Satisfying natural behaviour in dairy cows – Effects on welfare and production

Karin Schütz, AgResearch Ltd
NAWRDE, Melbourne 7 November 2018
Natural behaviours in dairy cows
Other natural behaviour
Which behaviours are important for welfare?

Grazing/Foraging (including manipulating feed, Lindström & Redbo 2000), resting and ruminating to maintain health and production
Lying behaviour

- Lying behaviour is an important welfare indicator \((Haley et al. 2000)\)
- Cows on pasture spend 10-12 h/day resting
- Cows prefer and spend more time lying on soft and dry surfaces \((Tucker et al. 2003, 2009, Fregonesi et al. 2007, Schütz & Cox 2014)\)
Lying behaviour

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- Cows on pasture spend 10-12 h/day resting
- Cows prefer and spend more time lying on soft and dry surfaces (Tucker et al. 2003, 2009, Fregonesi et al. 2007, Schütz & Cox 2014)
- Lying deprivation is associated with:
  - possible immunosuppression (Chen et al. 2017, Davis et al. 2008)
- Cows will lie down rather than eat after a period of deprivation of both (Metz 1985)
Which behaviours are important for welfare?

Adaptive behavioural responses to maintain normal body temperature and avoid heat and cold stress
Which behaviours are important for welfare?

Grooming and keeping clean important to health

(Moncada et al. 2018, Schütz et al. 2018)
Which behaviours are important for welfare?

Grooming and keeping clean important to health (Moncada et al. 2018, Schütz et al. 2018)

What does it mean to have a social bond (relative or friend)?
How important is access to pasture?
How important is access to pasture?

Pasture preference is complex: between 9 to >70% of time is spent on pasture.
Preference for pasture depends on several factors

- **Season** *(Krohn et al. 1992, Charlton et al. 2011)*
- **Weather conditions** *(Legrand et al. 2009)*
- **Location of food** *(Charlton et al. 2011)*
- **Distance between indoor housing and pasture** *(Spörndly & Wredle 2004, Charlton et al. 2013)*
How strong is the motivation for pasture?
How strong is the motivation for pasture?

Von Keyserlingk et al. 2017
## Restriction of natural behaviour in dairy production systems?

<table>
<thead>
<tr>
<th>System</th>
<th>Self-groom</th>
<th>Turn around</th>
<th>Take several steps</th>
<th>Spend most of day in movement</th>
<th>Run/play</th>
<th>Lie in all positions</th>
<th>Choose where to spend time</th>
<th>Graze</th>
<th>Select diet</th>
<th>Access roughage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tethered calf stalls</td>
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<td></td>
<td></td>
<td>Yes/no³</td>
</tr>
<tr>
<td>Individual calf pens</td>
<td>Yes/Limited⁴</td>
<td>Yes/Limited⁴</td>
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<td></td>
<td>Yes/no³</td>
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<tr>
<td>Group housed calves</td>
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<td></td>
<td></td>
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<td></td>
<td></td>
<td>Yes/no³</td>
</tr>
<tr>
<td>Calf hutches with yard</td>
<td></td>
<td></td>
<td>Yes/Limited</td>
<td>Limited</td>
<td></td>
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<td></td>
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<td></td>
<td>Yes/no³</td>
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<tr>
<td>Tie stall without turnout</td>
<td></td>
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<td></td>
<td></td>
<td>Yes</td>
</tr>
<tr>
<td>Freestall</td>
<td></td>
<td></td>
<td></td>
<td>Yes/Limited⁵</td>
<td>Limited⁵</td>
<td>Limited/No³</td>
<td></td>
<td></td>
<td></td>
<td>Yes/Limited⁵</td>
</tr>
<tr>
<td>Drylot</td>
<td></td>
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<td></td>
<td>Yes/Limited⁵</td>
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<td></td>
<td>Yes</td>
</tr>
<tr>
<td>Pasture</td>
<td></td>
<td></td>
<td></td>
<td>Yes/Limited⁵</td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td>Yes</td>
</tr>
</tbody>
</table>
Natural behaviours restricted for a reason

Cow-calf bond
Natural behaviours restricted for a reason

Cow-calf bond  Grazing/foraging/access to pasture
How can natural behaviour be satisfied?

- Opportunities for natural behaviour can be given by providing more space and “high quality space”, eg for walking and resting
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- Providing resources, such as brushes, outdoor access and shade & shelter
How can natural behaviour be satisfied?

- Opportunities for natural behaviour can be given by providing more space and “high quality space”, eg for walking and resting
- Providing resources, such as brushes, shade & shelter and outdoor access
- Utilising alternative systems, eg to keep cow/calf together (Johnsen et al. 2016)
What are the benefits to welfare and production?

- Providing opportunities for natural behaviour is often an effective way to satisfy the needs of animals and provide emotionally positive experiences.

- Benefits to welfare and production will depend on the behaviour and situation.
Mud & Wetness:

- Reduce production *(Stull et al. 2008)*
- Increase the risk of lameness & mastitis *(Borderas et al. 2004, Schreiner & Ruegg 2003)*
- Increase energy requirements *(Degen & Young 1993, Dijkman & Lawrence 1997)*
- Reduce lying times *(Fisher et al. 2003, Chen et al. 2017)*
Factors influencing decision making about satisfying natural behaviours

- Level of understanding
- Individual beliefs
- Cost/benefit information
- Practical solutions
- Financial drivers
- Public/consumer perception & values
- Retailers
- Available scientific information
- Animal welfare standards/frameworks
Summary

- Providing opportunities for expression of natural behaviour is effective to satisfy cow needs and promote positive experiences at the same time as maintaining health and production.

- Information about natural behaviour in combination with what really matters to the animals can help guide development of management systems and provide solutions for issues in existing systems.
Thank moo!
How strong is the motivation for pasture?
How strong is the motivation for pasture?

- During the day, pasture use declined with increasing distance.
- Cows were willing to walk longer distances at night to access pasture (Charlton et al. 2013)
Individual calf pens

Pasture-based systems

Calf hutches with yard

Plenty of high quality space & opportunity for movement

Tethered calf stalls

Group-housed calves

Drylots

Food is limited & diet composition inappropriate

Food is abundant & diet composition appropriate

Free-stalls

Tie-stalls with turnout

Tie-stalls

No space or opportunity for movement
Satisfying natural behaviour in laying hens: Effects on welfare and production

Dr Dana Campbell | Research Scientist, CSIRO
November 7, 2018
Laying Hen Industry
Commercial Layer Production

Great-grandparent → Grandparent → Parent breeding flocks

Eggs to incubator → Day-old chicks to rearing farm → 16-17 week pullets to layer farm → Depopulation around 70+ weeks
Junglefowl Production

- Small groups – mixed sex
- Social hierarchy
- Territories
- Breeding season
- Hen-chick bond
Domesticated Hens
Junglefowl Behaviour

Time budgets of semi-wild junglefowl

Dawkins, 1989
Modern Hen Behaviour

- Nest box use
- Dust bathing
- Foraging and scratching
- Perching
Junglefowl vs. Modern Layer

- Modern layers exhibited energy-conserving behaviours (Schütz et al., 2001; Schütz and Jensen, 2001)
- Junglefowl exhibit more contrafreeloading (Lindqvist et al., 2002)
- Modern layers display low proportion of time foraging (Campbell et al., 2017)
Measuring Behavioural Needs

- Observe daily patterns
- Sham dust bathing, pre- lay behaviour, foraging in feed troughs
- Remove resources
- Frustration
- Preference testing
Behavioural Needs, Priorities, and Preferences
(Weeks and Nicol, 2006)

• Hens instinctively perform pre-lay/nest building behaviour – will work to gain access to an enclosed nest site

• Hens use perches and may work to gain access, preferentially roost high at night

• Foraging is a behavioural need, will still forage when there is a cost

• Dust bathing is a behavioural need, but the value placed on it is uncertain

Abnormal behaviours

• Feather-pecking
• Aggression
• Cannibalism
• Smothering
Animal Well-Being

- Health
- Production
- Natural behaviour
- Stress
- Disease
- Emotional states
Modern Layer (Enriched) Environments
Additional Enrichments
Problems of Commercial Layer Production

- Keel bone fractures
- Feather pecking
- Cannibalism
- Footpad dermatitis
- Disease spread
- Mortality
- Environmental conditions
- Reduced production
Implementing ‘Safe Enrichments’

Soft Perches in an Aviary System Reduce Incidence of Keel Bone Damage in Laying Hens
Ariane Stratmann, Ernst K. F. Fröhlich, Alexandra Harlender-Matauschek, Lars Schrader, Michael J. Toscano, Hanno Würbel, Sabine G. Gebhardt-Henrich
Published: March 26, 2015 • https://doi.org/10.1371/journal.pone.0122568

A review of environmental enrichment for laying hens during rearing in relation to their behavioral and physiological development
D L M Campbell, E N de Haas, C Lee
Poultry Science, pey319, https://doi.org/10.3382/ps/pey319
Published: 11 August 2018

Access to litter during rearing and environmental enrichment during production reduce fearfulness in adult laying hens
Margrethe Brantsdatter, Fernando M. Tahamtani, Janicke Nordgreen, Ellen Sandberg, Tone Beate Hansen, T Gis Rodenburg, Randi Cipermann Moe, Andrew Michael Janzczak

April 2017 Volume 189, Pages 49–56
Individual Variation

Campbell et al., 2017

Rufener et al., 2018
## Animal Health & Well-Being

**KEY:**
- **EC** - Enriched Colony (EC)
- **AV** - Cage-Free Aviary (AV)
- **CC** - Conventional Cage

### Impact Scale

<table>
<thead>
<tr>
<th>IMPACT SCALE</th>
<th>NEGATIVE IMPACT</th>
<th>CC</th>
<th>POSITIVE IMPACT</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>-4</td>
<td>-3</td>
<td>-2</td>
</tr>
<tr>
<td></td>
<td>Exceptionally Worse</td>
<td>Substantially Worse</td>
<td>Worse</td>
</tr>
</tbody>
</table>

### Metrics

- **Mortality**
  - EC
  - AV

- **Behavior**
  - EC
  - AV

- **Cannibalism/Aggression**
  - EC
  - AV

- **Keel Damage**
  - EC
  - AV

- **Tibia/Humerus Strength**
  - EC
  - AV
Conclusions

• Natural behaviours are important for laying hens
• Enrichments, particularly housing design will increase expression
• Housing design can also have negative impacts on health, behaviour, welfare
• Research to continue optimising system design is necessary
• Critical to understand the interplay between hen welfare, ethics, economics, and commercial feasibility
Satisfying natural behaviour in meat chickens, effects on welfare and production

Dr Peta Taylor
University of New England
Meat chicken behaviour & welfare

Why has the behavioural time budget changed, and does it matter?

What has shown to alter behaviour & what are the implications for welfare

A new approach?
Red Jungle Fowl time budget
Schütz & Jensen (2001)

Meat chicken time budget
What has altered meat chickens behavioural time budget?

- **Resource allocation**
  - *Energy*

- **Morphology**

- **Environment**
  - *Restriction*

**Reduced motivation**
Environment

Free-range meat chicken time budget

Heterogeneous
Season dependent
Increased 2 weeks then stabilised

Leg health
Increased plumage cover
Decreased fearfulness & stress physiology

Growth rate
Decreased Litter quality & FPD

References: (Taylor et al., 2017a, 2017b, 2018; Haslam et al., 2006; Pagazaurtundua & Warriss, 2006; Dal Bosco et al., 2010)
Environment
Pecking objects

Use
2%

Welfare
↔ Fearfulness, growth, stress physiology or leg health

(Taylor et al., 2015)
Environment
Perches & platforms

Use

2 – 25 %
Platform preference (Bailie & O’Connell, 2016)
↑ with ↑ SD

Welfare

↑ Leg health (Groves & Muir, 2013; Kaukonen et al., 2016)
↔ Leg health (Bailie and O’Connell, 2015; Su et al, 2000; Ventura et al, 2010)
↓ FPD (Ventura et al., 2010)

Risk

Breast burn/blisters (Bessei, 2007)
Environment

Hay bales & Barriers

Use

✅ Cluster (Kells et al., 2001; Bailie et al., 2013; Bergmann et al., 2017)

Welfare

↑ Leg health (Bailie et al., 2013)

Altered tibia morphology (Bizeray et al., 2002)

Risk

⚠️ Biosecurity risk

↑ mortality (Gordon & Forbes, 2002)

Bergmann et al., 2017
Can we attempt to use natural behaviour / natural environment to develop effective enrichment programs for meat chickens?
1 Day old Hatch

Day old knows mother hen call

10-12 days old Disperse

14 days old Pecking order est.

16 days old Pecking order est.

21-25 days old Thermo-regulation

6 weeks old Perch with hen

12-16 weeks Hen drives out chicks
Can the provision of particular characteristics of the maternal environment improve meat chicken behaviour and welfare?
### Maternal Environment

Darkness & warmth

<table>
<thead>
<tr>
<th>Practical mimicry</th>
<th>Outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td>40min:40min L:D</td>
<td>↑ Rest, ↔ FCR, ↔ Growth (Malleau et al., 2007)</td>
</tr>
</tbody>
</table>

Bergmann et al., 2017
### Maternal Environment
Vocalisations

<table>
<thead>
<tr>
<th>Practical mimicry</th>
<th>Outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vocalisation playback</td>
<td>↓ chick stress response (Edgar et al., 2015)</td>
</tr>
<tr>
<td></td>
<td>↓ FCR, ↑ body weight (Woodcock et al., 2004)</td>
</tr>
</tbody>
</table>

Cluck!
Maternal Environment

Olfaction

<table>
<thead>
<tr>
<th>Practical mimicry</th>
<th>Outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hen preen gland secretions (MHUSA)</td>
<td>↓ stress response, ↔ body weight, ↑ carcass weight, ↓ downgrades at slaughter (Madec et al., 2008)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>Males</th>
<th>Females</th>
</tr>
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<tbody>
<tr>
<td></td>
<td>Control</td>
<td>MHUSA</td>
</tr>
<tr>
<td>Suffocated (%)</td>
<td>1.11 ± 0.11</td>
<td>1.36 ± 0.12</td>
</tr>
<tr>
<td>Scratched (%)</td>
<td>22.0 ± 0.41</td>
<td>8.0 ± 0.27</td>
</tr>
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</table>
Conclusions

The welfare implications of meat chicken behaviour are not fully understood, but will reveal the implications for welfare.

Mimicking the maternal environment may improve welfare.

Care must be taken before recommendations are made.
Acknowledgements

Professor Jean-Loup Rault
Professor Paul Hemsworth
Professor Peter Groves
Dr Sabine Gebhardt-Henrich
AWSC staff & students
Environmental enrichment
What do chickens want?

Newberry (1999)

1. Essential resources: Heat, food & water
2. Supplementary resources: Peat moss, hay bales
3. Novel objects
4. No resources
Resource allocation theory

Energy conservation for growth is achieved by reducing motivation to perform other energy-demanding behaviours.

Contrafreeloading (CFL)

Lindqvist et al., (2006)

Age  
Bizeray et al., (2000)

2 – 3 days of age

CFL (%)

Meat chickens  Laying hens

Time (s)

Walking  Running  Standing

Slower growing  Faster growing
Morphology

Reduction in activity by around 4-5 weeks of age is well known and documented.

Faster growing (○) Slower growing (■)

Bokkers & Koene (2003)