made up of project partners such as Ivan Rychlik who discussed the ‘Composition of gut microbiota in poultry – what we know about it’, Tommy Van Limbergen who gave a talk entitled ‘Eliminate the risk of

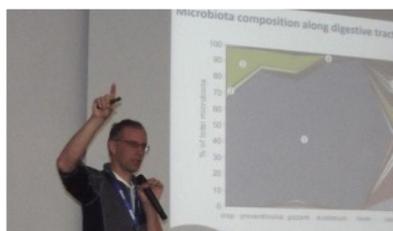


Figure 2. Ivan Rychlik from PROHEALTH partner VRI presenting at the 3rd Technical Conference in Poland.



Figure 3. Prof. Piotr Szeleszczuk of PROHEALTH partner SGGW.

production diseases occurring as a part of antibiotic use reduction - EU experience’ and Piotr Szeleszczuk whose presentation was titled ‘Algorithms - diagnostics and therapeutics in selected bacterial diseases of chickens’.

### Health the most important factor in profitable swine production – Poland

PROHEALTH members represented the project by presenting their findings at the XXII International Scientific Conference by the National Veterinary Institute. This conference was held in Pulawy, Poland on the 6th and 7th June.

PROHEALTH were delighted to be contributors to this event which was attended by more than 1000 experts in the swine sector and included presentations by the following PROHEALTH partners:

- On behalf of the PROHEALTH coordinator, Prof. Ilias Kyriazakis, Prof. Piotr Szeleszczuk (managing the work of the Polish team) informed the listeners about the assumptions and purpose of our project.

- Ioannis Arsenakis spoke on the ‘Diagnosis of respiratory disease, and vaccination strategies against *Mycoplasma hyopneumoniae*’
- Fanny Pandolfi presented ‘Risk factors for neonatal pig mortality’
- Gemma Montalvo discussed the ‘Influence of climate and environmental conditions on pig health and performance’

### EAAE Congress 2017

Aimed at scientists, policy-makers and stakeholders in both the pig and poultry sectors, the XV EAAE (European Association of Agricultural Economists) congress was held on the 29th August – 1st September 2017 in Parma, Italy. This is a triennial event that brings together members from the whole association.

The main theme of the congress was titled ‘Towards Sustainable Agri-Food Systems, Balancing between Markets and Society’.

PROHEALTH organised a special session called ‘Economic rationale of controlling production diseases in broiler and pig meat production’.

PROHEALTH members provided interesting insight by presenting on the following topics:

- Philip Jones, Jarkko K. Niemi and Richard Tranter – ‘Stakeholder preferred ways to reduce production diseases’
- Jarkko K. Niemi, Nathalie Le Floc’h and Philip Jones – ‘Does good biosecurity in pig fattening pay- a case study’
- Beth Clark, Gavin B. Stewart, Luca .A Panzone, Ilias Kyriazakis, Jarkko K. Niemi, Terhi Latvala, Richard Tranter, Philip Jones and Lynn J. Frewer- ‘Consumer views on controlling production diseases in intensive production systems’

- Beth Clark, Gavin B. Stewart , Luca A. Panzone and Lynn J. Frewer – ‘Consumer willingness-to-pay and attitudes for farm animal welfare: a systematic review and meta-analysis’

**ANAPORC-PROHEALTH CONGRESS**

This is one of the most international and high-level scientific-technological meetings held by Anaporc in its 38th edition. On this occasion, the XXXVIII Symposium brought together 604 specialists from the pig sector, which represents a new high record of participation. PROHEALTH was a main contributor to the event.

The Symposium dealt with different scientific-professional topics, many of them focused on the outcomes of the PROHEALTH Project, such as:

- Sandra Edwards (Newcastle University) - ‘Introduction to PROHEALTH project’

- Dominiek Maes ( Ghent University) –‘Scoring of management and biosecurity in pig herds’
- Sandra Edwards (Newcastle University) – ‘Impact of maternal and neonatal factors on piglet survival’
- Nathalie Le Floc’h (INRA, France) –‘ Impacts of genetics and housing on pig health’
- Carlos Piñeiro,( PigCHAMP Pro Europa S.L., Spain)-‘ Influence of environmental conditions on pig health and performance
- Neil Foster (Nottingham University) –‘Reading the genetic signatures of production diseases’
- Ivan Rychlik (Veterinary Research Institute Brno, Czech Republic)-‘Age-dependent development of pig gut microbiota’
- Jarkko Niemi, (Luke, Finland)-‘ The economic significance of production diseases and their control in pig farms’

Whilst many more conferences and events are on the horizon, in the meantime the PROHEALTH team are busy publishing the outcomes

of the conducted research in high quality peer reviewed journals. The publications are attracting attention for their quality and impact of its findings.

A great example of this is the research paper by T Van Limbergen et al., on behalf of the PROHEALTH consortium; Scoring biosecurity in European conventional broiler production, Poultry Science, pex296, <https://doi.org/10.3382/ps/pex296>.

This research highlights the importance of biosecurity on EU broiler farms and was picked up by Poultry World in an article entitled ‘Staff and visitors letting down biosecurity on EU broiler farms’.

<http://www.poultryworld.net/Meat/Articles/2017/10/Staff-and-visitors-letting-down-biosecurity-on-EU-broiler-farms-203713E>

Keep an eye on the website for all of the PROHEALTH consortium publications at:

[www.fp7-prohealth.eu/](http://www.fp7-prohealth.eu/)



Figure 4. Carlos Piñeiro of PigCHAMP presenting at the Anaporc Symposium.