# Effect of feeding system on lying behavior of mid-lactation dairy cows

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# INTRODUCTION

Interest in dairy cow's behavior and welfare has increased in the last decade because:

- ✓ its impact on milk production
- ✓ increasing consumers' concern of living conditions and well-being of animals

Housing and management practices have a substantial impact on lying behavior:

- ✓ Cows in confined systems lie down between 10 and 12 h/d while on pasture, lying time is reduced to 9 to 10 h /d (Tucker et al., 2021; Connor et al., 2019)
- ✓ High stocking rates, small/narrow stalls, inadequate bedding, and hard, wet or dirty surfaces reduce lying time (Tucker et al., 2021)

# INTRODUCTION

In mixed dairy production systems, grazing is combined with supplementation to achieve high-milk yields (Bargo et al., 2002; Salado et al., 2020) and lying behavior would be affected by:

- ✓ Pasture access time and housing conditions – indoor vs. outdoor - during supplementation as cows could be less or more exposed to environmental conditions – heat stress, rain, mud, etc.

- ✓ It has been reported that lying time of dairy cows decreased as temperature-humidity index (THI) increase, particularly when THI > 72 (Tullo et al., 2019; Lovarelli et al., 2020)

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## OBJECTIVE

To evaluate the effect of feeding system (total mixed ration [TMR] in confinement *vs*. grazing plus supplementation [GRZ]) and housing facilities during supplementation of grazing cows (compost-bedded pack barn [CB] *vs*. outdoor soil-bedded pen [OP]) on lying behavior of mid-lactation dairy cows in summer.

## HYPOTHESIS

Grazing cows will spend less time lying than TMR-fed cows and lying time will be reduced as THI increase, but this reduction will be less for cows supplemented in CB than OP.

# MATERIALS AND METHODS: Animal, diets and experimental design

2019-2020

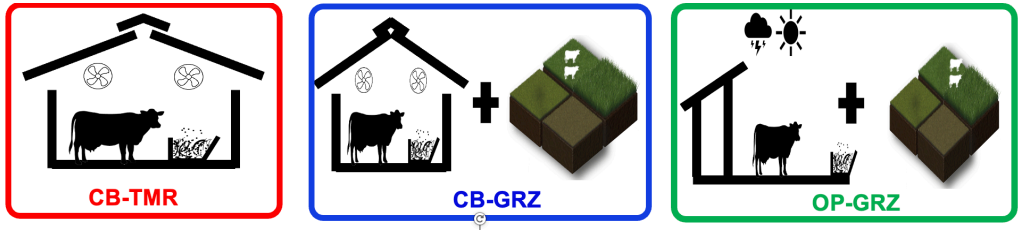
Estación experimental
**"Dr. Mario A. Cassinoni".**
**Facultad de Agronomía**
Universidad de la República.

- Multiparous Holstein cows (n = 50, 2.8 ± 1.3 lactations)
- Spring calving
- Body weight of 653 ± 74 kg
- Body condition score of 3.0 ± 0.2

Diets:

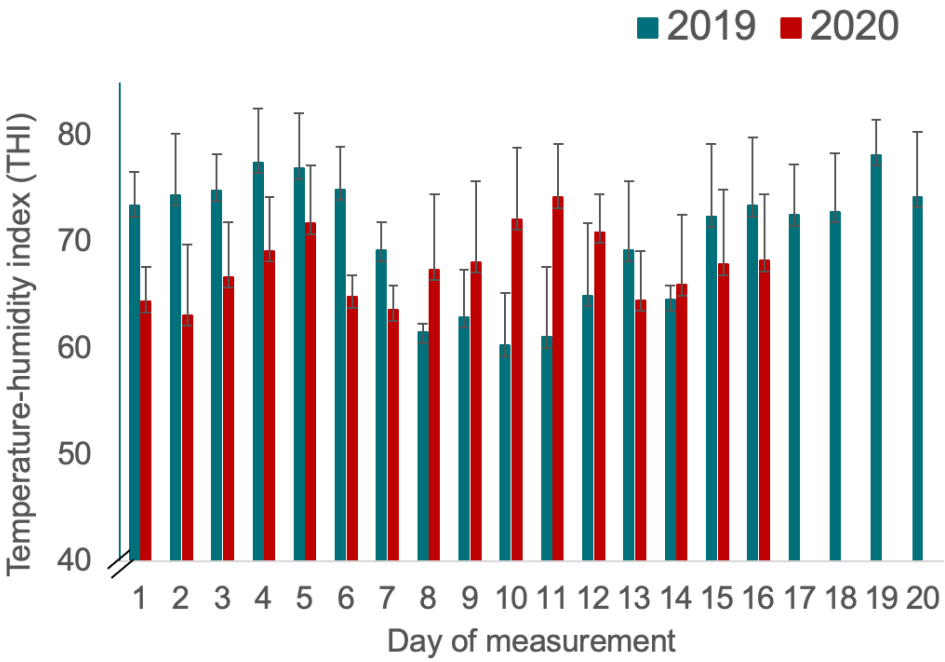
- TMR (NRC, 2001) – 40:60 forage to concentrate ratio (16% CP, 35% NDF, 1.64 Mcal NEL/kg DM).
- Grass-legume pasture (3000-3500 kg DM/ha; 27 kg DM/cow/d)

Experimental design: randomized block design of three feeding systems:



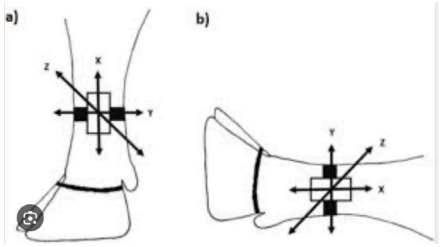

# MATERIALS AND METHODS: Animal, diets and experimental design

- ✓ Cows were milked twice a day (04:30 and 16:30 h).
- ✓ TMR was offered once a day after the morning milking when all cows were confined in their respective pens.
- ✓ Grazing cows had access to pasture paddock from 18:00 to 3:00 h.



# MATERIALS AND METHODS: Lying behavior

- At 165 ± 13 DIM, cow lying behavior was recorded for at least 5 days.
- Electronic data loggers: three-axis accelerometers (HOBO Pendant G; Onset Computer Corporation, Bourne, MA) attached on the medial side of the hind leg (Ledgerwood et al., 2010) set to record the x- and y-axis at a 1-min interval




Hendricks et al., 2020

- y-axis parallel to the ground pointing cranially
- x- axis was perpendicular to the ground pointing toward the ground
- z-axis was parallel to the ground pointing toward the median plane

Lying behavior:

✓Daily lying time (h/d),

✓Frequency of lying bouts (n/d),

✓Average duration of lying bouts (min/bout)

**MIXED procedure**

Mixed model considering treatment and year as fixed effects, and measurement day within year and cow as random effect

**MIXED regression**

Lying time regressed on THI

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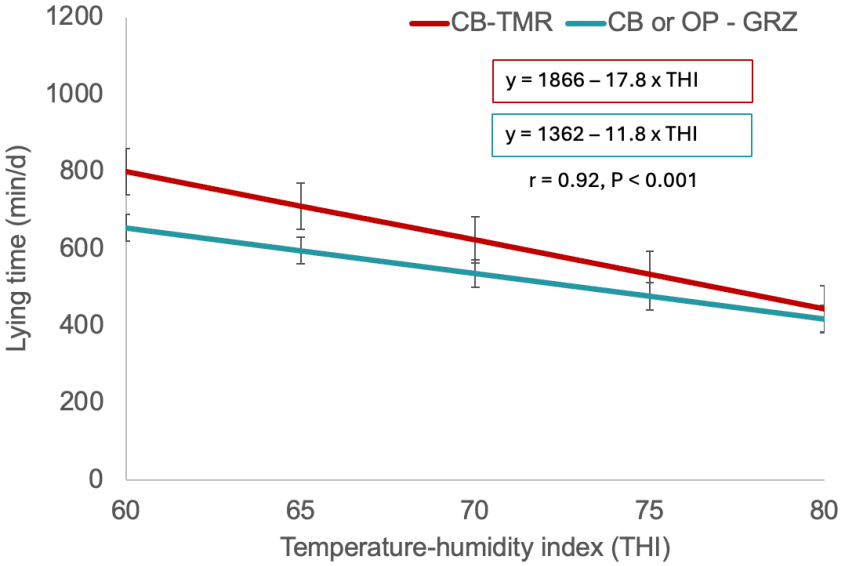
# RESULTS – Milk production and composition

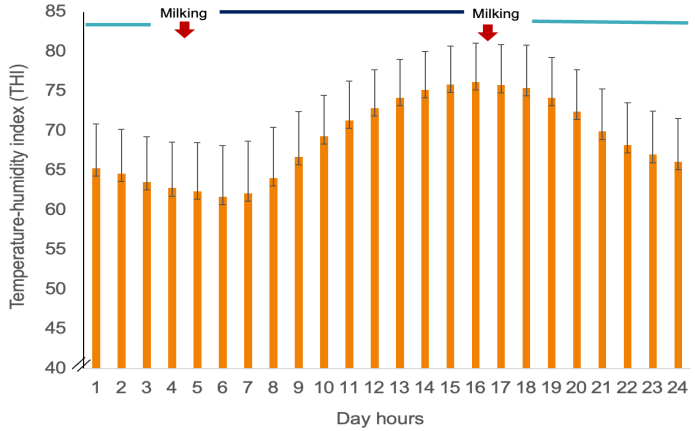
| | Treatment | | | | |
|---|---|---|---|---|---|
| | CB-TMR | CB-GRZ | OP-GRZ | SE | p-value |
| Milk yield (kg/d) | 38.7 | 26.2 | 25.7 | 3.9 | <0.01 |
| Milk composition (%) | | | | | |
| Fat | 3.5 | 3.7 | 3.6 | 0.1 | 0.29 |
| Protein | 3.4 | 3.4 | 3.3 | 0.1 | <0.01 |
| Lactose | 5.1 | 4.9 | 4.9 | 0.1 | <0.01 |

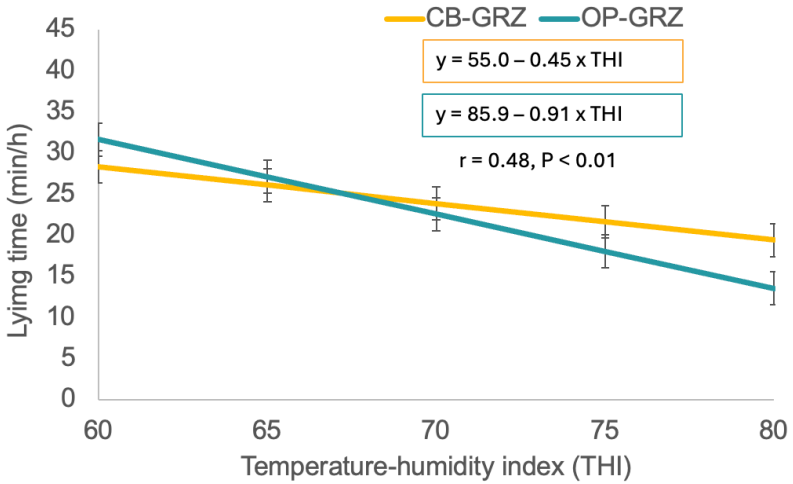
# RESULTS - Lying behavior

| | Treatment | | | SE | p-value |
|---|---|---|---|---|---|
| | CB-TMR | CB-GRZ | OP-GRZ | | |
| Daily | | | | | |
| Lying time (min) | 645[a] | 528[b] | 542[b] | 28 | <0.01 |
| Lying bout (n/d) | 12.5[a] | 10.3[b] | 10.1[b] | 0.4 | <0.01 |
| Lying time per bout (min/bout) | 52.3 | 50.7 | 54.7 | 2.1 | 0.37 |
| During supplementation (8:00 to 15:00 h) | | | | | |
| Lying time (min) | 254 | 245 | 230 | 16 | 0.53 |
| Lying bout (n/d) | 4.7 | 4.7 | 4.2 | 0.3 | 0.38 |
| Lying time per bout (min/bout) | 54.5 | 51.2 | 52.1 | 4.3 | 0.95 |
| During grazing (18:00 to 3:00 h)* | | | | | |
| Lying time (min) | 228[a] | 188[b] | 204[b] | 10 | 0.01 |
| Lying bout (n/d) | 4.9[a] | 3.9[b] | 4.0[b] | 0.3 | 0.01 |
| Lying time per bout (min/bout) | 47.3 | 47.8 | 52.2 | 2.2 | 0.56 |

# RESULTS; Lying time and THI



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# CONCLUSION

- Grazing decreased milk yield (by 30 %) and lying time (~ 2 h/d) when compared to 100% TMR-fed cows probably due to competition with grazing time.

- Environmental control during supplementation (CB vs. OP) did not have a great impact on lying behavior probably because no extreme weather conditions occurred during the measurement periods;
  ✓ when THI > 70 lying time during supplementation was reduced for OP than CB cows.

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# Thank you