ANIMAL WELFARE AS A PILLAR OF A SUSTAINABLE CATTLE BREEDING

Giulio Cozzi
Who could benefit of a routine application of the welfare assessment scheme?

FARM ANIMALS - better health and welfare

FARMERS - increase farm economics by reducing medical treatments & culling rates and by improving animal performance
Who could benefit of a routine application of the welfare assessment scheme?

PUBLIC AUTHORITY - valid tool to certify a given welfare level, pay/ negate the EU-CAP subsidy

CONSUMERS - recognize and choose animal products with a true intrinsic added value coming from a “welfare friendly” rearing systems

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Definition of animal welfare

The welfare of an individual is its physical and mental state as regards its attempts to cope with the surrounding environment (Broom, 1991)

.... even animals with normal productive and reproductive performance may be in a state of poor welfare when kept in unsuitable conditions or ill-treated

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Housing factors
- type of housing (free or tied)
- space allowance
- number of cubicles
- type of pen floor
- manger space
- drinking points...

Social / hierarchical factors
- number of pen mates
- age and parity
- body weight
- gender of the animals...

Microclimate conditions
- temperature
- humidity
- air speed and quality
- photoperiod & light intensity...

Management factors
- feeding plan
- diet preparation
- regrouping
- prophylaxis...

Surrounding environment

Human-animal interaction

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## Welfare indicators in dairy cattle

<table>
<thead>
<tr>
<th>Productive</th>
<th>Physiological</th>
<th>Pathological</th>
<th>Behavioural</th>
</tr>
</thead>
<tbody>
<tr>
<td>Milk yield</td>
<td>Hearth rate</td>
<td>Skin lesions &amp; wounds</td>
<td>Lying time and postures</td>
</tr>
<tr>
<td>Milk quality</td>
<td>Respiratory rate</td>
<td>Lameness</td>
<td>Locomotion</td>
</tr>
<tr>
<td>Feed intake</td>
<td>Rectal temperature</td>
<td>Mastitis</td>
<td>Feeding behaviour</td>
</tr>
<tr>
<td>BCS</td>
<td>SCC</td>
<td>Abortions</td>
<td>Aggressiveness</td>
</tr>
<tr>
<td>Days open</td>
<td>Cortisol</td>
<td>Distocia</td>
<td>Stereotypes</td>
</tr>
<tr>
<td>Conception rate</td>
<td>Blood parameters</td>
<td>Metritis</td>
<td>Fear for humans</td>
</tr>
<tr>
<td>Cleanliness</td>
<td></td>
<td>Abomasal displacements</td>
<td></td>
</tr>
<tr>
<td>Culling rate</td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>

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Risk factors for dairy and beef cattle welfare
Overcrowding in dairy cattle

Stocking density (SD) and cows activity
(Hill et al., 2006)

<table>
<thead>
<tr>
<th>% of cows:</th>
<th>100%</th>
<th>115%</th>
<th>130%</th>
<th>140%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Resting</td>
<td>71.1</td>
<td>70.0</td>
<td>63.7</td>
<td>58.7</td>
</tr>
<tr>
<td>Feeding</td>
<td>11.8</td>
<td>12.6</td>
<td>14.6</td>
<td>15.4</td>
</tr>
<tr>
<td>Standing in alley</td>
<td>3.9</td>
<td>5.4</td>
<td>8.7</td>
<td>12.6</td>
</tr>
</tbody>
</table>

Cows wasting about 1 h/d standing at 140%

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Overcrowding in a free stall with cubicles

![Graph showing the relationship between n. cubicles/cow and Locomotion (min). The graph indicates a negative correlation, with points scattered across the graph and a line of best fit.]
Overcrowding and behavioural response

- Feeding behavior and greater SD
  - Frequent aggressions and displacements
  - Fewer meals, eating rate increased
  - Increased risk of metabolic disorders
  - Largest effect on subordinate cows

- Rumination behavior and greater SD
  - decreased by 25% at 130% SD (Batchelder, 2000)
  - ~2 h/d less rumination

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Overcrowding and milk quality
(Hill et al., 2006)

<table>
<thead>
<tr>
<th></th>
<th>100%</th>
<th>113%</th>
<th>131%</th>
<th>142%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Milk fat, %</td>
<td>3.84</td>
<td>3.77</td>
<td>3.77</td>
<td>3.67</td>
</tr>
<tr>
<td>SCC, $\times$ 1000/ml</td>
<td>135</td>
<td>114</td>
<td>169</td>
<td>236</td>
</tr>
</tbody>
</table>

- Overstocked cows eat faster, ruminate less
- Overstocked cows experience a greater exposure to environmental pathogens; worse cleanliness

1= Clean
2= Less dirty
3= Dirty
4= Very dirty

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# Overcrowding in beef cattle

## Housing Systems for Beef Cattle (SCAHAW, 2001)

<table>
<thead>
<tr>
<th>Country</th>
<th>Slatted floor</th>
<th>Deep litter</th>
<th>Litter and concrete or slatted floor</th>
<th>Tie stall</th>
<th>other</th>
</tr>
</thead>
<tbody>
<tr>
<td>Belgium</td>
<td></td>
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<tr>
<td>Finland</td>
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<tr>
<td>France</td>
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<tr>
<td>Germany</td>
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<tr>
<td>Ireland</td>
<td>***********</td>
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<tr>
<td>Spain</td>
<td>***********</td>
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<tr>
<td>Sweden</td>
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<tr>
<td>United Kingdom</td>
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<tr>
<td>Italy</td>
<td>****</td>
<td>****</td>
<td></td>
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<td>*</td>
</tr>
</tbody>
</table>

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Overcrowding and behavioural and productive response in beef cattle

Space allowance for finishing beef cattle > 500 kg BW

- Slatted floor <3 m²
- Deep litter <4 m²

- Aggressive behaviour
- Risk of injuries
- Feed intake
- Lying & resting time
- Pen daily gain

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Insufficient manger space

All the pen-mates should have free access to the manger, particularly at the time of feed delivery

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Insufficient manger space and reproduction in dairy cattle

Data from 153 farms

<table>
<thead>
<tr>
<th>Manger space cm/cow</th>
<th>60</th>
<th>30</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cows pregnant at 150 DIM</td>
<td>70 %</td>
<td>35 %</td>
</tr>
</tbody>
</table>

30 cm is easy to obtain in free stalls with 3-row pens

(Caravello, et al., 2006)
Insufficient manger space and beef cattle behavior and performance

(SCAHAW, 2001)

Manger space <60 cm

- aggressions
- displacements
- feed intake
- lying & resting time
- pen daily gain

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Type and quality of the pen floor

- **The pen floor:**
  - is the interface between foot and environment
  - is a reservoir of infections
  - determines the consumption of the horn
  - source of trauma due to slipping or excess of friction

- **Cattle adapt to a given pen floor by**
  - changing their gait
  - modifying the daily time budget spent resting or standing
  - changing time and way of lying down
When cattle is free to choose between floor types they prefer deep litter to slatted floor for resting (SCAHAW, 2001)

On hard floor, the stride length is shorter and the animal walks with closed hocks

On a soft floor the stride length is longer and the animal walks with more open hocks
Type and quality of the pen floor

Effect of the slipperiness of the floor on cattle locomotion (Webb e Nilsson, 1983)

Slipping injures

Motivation to move

slipperiness of the floor

High

Low

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In a comfortable environment, the daily time budget of a dairy cow is made of:

- **12-14 h of rest**
- **3-5 h of feeding with ≥ 10 visits to the manger**

Number of visits and time spent at the manger are strongly related to the walking comfort.
Type and quality of the pen floor

Type of floor in fattening bulls

Criticisms to the fully slatted floor

Anomalous lying sequence (Wierenga, 1987; Andreea, 1979)

Number of transitions (Graf, 1979; Ladewig, 1987)

6-12 times in 24 h on full slats

12-24 times in 24 h on deep litter

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Type and quality of the pen floor

Type of floor and bulls behaviour

- Full slats
- Holed floor
- Rubber covered

(Coazzi, 2011 unpublished data)

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Type and quality of the pen floor

Type of floor and bulls behaviour
(Cozzi, 2011 unpublished data)

**Lying down attempts**
- Slatted: 17.3
- Holed: 10.3
- Rubbered: 1

**Slipping events**
- Slatted: 52
- Holed: 16.5
- Rubbered: 1

**Mounts events**
- Slatted: 4
- Holed: 8.75
- Rubbered: 27

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Type and quality of the pen floor

Type of floor and veal production

Is a fully slatted floor comfortable?

- wooden vs. concrete slats
  - better thermal condition during the cold season
- slippery, hard or splintery wood slats
  - may cause injuries, reduce locomotion & and modify lying-standing behaviours

(Cozzi, 2007)
## Type and quality of the pen floor

### Type of floor and veal production

### Possible solutions (Cozzi, 2007)

#### Rubber mat over slatted or full floor

<table>
<thead>
<tr>
<th>cost</th>
<th>comfort</th>
<th>cleanliness</th>
</tr>
</thead>
<tbody>
<tr>
<td>+++</td>
<td>+</td>
<td>---</td>
</tr>
</tbody>
</table>

#### Deep litter over full floor

<table>
<thead>
<tr>
<th>cost</th>
<th>comfort</th>
<th>cleanliness</th>
<th>meat colour</th>
</tr>
</thead>
<tbody>
<tr>
<td>++++</td>
<td>+++</td>
<td>++/--</td>
<td>??</td>
</tr>
</tbody>
</table>

#### Rubber slat-mat over the slats

<table>
<thead>
<tr>
<th>cost</th>
<th>comfort</th>
<th>cleanliness</th>
</tr>
</thead>
<tbody>
<tr>
<td>++</td>
<td>++</td>
<td>++</td>
</tr>
</tbody>
</table>

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Drinking water availability

Along with fulfilling its requirement, water intake helps cattle to cope with the hot climate (heat dissipation)

Dairy cows should drink 1.5-2 L of water / kg of milk

<table>
<thead>
<tr>
<th>Drinking water</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Milk yield</td>
<td>r = 0.94</td>
</tr>
<tr>
<td>DMI</td>
<td>r = 0.96</td>
</tr>
</tbody>
</table>

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Drinking water availability

- Number of drinking points/pen > 2
- Cows/drinking point < 30 (Perkins, 2001)
- > 6 cm of space at the waterer/cow

Survey in the Eastern Po Valley

<table>
<thead>
<tr>
<th>Sample size</th>
<th>30 dairy farms</th>
</tr>
</thead>
<tbody>
<tr>
<td>Farm size</td>
<td>73 ± 36 cows</td>
</tr>
<tr>
<td>Farms fulfilling at least one recommendation</td>
<td>46%</td>
</tr>
</tbody>
</table>

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Drinking water in veal calves fattening

(Gottardo et al., 2002)

Oral stereotypes

* P< 0.05
Provision of drinking water in veal calves

- Absolutely necessary during the hot season
- To be increased according to the intake of solid feeds

Correct amount
Supply systems

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### Microclimatic conditions

#### Temperature - Humidity Index (THI)

<table>
<thead>
<tr>
<th>Temperature (°C)</th>
<th>Humidity (%)</th>
<th>Index</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>5</td>
<td>1</td>
</tr>
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<td></td>
<td>10</td>
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<td>85</td>
<td>17</td>
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<td>90</td>
<td>18</td>
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<tr>
<td></td>
<td>95</td>
<td>19</td>
</tr>
<tr>
<td></td>
<td>100</td>
<td>20</td>
</tr>
</tbody>
</table>

**NO HEAT STRESS**

**MILD HEAT STRESS**

**HEAT STRESS**

**SEVERE HEAT STRESS**

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Cattle response to heat stress

- Increase heart & respiratory rate;
- Increase body temperature;
- Alteration of electrolytic balance
- Metabolic alkalosis
- Immunosuppression
- Loss of DMI
- Drop in milk yield
- Low fertility rate
Microclimatic conditions

Noxious gasses concentration in cattle

<table>
<thead>
<tr>
<th>Gases</th>
<th>Threshold</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ammonia</td>
<td>20</td>
<td>ppm</td>
</tr>
<tr>
<td>Hydrogen sulphide</td>
<td>5</td>
<td>ppm</td>
</tr>
<tr>
<td>Carbon dioxide</td>
<td>3000</td>
<td>ppm</td>
</tr>
<tr>
<td>Carbon monoxide</td>
<td>30*</td>
<td>ppm</td>
</tr>
</tbody>
</table>

*Reference threshold for humans

EFSA 2006
Microclimatic conditions

Ammonia toxicity in veal calves

Risk for respiratory diseases at NH$_3$ levels < 6 ppm

Lungborg, 2005
Quality of the stockmanship

Good farm management practices

- routine health inspection of the herd
- transfer of sick, lame or recumbent animals to dedicated infirmary pens
- use of medical treatments to avoid pain induced by routine mutilations (i.e. disbudding, castration)
- routine analysis of feedstuffs and diets to fine tuning cattle feeding program
- attention towards the cleanliness of housing facilities
- introduction of specific solutions for cattle handling and loading/unloading
Where are we?

Anyone seen my horns?
Use of drugs during the procedure – Dairy farms (%)

DISBUDDING (89%)

If yes (% of farms):
- Sedation (SED) 18.2
- Local Anaesthesia (LA) 54.1
- Analgesia (AG) 4.0
- SED+LA 14.2
- SED+AG 2.5
- LA+AG 0.8
- SED+LA+AG: 6.2

DEHORNING (11%)

If yes (% of farms):
- Sedation (SED) 34.5
- Local Anaesthesia (LA) 35.0
- Analgesia (AG) 1.7
- SED+LA 17.9
- SED+AG 0.7
- LA+AG 0.7
- SED+LA+AG: 9.4

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Lack of dedicated alleys for cattle moving and specific loading/unloading ramps

Creates a negative perception towards humans

Increases the risk of injuries for both animals and farm crew

<table>
<thead>
<tr>
<th>Carcasses depreciated for DCB</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Veal calves</td>
<td>1.5%</td>
</tr>
<tr>
<td>Young bulls</td>
<td>1.1%</td>
</tr>
<tr>
<td>Beef heifers</td>
<td>1.2%</td>
</tr>
</tbody>
</table>
Quality of the stockmanship

Human-animal interaction

- cattle benefit from a positive attitude of the stockman
- negative human contacts increase the incidence of diseases and lead to fearful reactions during handling

Is the farm personnel trained???
There is still room for a significant improvement of cattle welfare.

On-farm monitoring schemes to detect the main risk factors.

Development of feasible solutions.
Implications

- Improvements of cattle welfare can reduce production costs related to poor performance and impaired health.
- A welfare assessment should be integrated within the management practices of the modern cattle farm to detect and overcome the limiting factors due to housing facilities and poor management.
- Advances in farm technology and engineering will help to solve welfare constraints linked to housing and environment.
- A more difficult target will be the achievement of more “welfare friendly” rearing and handling practices by the stockman.
Thank you for your attention

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