Advancing poultry welfare – insights from layer and broiler research

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Welfare encompasses

- Physical health
- Mental health
- Behavioural opportunities
  - Includes both positive and negative experiences

- What aspects are most important for welfare for poultry?
  - Poultry welfare science

- What are the practical limitations on these?

Laying hens

- Key welfare issues
  - Suitable nesting site
  - Appropriate perches
  - Injurious pecking
    - Aggression
    - Feather pecking
    - Cannibalism
    - Associated beak trimming
  - Keel damage
  - Foot pad issues
    - Bumblefoot
    - Pododermatitis
  - Diseases
    - E.g. Avian Influenza, Infectious Bronchitis, Newcastle Disease, Marek's Disease, etc
  - Weakened skeletons
    - Cage Layer Fatigue Syndrome
  - Internal laying
    - Egg peritonitis

Feather pecking

- Removal of feathers of one bird by another
  - Causes pain
  - Can lead to increased pecking by other birds
  - Can lead to cannibalism
  - Associated stress can increase disease susceptibility
  - Can also decrease productivity, increase food consumption and increase mortality rates

From: https://www.fwi.co.uk/livestock/poultry/new-guide-to-avoid-feather-pecking

- Causes are multifactorial
  - Related to lack of suitable foraging opportunities
  - Related to stress/changes
    - Factors that reduce ability to perform normal foraging behaviour

- Advice on how to prevent/manage hens to reduce risk of feather pecking
  - E.g. FeatherWel (2013)
    - Keeping rearing and laying environment as similar possible
    - Don't stimulate lay too early
    - Access to good quality litter
    - Providing pecking objects, e.g. pecking block
    - Use mash not pelleted feed
    - Even bird size/weight
    - Etc!

- But still a key welfare issue found in all housing systems
  - Research from last 20 years indicates between 24-94% of flock show feather pecking (Mens et al 2020)
  - Potential for more hens to be harmed in barn systems
    - But also global shift to increase cage-free production
- Prevalent research topic in poultry welfare
  - 1, 470 paper/abstracts involving feather pecking from 2021 to present

Beak trimming

- Removal of beak tip
  - By infrared laser or hot blade trimming usually
- Welfare issue itself
  - Painful
  - Reduces ability to perform normal behaviour
  - May require re-trim
- Doesn't stop the underlying causes behind feather pecking
  - Makes it more difficult for birds to do damage

From:https://www.hyline.com/ViewFile?id=f5e1b46b-b6d3-4b9c-8ad8-bb86bd5c0625

vs

From: https://www.mirror.co.uk/news/uk-news/horrifying-truth-brutal-life-free-7634201/

- Some countries ban beak trimming
  - E.g. Germany
- Others considered ban but did not go ahead
  - E.g. UK
- Note Organic labelled flocks generally can not be trimmed

Potential alternatives to beak trimming

- Beak blunting
  - Abrasive material in feeder
    - May decrease beak length in some breeds (van de Weerd et al 2006) but not others (Struthers et al 2022)
      - Didn't affect or decreased feather cover
  - Abrasive pecking boards
    - Didn't reduce beak length/sharpness (Morrissey et al 2016)
    - Performed less feather pecking but no effect on feather cover
- No clear positive effect on beak sharpness or feather pecking

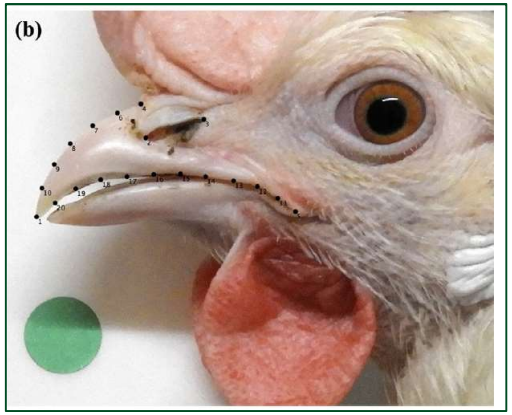
Potential alternatives to beak trimming

- Natural variations in beak shape
  - Appear to be heritable
  - Upper beaks ranged from long and narrow with pointed tips to short and wide with curved tips
  - Hens with naturally shorter and blunter upper beaks had improved feather cover and mortality (Icken et al 2017)
  - Beak size and shape can also differ between genetic lines of hens (Struthers et al 2021)

Variations in beak shape

Struthers et al 2023

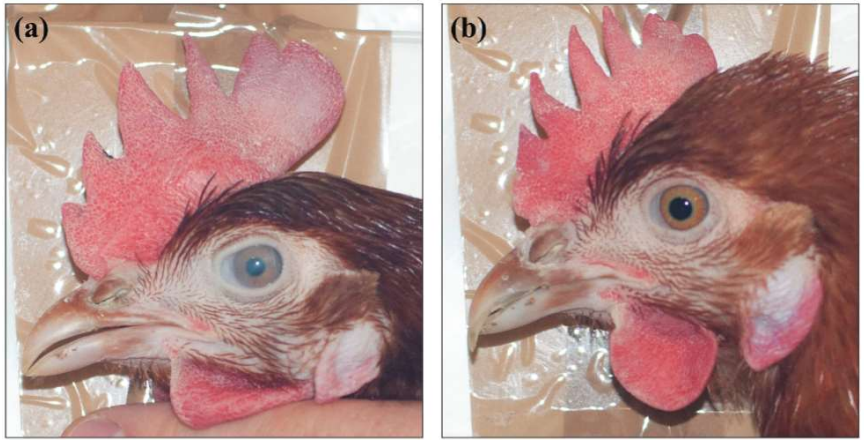
- 2 lines of hens
- Beak shape differed between lines
- Heritability for upper beak shape was moderate to high for one genetic line and low to moderate for the other
- Performance of damaging feather pecking has a low to moderate heritability
  - E.g. Lutz et al 2016
- But need to observe bird behaviour then incorporate this into breeding programmes
  - Challenging
- Easier to measure and select for beak size/shape than feather pecking behaviour



Variations in beak shape

Struthers et al 2024

- Does natural variation in beak shape affect the ability to cause pecking damage?
  - Sharp beaks vs blunt beaks
  - Recorded pecking a feather skin



- Number of pecks same between beak types
- Sharp beaked birds removed more feathers and caused more tissue damage to skin
  - More effective at causing damage
- Selection for naturally blunted beaks within a line could be a practical and effective way to reduce feather pecking damage without beak trimming
  - S. Struthers continuing this work in a *postdoc*
- **Good housing and management practices to reduce risk of feather pecking still required!**

Onto broilers…

Broilers

- Key welfare issues
  - Mainly related to fast growth genetics
    - Lameness
    - Increased mortality levels
    - Foot/hock lesions
    - Metabolic issues
      - Ascites, flip over
    - Heat stress
    - Muscle myopathies
  - Disease
    - Campylobacter, necrotic enteritis

- Attempts to improve welfare often focus on
  - Stocking density
  - Enrichment provided

- Lower stocking density can
  - Improve health outcomes
    - And productivity
  - Reduce foot pad and hock lesions
  - Reduce aggressive interactions
  - Reduce risk of lameness

e.g. Buijs et al 2009; Estevez 2007; de Jong et al 2012

- Addition of enrichments, such as straw bales and platforms can
  - Stimulate natural behaviour
  - Increase locomotion
  - Reduce fear responses
  - Improve foot health

  - Growth rate and weight of broilers can limit their ability to use enrichment items like perches

e.g. Lourenço da Silva et al 2021; Guinebretiete et al 2025

For example

- Adding straw bales, low platforms and laser projectors
  - Increased exploratory behaviour and comfort behaviour
  - Better footpad scores
  - Reduced fear of humans
  - Reduced muscle damage on back
    - Source of carcass condemnation
  - Didn't affect body weight at D42

Lourenço da Silva et al 2021

BUT

- The welfare improvements are low compared to changing growth rate
  - E.g. Rate of locomotion increased from 3.41% with no enrichment to 5.03% with enrichment
  - And dustbathing increased from 0.12% with no enrichment to 0.27% with enrichment
    - There was no difference in preening, foraging, eating or drinking behaviour
- Age can have a bigger effect on some behaviour than enrichment
  - E.g. Locomotion decreased from 5.12% at 13 days to 2.45% at 42 days

See review by Hartcher and Lum 2020 for more details

- So reducing stocking density and/or providing enrichment can improve some aspects of broiler welfare

- But slower growth genetics is needed for large improvements

Slower growing broilers

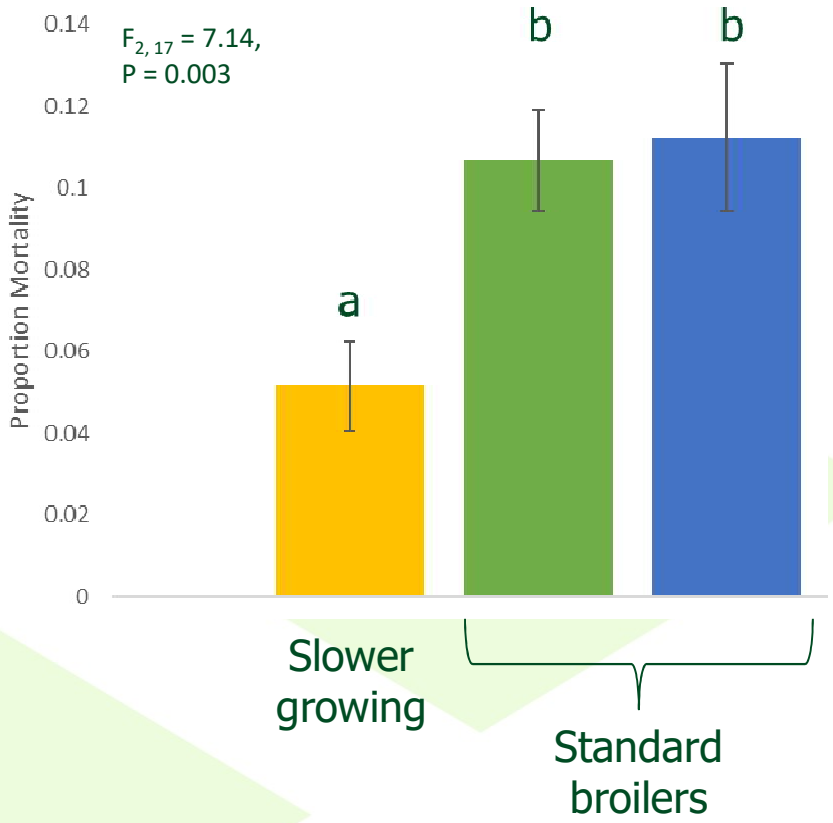
- Variety of breeds
- Used in Barn, Free Range and Organic systems
  - Slaughtered between 56 – 81+ days (usually)
- Required for higher welfare food schemes
  - E.G. RSPCA Assured
- More expensive
  - Eat more
  - Fewer crops of chickens per year

- Slower growing breeds have
  - Decreased mortality
  - Decreased lameness
  - Decreased foot/hock lesions
  - Decreased muscle myopathies
    - Decreased slaughter downgrades
  - Increased activity
  - More adaptable to different environmental conditions

- Compared to conventional faster growing breeds

e.g. Hartcher and Lum 2020; Riber and Wurtz 2024; Nicol et al 2024

For example - Mortality

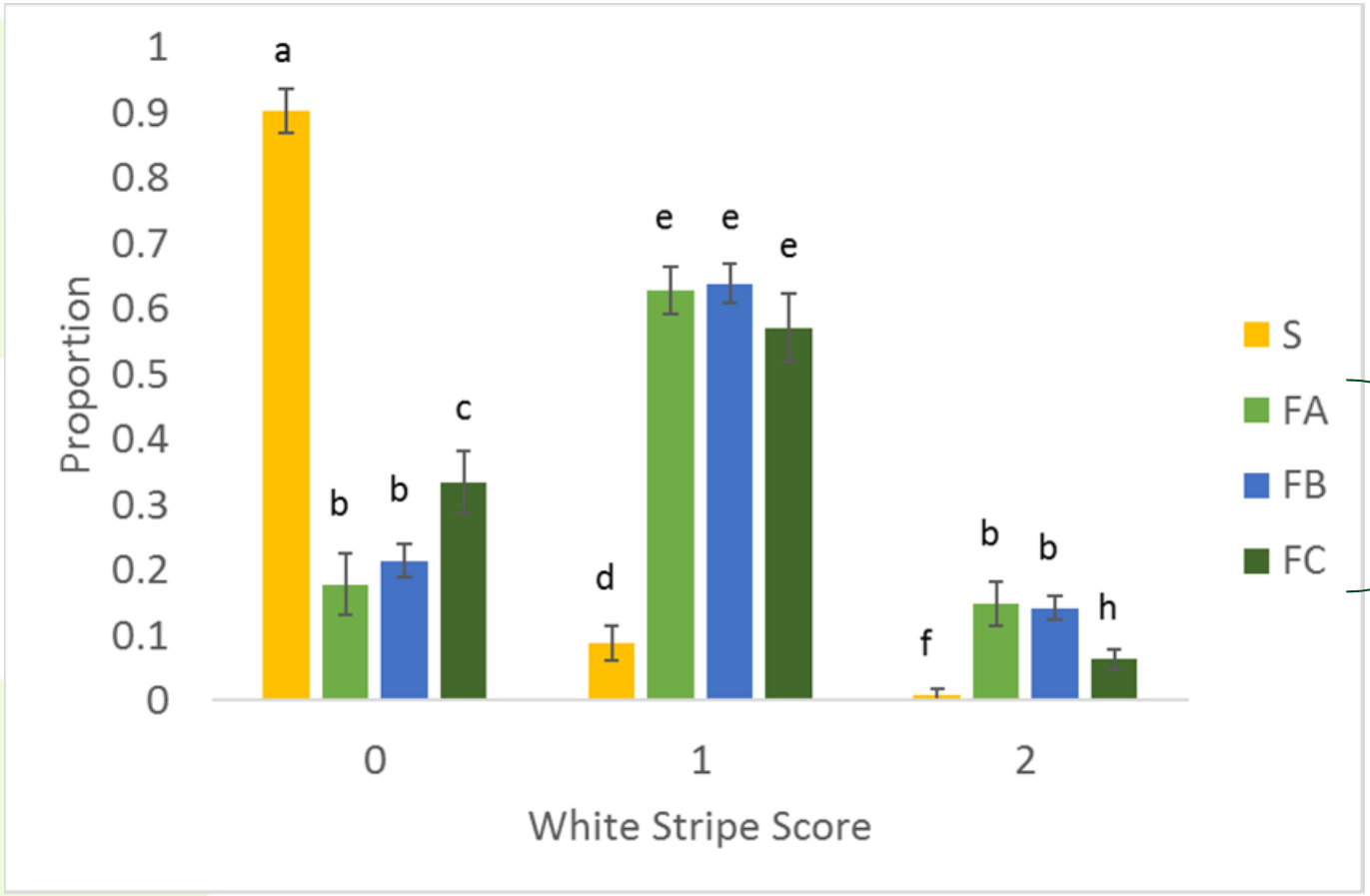


Welfare concern
+
birds costing money but not resulting in sellable product

Mortality is higher in early life
AND
higher near slaughter age

Dixon 2020

For example - White Striping



*Scale of no striping (0) to moderate striping (2)

Slower growing birds had <u>lower</u> white striping scores than the other breeds (P<0.001).

Dixon 2020

So using a broiler breed whose growth is slowed can have large effects on welfare

BUT

They eat more feed, fewer crops can be produced per year and the muscle tissue yield is less (even if slaughtered at the same weight as faster growers)

BUT

Mortality is lower

Meat quality is better, so fewer downgrades…

Producers can get a premium price

Development of intermediate growth broilers

- Compromise between production and welfare?

- Fast growth = 60+g/day
- Slow growth ~40g/day or less
- Intermediate growth ~45-55g/day
  - Definitions may differ a bit

- Intermediate breeds won't take as long to reach slaughter weight as slow growing breeds
  - And won't consume as much feed
  - But can welfare be maintained?

Example breeds

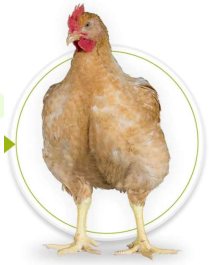
Slaughter weight of 2.5kg/bird, As Hatched

Fast ← → **Intermediate** ← → **Slow**

Standard faster growing breed
42 days

Redbro
47 days

Rustic Gold
48 days



Ranger Gold
54 days

JA757
56 days

Organic

JACY57
81 days

Extensive indoors

Free Range

Intermediate vs slow growth breeds

- Some intermediate breeds have similar levels for welfare measures
  - Lameness
    - E.g. Hubbard JA957, Ranger Classic, Hubbard Redbro
  - Foot pad lesions
    - E.g. Hubbard JA987, Ranger Classic, Rustic Gold
- Some measures are higher but still improved compared to fast growing breeds
  - E.g. Reduced lameness
- However there is limited research on many slower growing and intermediate breeds

Growing area of research

- Due to the improved welfare of intermediate growing breeds

and

- The improved production measures compared to very slow growing breeds

- There is growing interest in their use by animal welfare charities, retailers, governments, producers

M&S Oakham Gold chicken advert

Increased promotion of higher welfare chicken

SRUC

BETTER CHICKEN COMMITMENT

COMPASSION in world farming

More than 1 billion broiler chickens are set to positively benefit from these corporate pledges.

ACCOR HOTELS · COMPASS GROUP · DANONE · Dr.Oetker

IKEA · Interserve · itsu · KFC

KraftHeinz · Le Pain Quotidien · MARKS & SPENCER · Nestlé

Nomad Foods · PREMIER FOODS · PRET · sodexo

SSP · Unilever · wagamama · Waitrose

Individually Zizzi Italian

e.g. UK

5 EUROGROUP FOR ANIMALS : PAVING THE WAY FOR HIGHER WELFARE BROILER BREEDS IN THE EU

EUROPEAN ECONOMIC AREA COUNTRIES COMMITTED TO IMPROVING BROILER WELFARE

Several EU Member States and European Economic Area (EEA) countries have recognised the importance of phasing out fast-growing broiler breeds, and have done so by announcing a shift of public procurement policies towards higher welfare breeds.

The working group will prepare a report on animal welfare standards in Danish broiler production, including the conditions for parent animals. The report will gather input from relevant stakeholders and incorporate experiences from the Animal Welfare Label and other countries.

Still work to do

- Intermediate breeds do vary in their welfare outcomes
  - But these generally are improvements to faster growing breeds
- Currently limited research on specific breeds
  - More needed!
- Promising area for improving broiler welfare
  - While maintaining economically viable production levels and improving sustainability compared to very slow growing breeds

Increases in automatic monitoring

Briefly…

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Automated behaviour monitoring

- Behaviour used as a welfare indicator
  - Increased expression of positive behaviours
    - E.g. perching, preening, dustbathing
  - Decreased expression of negative behaviours
    - E.g. aggression, feather pecking
- But human observation of poultry behaviour is time consuming and difficult in large flocks
  - Only a proportion of birds get observed
  - Observations cover limited periods of time

- However, all animals often need to be monitored to ensure good welfare
  - Not practical in flocks of thousands of birds
- Although some measures could be done at a flock levels to indicate overall flock welfare
- Ongoing increase in research and application of automatic methods of assessing poultry behaviour and welfare
  - A few examples

Wearable sensors

- Track location and activity of individuals
  - Not common commercially due to size of tracker vs size of bird and/or cost
    - RFID microchips can be implanted in birds
    - RFID tags only had short term impact on bird behaviour (reviewed by Li et al 2020)
  - Location relative to resources can allow estimation of behaviour
    - Pair with egg detection sensor to associate egg with individual
  - Can also assess nest site preference
    - Use to improve nest box design, e.g. Ringgenberg et al 2015
  - Can monitor range use
    - And assess changes/additions to increase bird use

- Will this technology eventually be practical in commercial systems?
  - Decrease in cost
  - Automate RFID microchip insertion at hatchery??
  - Could this still be practical for thousands or tens of thousands of birds?
    - Or is monitoring a certain proportion of them enough to identify issues?
- Has the potential to improve welfare in real time
  - More practical than manually observing bird behaviour

Van der Sluis et al 2020 Sensors 20:3612

Image processing

- Can be used on flock level
  - Changes in activity, bird distribution

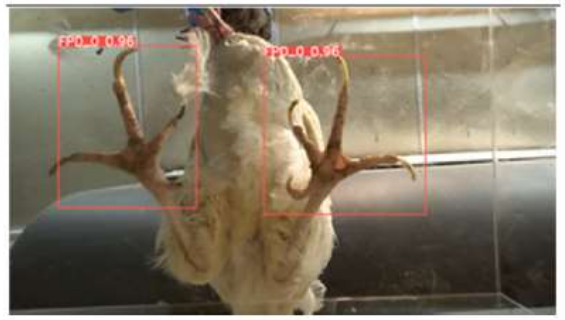
- Can be used on individuals
  - E.g. foot pad scoring

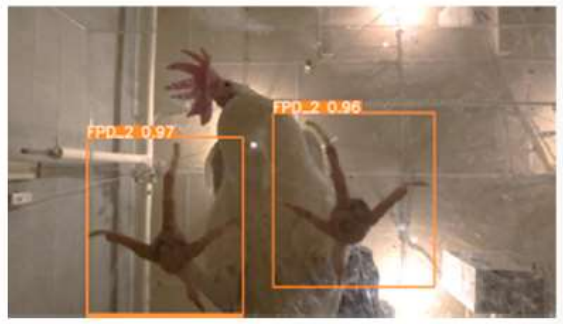
Bist et al 2024

- Assessing foot pads is time consuming
  - Often done at slaughter plant
    - Can’t improve welfare in real time

- Machine learning could automate this process
  - Allow welfare improvements for the flock

- Camera inside transparent box
  - Collected RGB and thermal images
  - Manually scored
  - Computer models trained to predict foot pad score
- Models successful at foot pad scoring
  - Variation within models
  - Variation within training time





Bist et al 2024

- Still some challenges
  - Manure/litter on feet
  - Not identifying individuals, so could be measuring same individual repeatedly in commercial setting
  - Thermal camera images had better success
    - But very expensive
- Potential to improve welfare commercially with further research

Bist et al 2024

Vocalisations

- 4 primary vocalisations characterised for broilers
  - Distress call
  - Short peep
  - Warble
  - Pleasure notes

(Marx et al 2001)

- Can be automatically monitored and categorised at the flock level
  - Need to know what's 'normal' first
    - E.g. age, diurnal rhythm, effects of enrichments, stressors
  - Some vocalisations had distinct diurnal rhythm
    - Stayed constant with age

(de Carvalho et al 2025)

- Short peep associated with active behaviours and this decreased as broilers aged and reduced activity
  - So could use as an indicator of welfare
    - BUT how much of a decrease in SP is ok??

- Also stress didn't change vocalisations
  - Increase in heat from 22 to 32C for 6 hrs/day over 10 days total
    - So will this detect other welfare issues?

- Nor did enriched environments
  - But this was found in other studies, e.g. reduced vocalisations overall in enriched environment (Meyer et al 2024)

(de Carvalho et al 2025)

- More research needed!
- But potential for automatic vocalisation detection and analysis in real time to alert producer to issue
- Easier to apply in commercial flocks than some other automated technology
- Overall, using multiple automated methods may improve scope for individual bird welfare assessment

Questions?

References

- Bist, R.B. et al. 2024. An automatic method for scoring poultry footpad dermatitis with deep learning and thermal imaging. Computers and Electronics in Agriculture 226: 109481.
- Buijs, S. 2009. Stocking density effects on broiler welfare: identifying sensitive ranges for different indicators. Poult. Sci. 88: 1536–1543.
- de Carvalho et al. 2025. Influence of age, time of day, and environmental changes on vocalization patterns in broiler chickens. Poultry Science 104: 105298
- de Jong, I. et al. 2012. Scientific Report Updating the EFSA Opinions on the Welfare of Broilers and Broiler Breeders, 9. EFSA Supporting Publications.
- Dixon L.M. 2020. Slow and steady wins the race: The behaviour and welfare of commercial faster growing broiler breeds compared to a commercial slower growing breed. PLoS ONE 15: e0231006. https://doi.org/10.1371/journal.pone.0231006
- Estevez, I. 2007. Density allowances for broilers: where to set the limits? Poult. sci. 86: 1265–1272
- FeatherWel 2013. Improving feather cover. Available from: https://www.compassioninfoodbusiness.com/media/6207575/improving-feather-cover-featherwel-a-guide-to-reducing-the-risk-of-injurious-pecking-occuring-in-non-cage-laying-hens.pdf
- Guinebretiere, M. et al 2025. Structuring and enriching the rearing environment in conventional broiler chicken production: effects on behavioral indicators, emotional states, and cecal microbiota composition. Poultry Science 104: 105663
- Hartcher, K.M. and Lum, H.K. 2020. Genetic selection of broilers and welfare consequences: a review, World's Poultry Science Journal, 76:54-167, DOI:10.1080/00439339.2019.1680025
- Lourenço da Silva, M.I. et al. 2021. Behaviour and animal welfare indicators of broiler chickens housed in an enriched environment. Plos one 16: e0256963.
- Mens, A.J.W. et al. 2020. Nutritional approaches to reduce or prevent feather pecking in laying hens: any potential to intervene during rearing? World's Poultry Science Journal 76: 591-610.
- Meyer, M.M. et al, 2024. Field report: methods for assessing laser environmental enrichment application in commercial broilers. J. Appl. Poult. Res. 33: 100391. https://doi.org/10.1016/j. japr.2023.100391
- Morrissey, K. L. H., et al. 2016. Can non-beak treated hens be kept in commercial furnished cages? Exploring the effects of strain and extra environmental enrichment on behaviour, feather cover, and mortality. Animals 6:17.
- Nicol C.J. et al. 2024. An analysis of the welfare of fast growing and slower-growing strains of broiler chicken. Front. Anim. Sci. 5:1374609. doi: 10.3389/fanim.2024.1374609
- Riber, A.B. and Wurtz, K.E. 2024. Impact of Growth Rate on the Welfare of Broilers. Animals 2024, 14, 3330. https://doi.org/10.3390/ani14223330
- Struthers, S. et al 2022. Specialized beak blunting feeders and their potential as an alternative to current beak treatment methods in leghorn pullets. J. Appl. Poult. Res. 31: 100285
- Struthers, S. et al. 2023. An analysis of the maxillary beak shape variation between 2 pure layer lines and its relationship to the underlying premaxillary bone, feather cover, and mortality. Poultry Science 102: 102854..
- Struthers, S. et al. 2024. Examining the relationship between different naturally-occurring maxillary beak shapes and their ability to cause damage in commercial laying hens, British Poultry Science, 65:2, 105-110, DOI:10.1080/00071668.2024.2308279
- van de Weerd, H. A., R. et al. 2006. Beak blunting, an alternative to beak trimming in laying hens? Br. Poult. Abstr. 2:2–3.