# Foot-pad dermatitis.

# Causes and impact on carcass quality and welfare

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# Context

- **First reported in broilers and turkeys in the late 1970s – 1980s**
  - Development of the paw market

*Schepherd & Fairchild, PS, 2010*

  - Huge increase of the development of contact dermatitis

*AHAW, 2000*

**1969**

**1988**

**1.4 %** → **34.5 %**

## Context

- **European regulation on the protection of animals**

2000 ⬇ — 2007 ⬇ — 2010 ⬇

**Report EC** → **Directive 2007/43/EC** ⟶ Transposition

**Annex III (post mortem inspection)**

Density > 33 ~~X~~ kg/m²

"… the official veterinarian … identify possible indications of poor welfare conditions such as **abnormal levels of contact dermatitis**, …"

The welfare of chickens kept for meat production
*AHAW, 2000*

**Contact dermatitis** = one of the problem identified

➡ **Growing interest in FPD**

- **FPD: What is it?**
- **How to measure FPD?**
- **Which incidence in Europe?**
- **What are the causes?**
- **What are the consequences?**
  - **Carcass quality**
  - **Animal welfare**
- **How to prevent FPD?**
- **Conclusion**

# FPD: What is it?

- **Lesions of skin on the**

**feet** (plantar surface) — FPD

**intertarsal joint** — Hock burn

**breast** — Breast burn


- **Degenerative disorders (non infectious)**

*Bradshaw et al., APBR 2002*

*Greene et al, AP 1985; Olivère et al, 9e JRA 2011*

## FPD: What is it?


- **Pathology**
  - Hyperkeratosis (proliferation) no discoloration


  - Hyperkeratosis discoloration (brownish)


  - Ulceration, scabs (black) inflammatory reactions


- **Histology**
  - Mild hyperkeratosis, superficial congestion and oedema
  - Hyperkeratosis, necrosis of the epidermis (basal layers intact), dermal inflammation
  - Oedema, complete destruction of the epidermis, marked inflammation of the dermis

*Green et al., AP 1985; Schepherd & Fairchild, PS 2010; Michel et al., BPS in press*

- FPD: What is it?
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# How to measure FPD?

- **Measurements on farm OR at slaughterhouse**
- **Several scoring systems**

  From **3- to 11-point scale** based on

  **severity** *Ekstrand et al., BPS 1998*

  0 No lesions, only mild hyperkeratosis
  1 Superficial lesions, erosions, papillae & discoloration
  2 Deep lesions, ulcers and scabs

  **relative or absolute surface area**

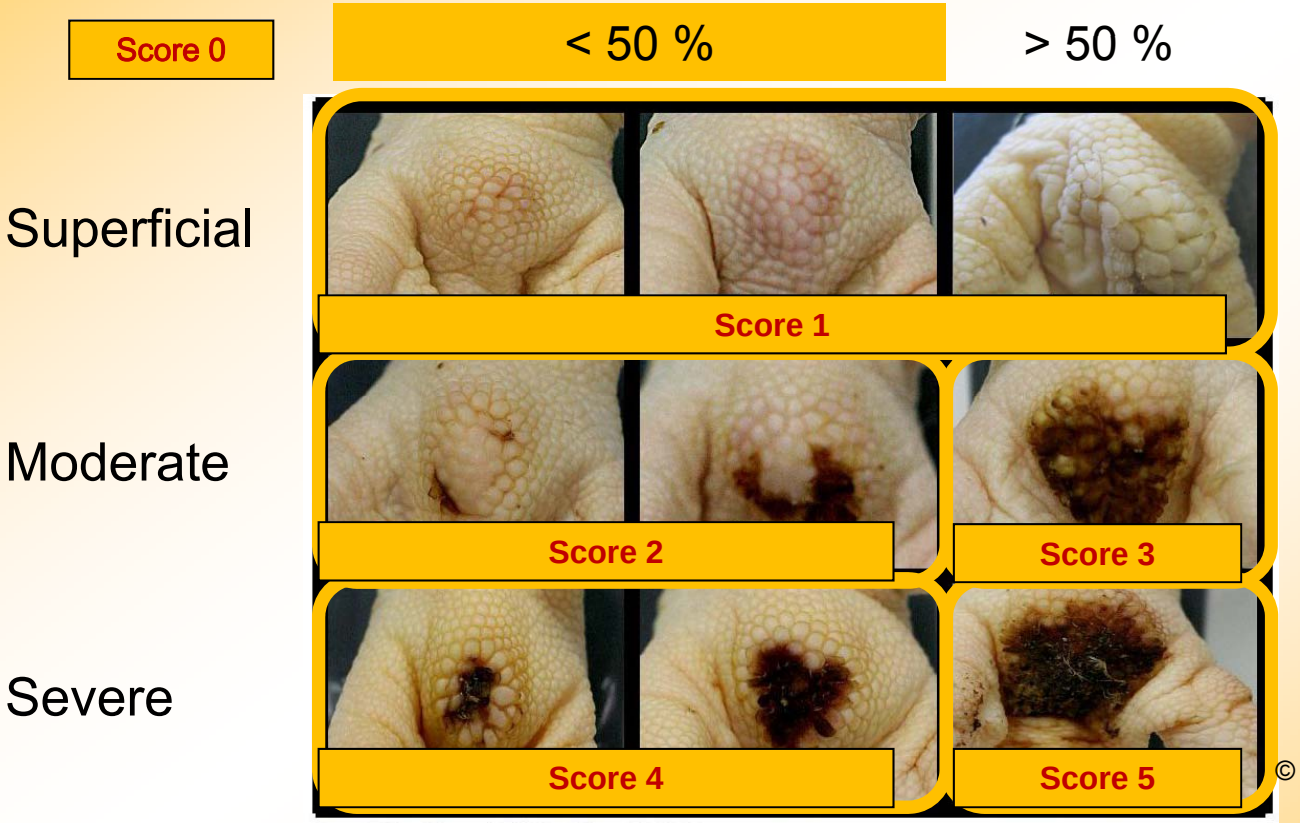
  0 No lesions *Dawkins et al., Nature 2004*
  1 < 5 mm
  2 > 5 mm

*For review: Arnould et al., WQ report 2009; Shepherd & Fairchild, PS 2010*

## How to measure FPD?

Scoring systems based on a

**combinaison of severity & surface area**




*Allain et al., BPS 2009; Michel et al, BPS in press*

➡ **Several scoring systems**
**Comparisons between studies are difficult**

- **FPD: What is it?**
- **How to measure FPD?**
- **Which incidence in Europe?**
- **What are the causes?**
- **What are the consequences?**
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# Which incidence in Europe?

- **Difficult to establish the exact prevalence of FPD in Europe** *EFSA, 2010*

  Lack of data from the industry, scoring systems vary

  - **19 %** UK (114 flocks) *Dawkins et al, Nature 2004*
  - **> 70 %** Portugal (765 birds), France (55 flocks)
    All flocks had lesions, severe in **16 / 24 flocks** Italy
    *Gouveia et al, AW 2009; Allain et al, BPS 2009; Meluzzi et al, BPS 2008*
  - **87 %** Japan (45 flocks) *Hashimoto et al, AP 2011*

  - **98 %** males & **99 %** femelles Germany (54 flocks)
    *Krautwald-Junghanns et al, PS 2011*

➡ **Prevalence is certainly high**

## Which incidence in Europe?

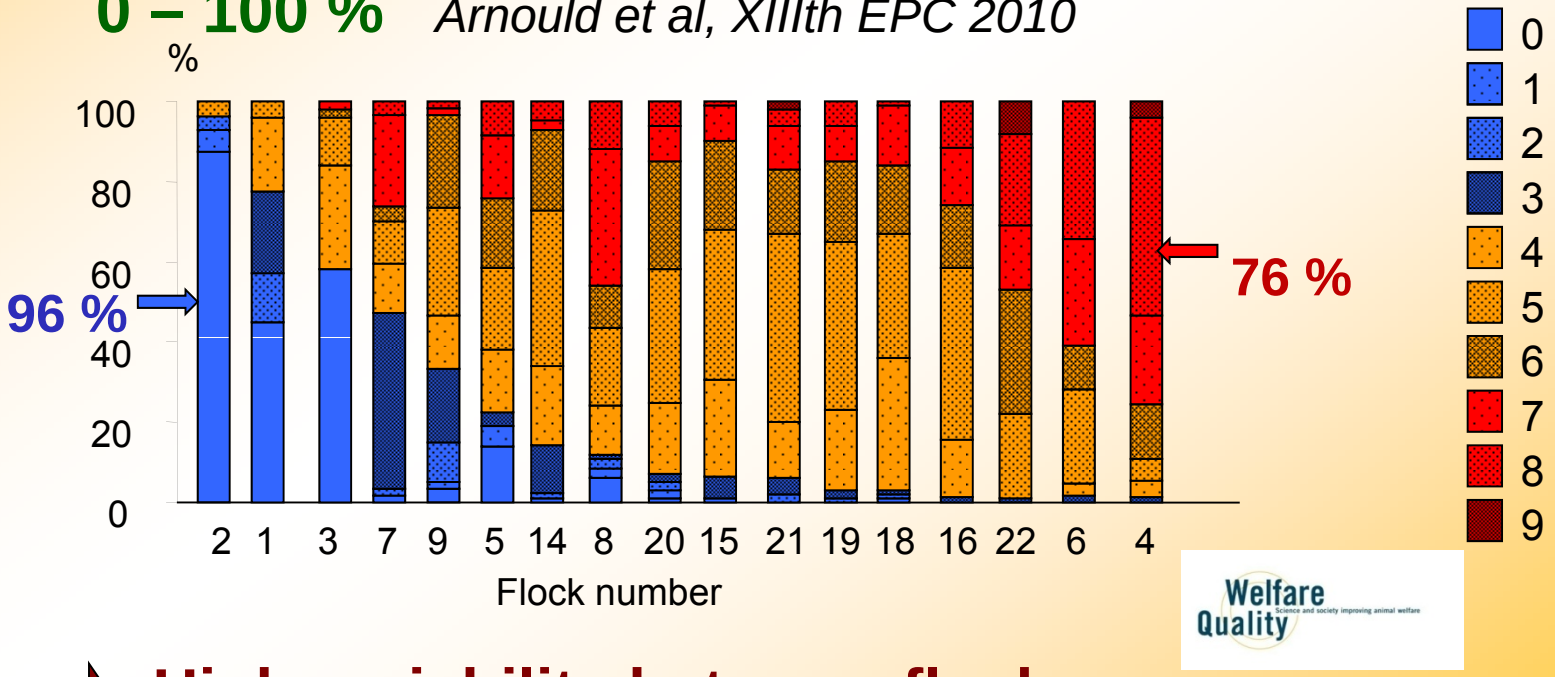
- **Results vary according to the flocks**

**0 – 48 %** *Dawkins et al., Nature 2004*

**2 – 76%** *Arnould & Colin, 8e JRA 2009*

**1 – 90%** *Melluzzi et al., BPS 2008*

**0 – 100 %** *Arnould et al, XIIIth EPC 2010*




**High variability between flocks**
**It is possible to obtain low levels of FPD**

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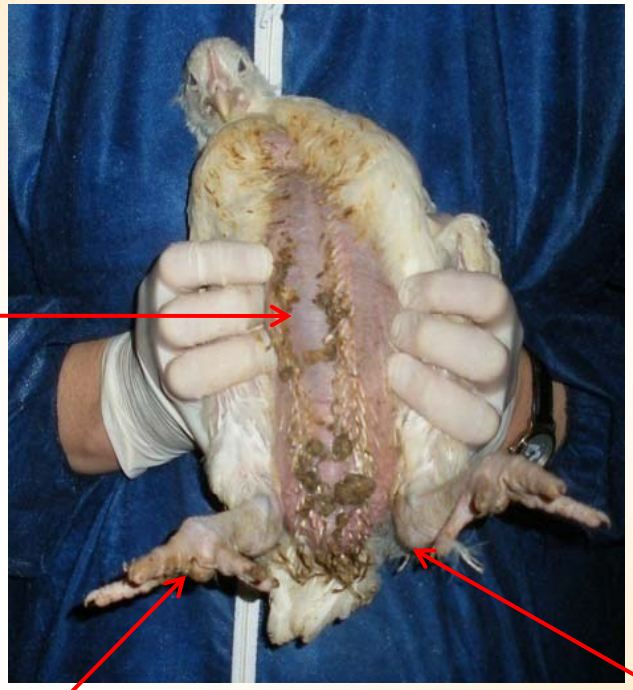
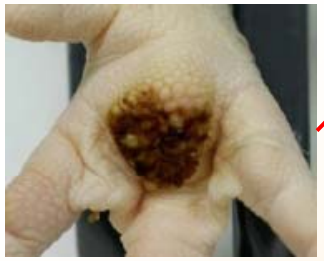
# What are the causes?

- **Occur at body sites in contact with the litter for prolonged period**



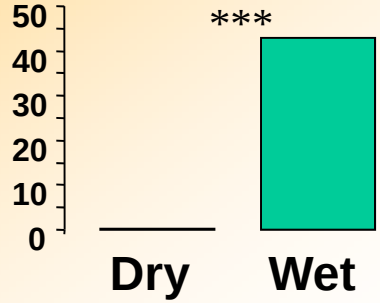


## What are the causes?

- **Wet litter**

  prevalence or severity  ↗ when litter is wet

  - Area of foot affected by scab (%)




*Martland, AP 1985*

- Wet litter has been identified as a **risk factor** (> 12 papers)

  *Bradshaw et al, APBR 2002; Shepherd & Fairchild, PS, 2010*

- Welfare Quality 91 flocks – 5 countries (2007-2009)

With ↘ litter quality, the percentage of birds with moderate or severe FPD ↗

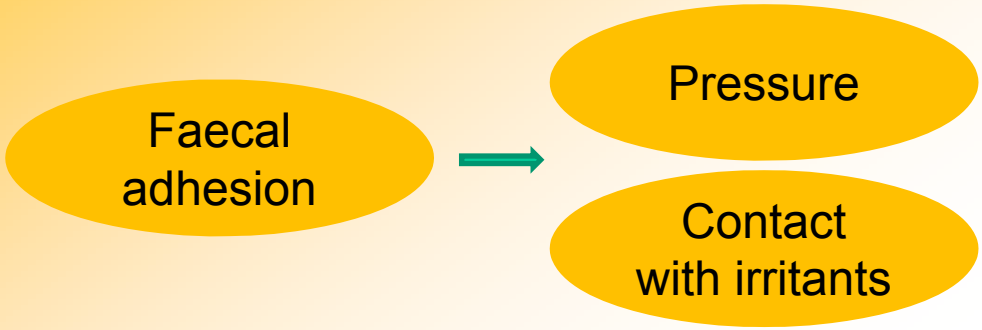
Rise with **12.9%** per litter-scoring unit (5 point-scale)

*Bassler et al, 5e Int Conf WAFL 2011*

➡ **Wet litter is probably the most important factor**

## What are the causes?

- Wet litter ↗ the chance of




Ammonia = causative agent?

Skin more prone to mechanical damages?

- Other risk factors are:
  - Type of water system
  - Litter depth
  - Type of litter & flooring beneath the litter
  - Age at slaughter
  - Season
  - Stocking density

**Appropriate environmental conditions**

*Bradshaw et al, APBR 2002; Shepherd & Fairchild, PS, 2010*

## What are the causes?

- Other factors that may accelerated litter deterioration are:
  - Nutritional factors
    - Indigestible carbohydrates (non starch polysaccharides)
    - High dietary fat level & fat sources of poor digestibility
    - Protein levels and sources ?

→ **↗ digesta viscosity**
**sticky consistency**

**Few data available & inconsistent results**

  - Diarrhoea resulting from intestinal disorders

*Shepherd & Fairchild, PS, 2010*

➡ **All factors that increased water content of the litter contribute to FPD**

## What are the causes?

- **Is there other causes than wet litter?**
  - Occured very early (D7 – D10)


*Green et al AP 1985; Hashimoto et al, AP 2011*
*Mayne et al, BPS 2006*


D9: 5 / 345 (1,45%) have moderate FPD

*Olivère et al, 9e JRA 2011*



Hyperkeratosis, epithelial hyperplasia, moderate erosion, inflammation

➡ **Suggest other risk factors than wet litter**
as no litter deterioration at these ages
Mechanical or chemical factors?

Inflammatory immune response rather than an allergic reaction to an environmental stimulus

*Mayne et al AP 2007*

## What are the causes?

- **What about genotypes?**
  - Prevalence of FPD varied according genotypes

    **74.5 %** vs **51.3 %** p<0.01 *Allain et al, BPS 2009*

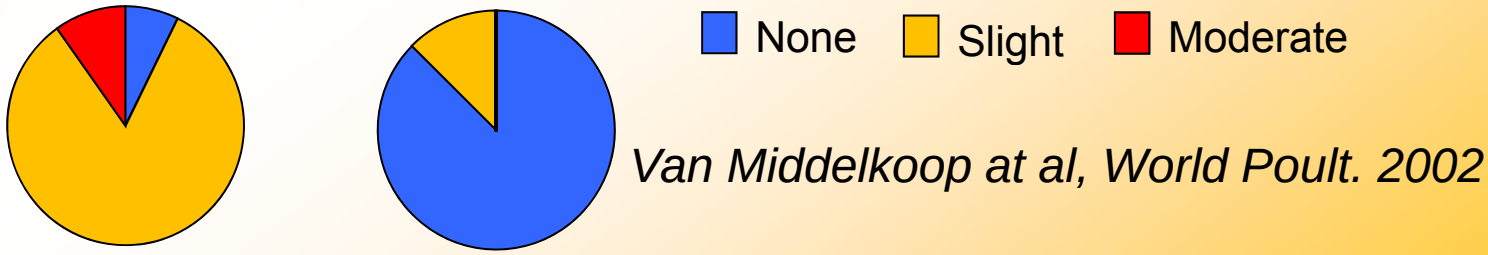
    *Sanotra et al AW 2003, Haslam et al BPS 2007, Ask PS 2010*

  - Confirmed in experimental unit
    - Flocks with 2 genotypes mixed

      FPD score at D35:

      **2.50** vs **2.32** p=0.01 *Olivère 2010*

    - Fast GR and slow GR, same weight




*Van Middelkoop at al, World Poult. 2002*

➡ **Genetic variations in the propensity to develop FPD**

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# Consequences on carcass quality

- **Visual aspect of the carcasses**
  - **Unsightly lesions**

    ➡ Downgrades and condemnations (market)

    Two-year survey (UK) average incidence of HB **20%**

    *Pattison 1987 cited in Bradshaw et al, APBR 2002*
  - **Consequences on consumer purchases if can be seen on the point of sale**

    Fresh whole chickens of British Farm Standard Grade A quality

    11 supermarkets, 8 companies *Broom & Reefman, BPS 2005*

    **82%** (302 / 370 whole chickens)
- **Portal entry for bacteria**

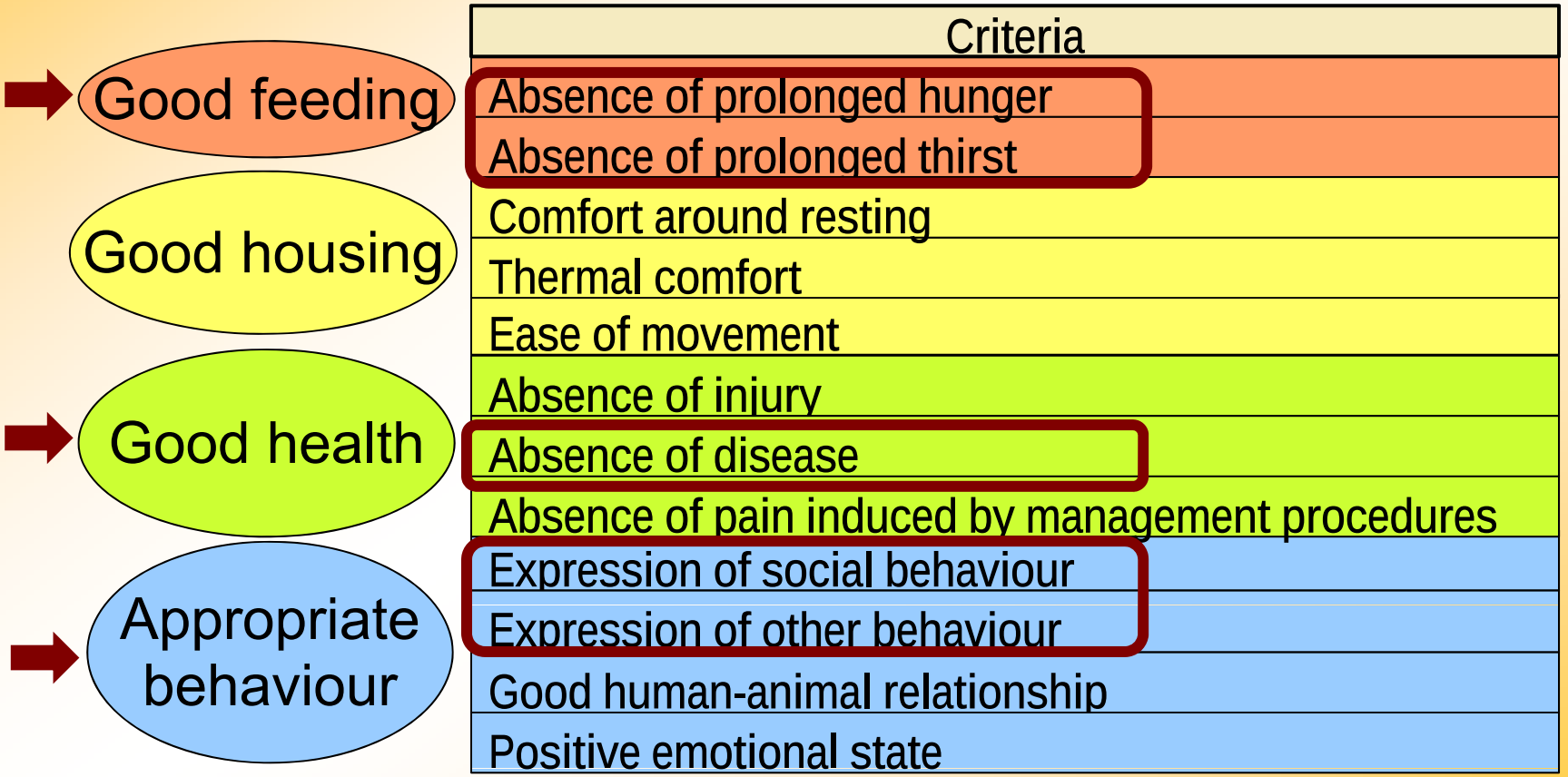
  ➡ Food safety *Jensen et al, PS 1970; Hester , PS 1994*

  Never been evidenced

# Consequences on animal welfare

- **Animal welfare = multidimensional concept**

→ Physical & mental states




*Botreau et al, AW 2007; AW 2009*

## What are the consequences? Animal welfare

- **Pain**
  - Pathology of the condition suggests it is **extremely painful** - Ulcerations and inflammatory reactions


  - Bird behaviour

Broilers. Reluctant to move and lame *Green et al, AP 1985*

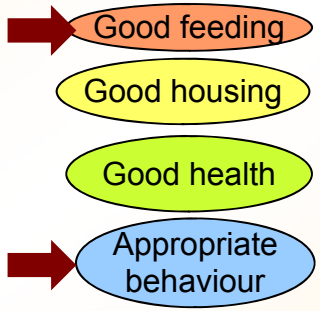
Turkeys. Reluctant to stand *Martland, AP 1984; Mayne et al, BPS 2007*

- Handling of the foot pads produced an obvious pain reaction *Martland, AP 1984*

  Correlation between FPD severity and presence of struggling *Arnould and Colin, 4th Int Workshop on WAFL 2008*

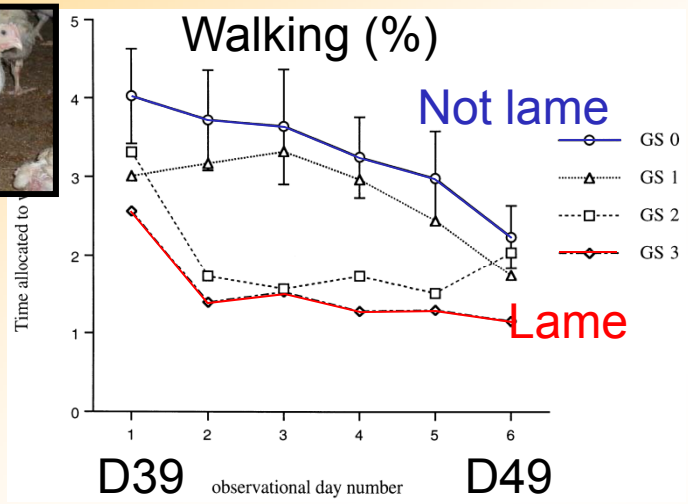
➡ **Probably painful in severe cases**
**even if there is no clear experimental demonstration**

## What are the consequences? Animal welfare




- **Inability to perform certain behaviour**
  clearly impaired welfare as a consequence
  feeding, drinking, walking, preening, scratching

*SCAHAW 2000; Botreau et al, AW 2007*




| | Not lame | Lame | |
|---|---|---|---|
| Laying | **86** | **76** | * |
| Standing eating | **4.7** | **3.1** | *** |
| Preening | **10** | **8** | ** |

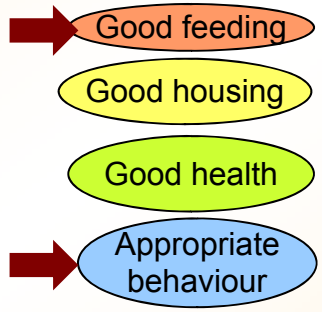
*Weeks et al, AABS 2000*

Broiler chickens severely lame suffer of dehydratation

*Butterworth et al, AABS 2002*

➡ **Lameness when severe affect the behaviour of broilers**

## What are the consequences? Animal welfare




- Inability to perform certain behaviour:

**What about the effect of FPD?**

*Green et al, AP 1985* Chicken are reluctant to move and lame

*Martland et al, AP 1985* Chicken grown on wet litter became dirty, when those reared on dry litter remained active and clean

BUT no measure performed

+ 0.38

**+ 0.53**

Plumage dirtiness

*Arnould & Colin, WPSJ 2009*

Correlation activity - pododermatitis

n = 29

Spearman rho = **- 0.41** *****

*Arnould & Colin, 4th Int Workshop on WAFL 2008*

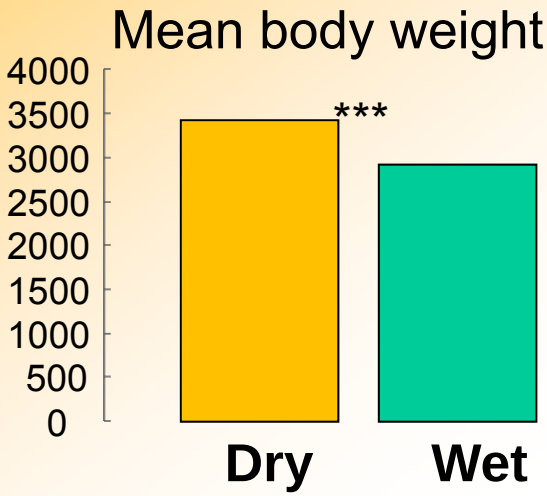
**Suggest relationship between activity and FPD**
**BUT need to be confirmed**

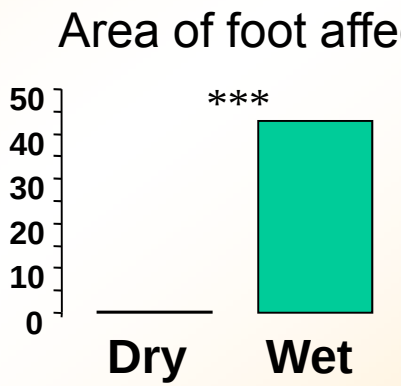
## What are the consequences? Animal welfare

Good feeding
Good housing
Good health
Appropriate behaviour

- **Effect of contact dermatitis (FPD and HB) on growth rate**

N=10 birds




*Martland, AP 1985*
*Martland, AP 1984 (turkeys)*

Survey on 986 flocks

Flocks which did not reach their average target weight


↗ 13%


↗ 33%

*Mc Ilroy et al, AP 1987*

**Painful locomotion**
**Birds on wet litter may lose more energy (conductance, evaporative cooling)**

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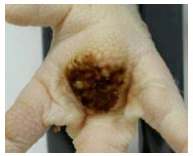
# How to prevent FPD?



- **Management practises**

  **Provision and maintenance of dry litter**

  Monitoring litter condition, replacing damp area by fresh litter, reducing water leakage…

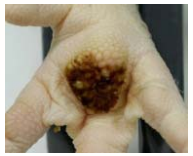
  Getting water consumption and faecal consistency under control (constituents of the feed)

  Control of humidity, temperature, ventilation is essential
  - to encourage evaporation of litter moisture
  - to prevent condensation

  Maintain good **ventilation** during winter

*Bradshaw et al, APBR 2002*

## How to prevent FPD?



- **Selection**

  Commercial broiler hybrid (fast growing strain)

  Commercial pure lines *Kjaer et al PS 2006; Ask, PS 2010*

ns

**0.31, 0.21, 0.08** **0.08 – 0.10**

**- 0.51**, - 0.08, + 0.08 Body weight ns

➡ **- Selection against the propensity to develop FPD and HB is possible**
**- Important to select for FPD and HB**
**- Ignoring FPD could lead to an increased propensity to develop FPD**

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# Conclusion

- **FPD is widespread in Europe but also outside Europe**
- **It is a welfare problem and also have economical consequences**
- **Some of the factors that affect their incidence and severity are understood – litter moisture**

  However, there is still a need to understand the factors involved when lesions appear early in the life of the birds

  **Selection** is probably a contributing factor

## Conclusion

**One of the challenges of the poultry production in the next future**

**to decrease the prevalence of contact dermatitis and especially FPD**

➡ **Actions at farm level**
**BUT ALSO at the level of breeding companies**

**will be necessary**

# Collaborators

- **Laure BIGNON, Luc MIRABITO**
  Institut Technique de l'
- **Virginie MICHEL**
  Agence Nationale de S

**Muchas gracias por su atención**

- **Team Neurobiologie, comportement, adaptation**
  INRA Tours-Nouzilly

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## What are the causes?

– Allergic reaction to an environmental stimulus (litter) or inflammatory immune response?

*Mayne et al AP 2007*

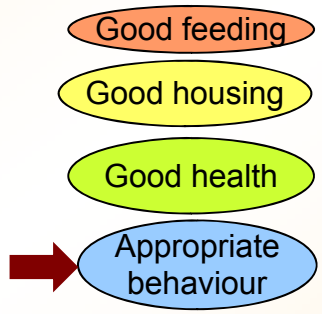
After 48h on wet litter  Wet > Dry

- Large increase of CD4+ & CD8+ T lymphocytes, macrophages, IL-1β, IL-6, IFN-γ
- Small changes for IL-13

Cytokine and cellular changes indicative of an **inflammatory immune response rather than an allergic reaction**

➡ **Early development of FPD is likely due to mechanical factors rather than chemical ones**
More researches are needed

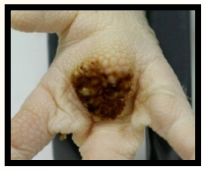
## What are the consequences? Animal welfare




- **Effect on fear response**

52- wk-old cocks in cages n=36 / treatment

*Campo et al, PS 2005*



Tonique Immobility duration

*Gallup, AB 1979*

**495 s** **407 s** **p < 0.05**

➡ **Cocks with FPD are more fearful**
**FPD affect negatively bird welfare**