Differences in feeding in stalls or at pasture may be linked to differences in feeding strategies: a meta-analysis

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<table>
<thead>
<tr>
<th>Context</th>
<th>Pasture</th>
<th>Stalls</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Cattle population</strong> (millions of heads)</td>
<td>406 (VS)</td>
<td>29</td>
</tr>
<tr>
<td><strong>Cattle production</strong> (millions of tonnes)</td>
<td>14.6 (VS)</td>
<td>3.9</td>
</tr>
<tr>
<td><strong>Cattle production. head⁻¹</strong> (millions of tonnes.head⁻¹)</td>
<td>0.03 (VS)</td>
<td>0.13 (FAO, 2009)</td>
</tr>
</tbody>
</table>

- Grass feeding, seldom with supplements
- Diet with greater nutritional density (protein and energy supplements)
Pasture vs Stalls

Pasture:
- Standing roughage
- Outdoor
- + 21% energy expenditure
  (Kaufmann et al., 2011)
- Lean carcass

Stalls:
- Mowed roughage or other (silage, TMR….)
- Shade
- Low energy expenditure
- Fat carcass
Objectives of the meta-analysis

• Provide an overview of the differences reported between the 2 feeding environments (FE) on ADG of CATTLE and SMALL RUMINANTS

• Determine which factors (animal species, physiological stages, sex, complementation strategies) influence the differences between the 2 FE
Process of selection of the publications comparing ADG between stalls and pasture

1304 references
(CAB: 885; WOS: 419)

≈ 100%

Complete article not available

111 journal articles

≈ 8%

Stalls and pasture FE not conducted at the same time

No ADG measurements

108 journal articles

• 116 experiments
• 399 treatments

Aberrant data
Description of the database (meta-design)

Animal species
- Cattle: 54% (Pasture), 53% (Stalls)
- Small ruminants: 46% (Pasture), 47% (Stalls)

Physiological stages
- Unweaned: 42% (Pasture), 54% (Stalls)
- Growing: 39% (Pasture), 38% (Stalls)
- Finishing: 16% (Pasture), 4% (Stalls)
- Gestation: 3% (Pasture), 4% (Stalls)

Sex
- Female: 11% (Pasture), 11% (Stalls)
- Male: 79% (Pasture), 77% (Stalls)
Potential confounding factors

Qualitative modalities of complementation

1. ± concentrate in the diet
   - Pasture: 58% Grass only, 42% Grass + concentrate
   - Stalls: 82% Grass only, 18% Grass + concentrate

2. Nature of the concentrate
   - Maize: Pasture 38%, Stalls 46%
   - Barley: Pasture 53%, Stalls 47%
   - Other: Pasture 9%, Stalls 7%

Quantitative modalities of complementation

3. % of concentrate in the diet
   - Pasture: 19.4 ± 18.3%
   - Stalls: 61.88 ± 25.22%

4. Quantity of concentrate in the diet
   - Pasture: 6.8 ± 4.7 g DM.kg LW⁻¹
   - Stalls: 12.4 ± 5.0 g DM.kg LW⁻¹
Hierarchical model

Animal Species

- Cattle
- Sheep + Goat

Physiological Stage

- Unweaned
- Growing
- Finishing
- Gestation + Lactation

Sex

- Male
- Female
- Male + Female

Experiment n°

- 1
- 7
- 17
- 71
- 73
- 76
- 96
- 98
- 11
- 5
- 11
- 8
- 690
- 940
- 941
- 1210
- 1211
- Pasture: 1
- Stalls: 1
- Pasture: 2
- Stalls: 1
- Pasture: 3
- Stalls: 2
- Pasture: 4
- Stalls: 1
- Pasture: 1
- Stalls: 1
- Pasture: 2
- Stalls: 1
- Pasture: 1
- Stalls: 1
- Pasture: 1

Covariates

- Sex
- FE
- Complementations strategies

Fixed factors

- Cattle: Male
- Cattle: Female
- Cattle: Male + Female
- Sheep + Goat: Male
- Sheep + Goat: Female
- Sheep + Goat: Male + Female

Covariate

- FE
- Confounding factors

Complementations strategies
Effect of FE on ADG

Qualitative confounding factors

Stalls animals had a greater ADG

FE effect remained significant
Quantitative confounding factors

**FE+ % of concentrate**

ADG = 2.98 + 0.08 FE + 0.023 PCO
(nexpe = 10; ntreat = 24;
$r^2 = 99.43$; RSD = 0.48)

No more effect of FE
ADG = 2.24 + 0.58 FE + 0.13 QCO
(nexpe = 10; ntreat = 25; 
$r^2 = 99.77$; RSD = 0.29)
Differences between feeding in stalls or at pasture appeared as mainly driven by complementation strategies.

Grazing animals can possibly achieve the same performances as those fed in stalls, with leaner meat (Agastin et al., 2013, J. of Anim. Science).

Gap in knowledge:
Lack of studies on goat
Measurements on intake and digestibility at pasture

The same analyzes were conducted on carcass characteristics....
Thank you for your attention