Faculty of Agricultural and Nutritional Science

Christian-Albrechts-University Kiel
Institute of Animal Breeding and Husbandry

Social network analysis of dairy cows' group structure at the feeding trough

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Session 80: Animal behaviour
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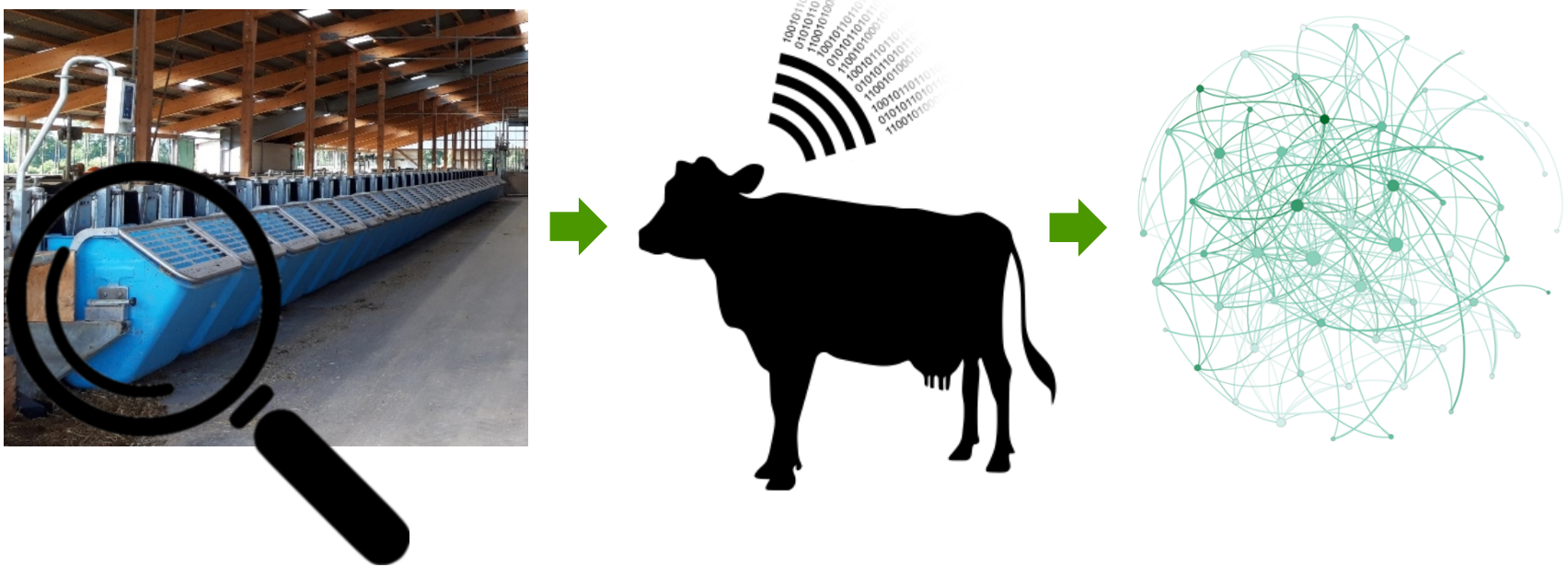
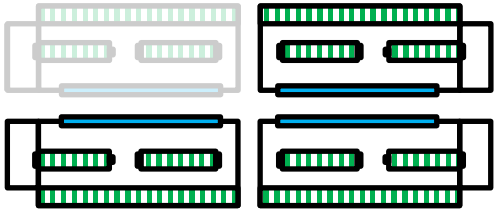
Introduction



Material & Methods

Data base:

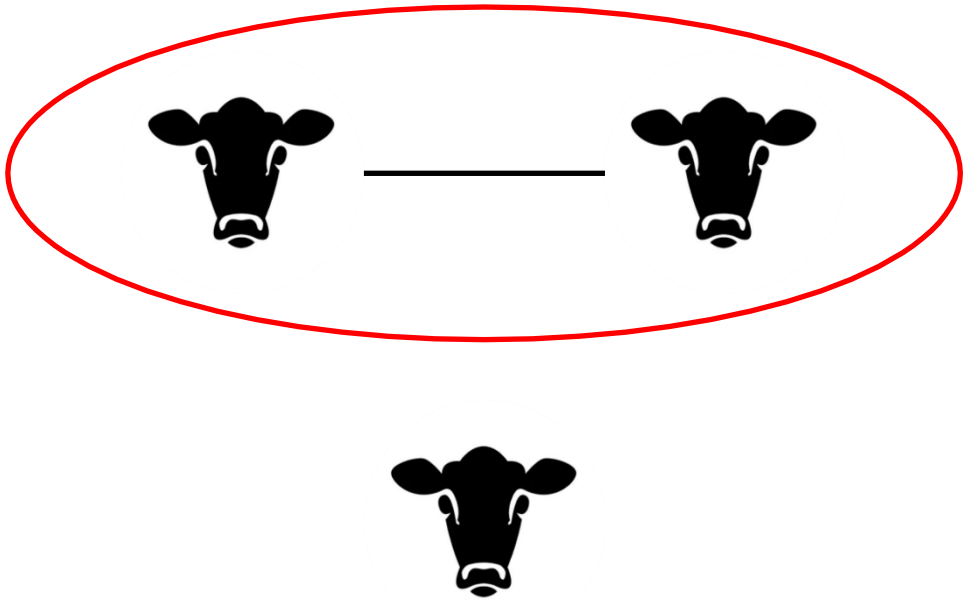
- 3 compartments
- 32 weighing troughs



- Collected data
  - Time
  - Trough ID
  - Animal ID
  - (feed intake)
- 3 time windows
  - Nov ’22, Feb ’23, Jun ‘23

Material & Methods

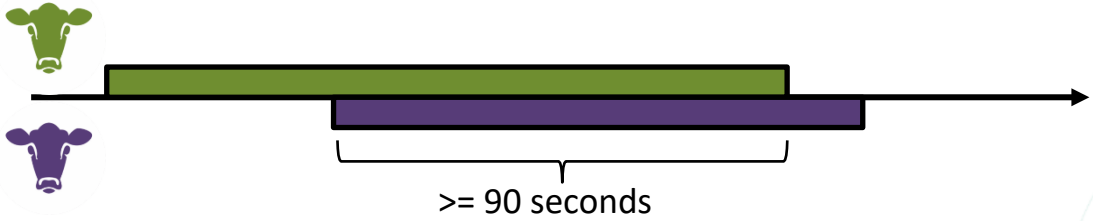
Social network analysis

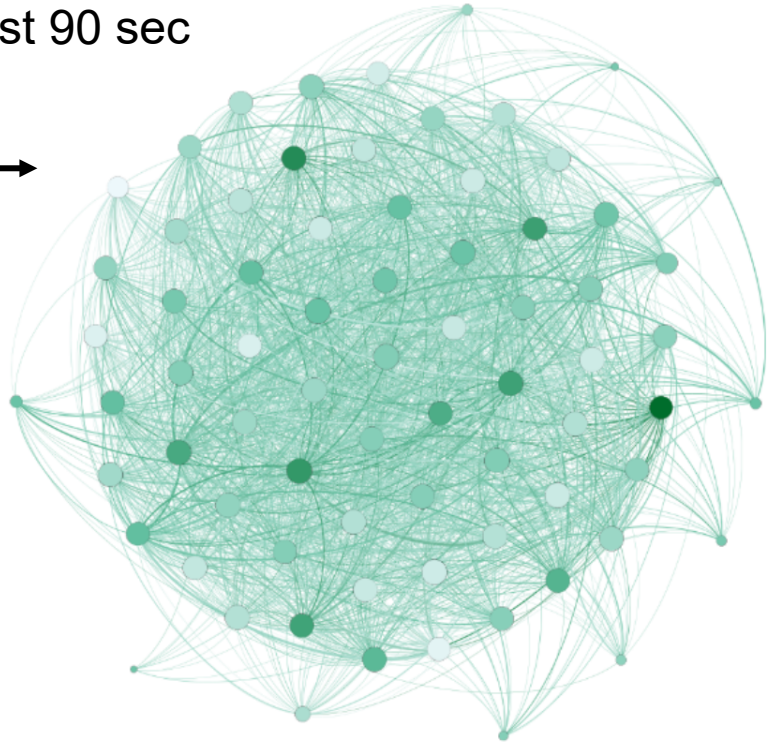


Material & Methods

Network of adjacent eating (NEA)

Contact: Eating at adjacent troughs for at least 90 sec



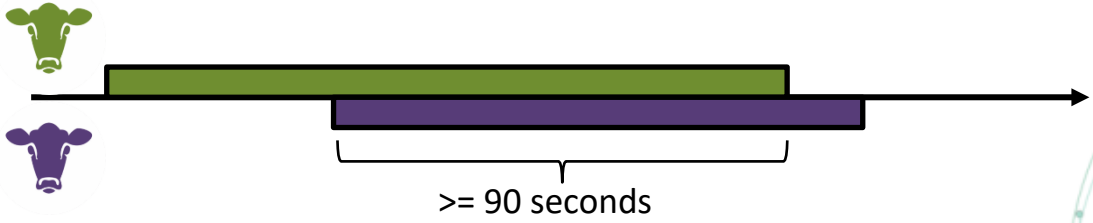


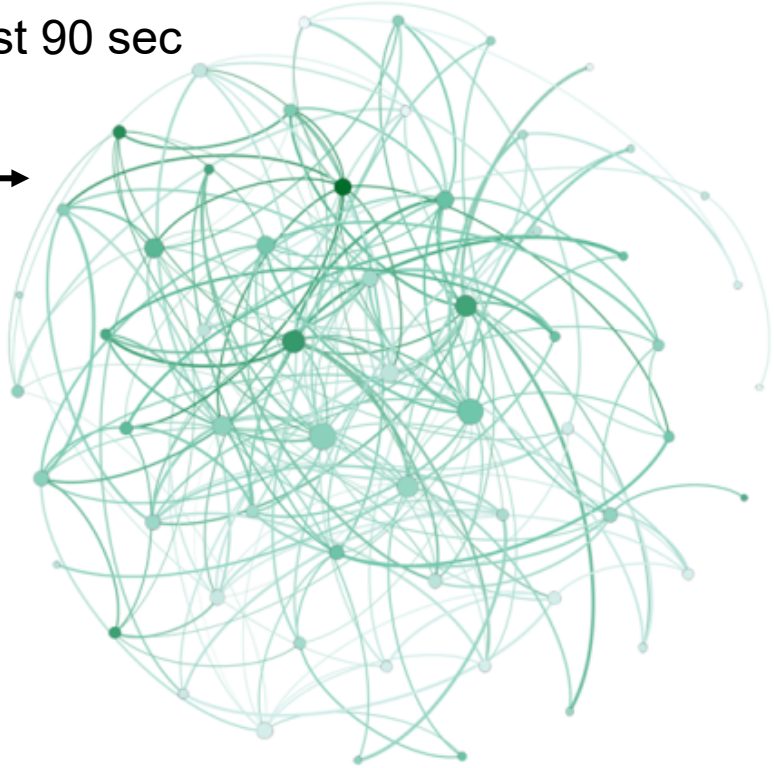
- One network per week
- All contacts:
  - Mean number of edges = 2026

Material & Methods

Network of adjacent eating (NEA)

Contact: Eating at adjacent troughs for at least 90 sec



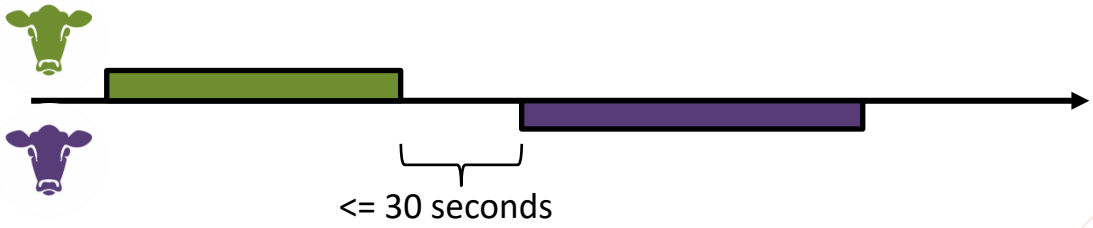


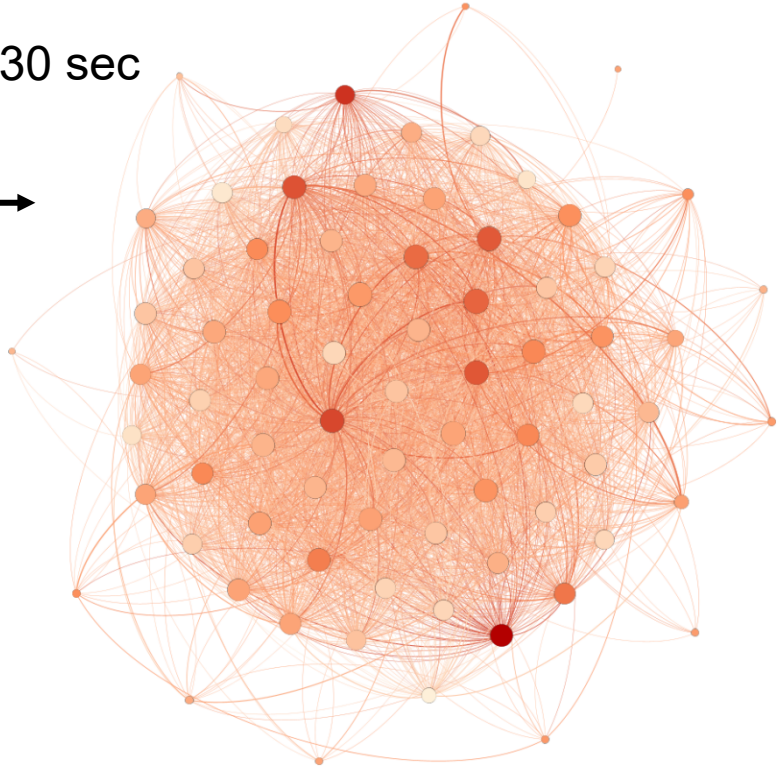
- One network per week
- All contacts:
  - Mean number of edges = 2026
- Filter ($duration_{total}$ > 20 min):
  - Mean number of edges = 274
  - ➢ Weighted Degree

Material & Methods

Network of displacement behaviour (NDB)

Contact: Animal change at one trough within 30 sec



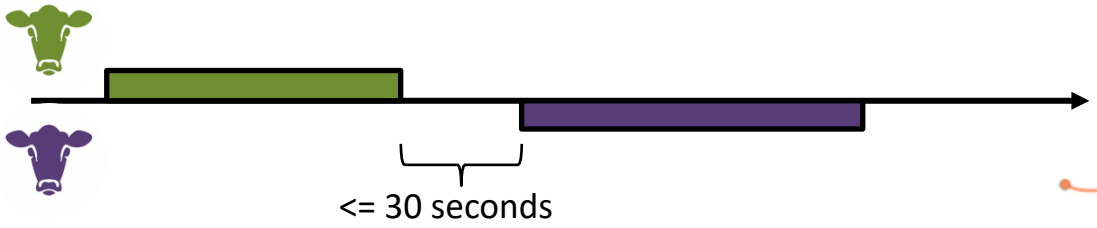


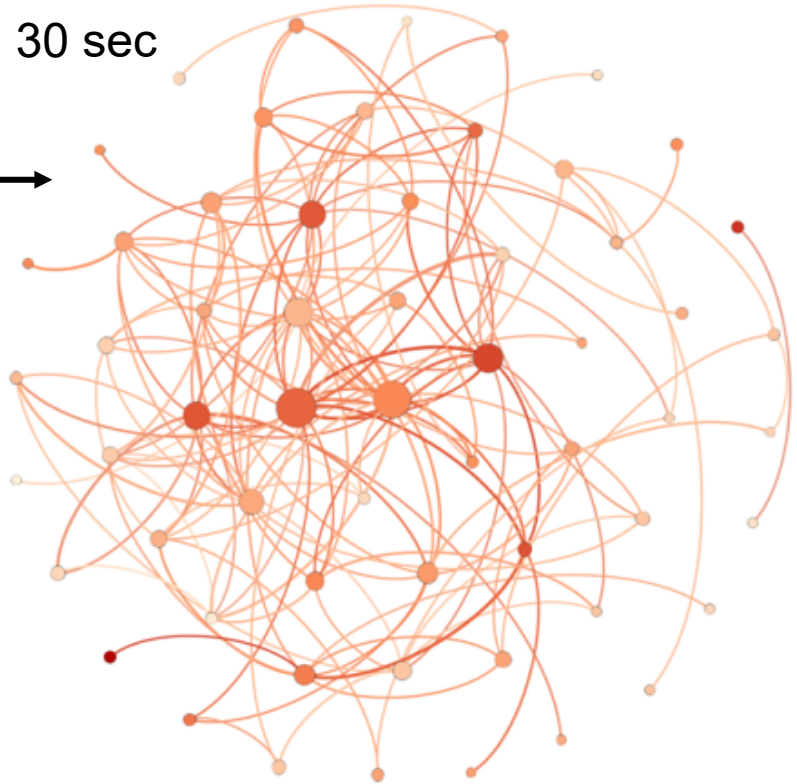
- One network per week
- All contacts:
  - Mean number of edges = 2516

Material & Methods

Network of displacement behaviour (NDB)

Contact: Animal change at one trough within 30 sec





- One network per week
- All contacts:
  - Mean number of edges = 2516
- Filter ($n_{total} > 2$):
  - Mean number of edges = 239
  - ➢ Weighted In- and Outdegree

Material & Methods

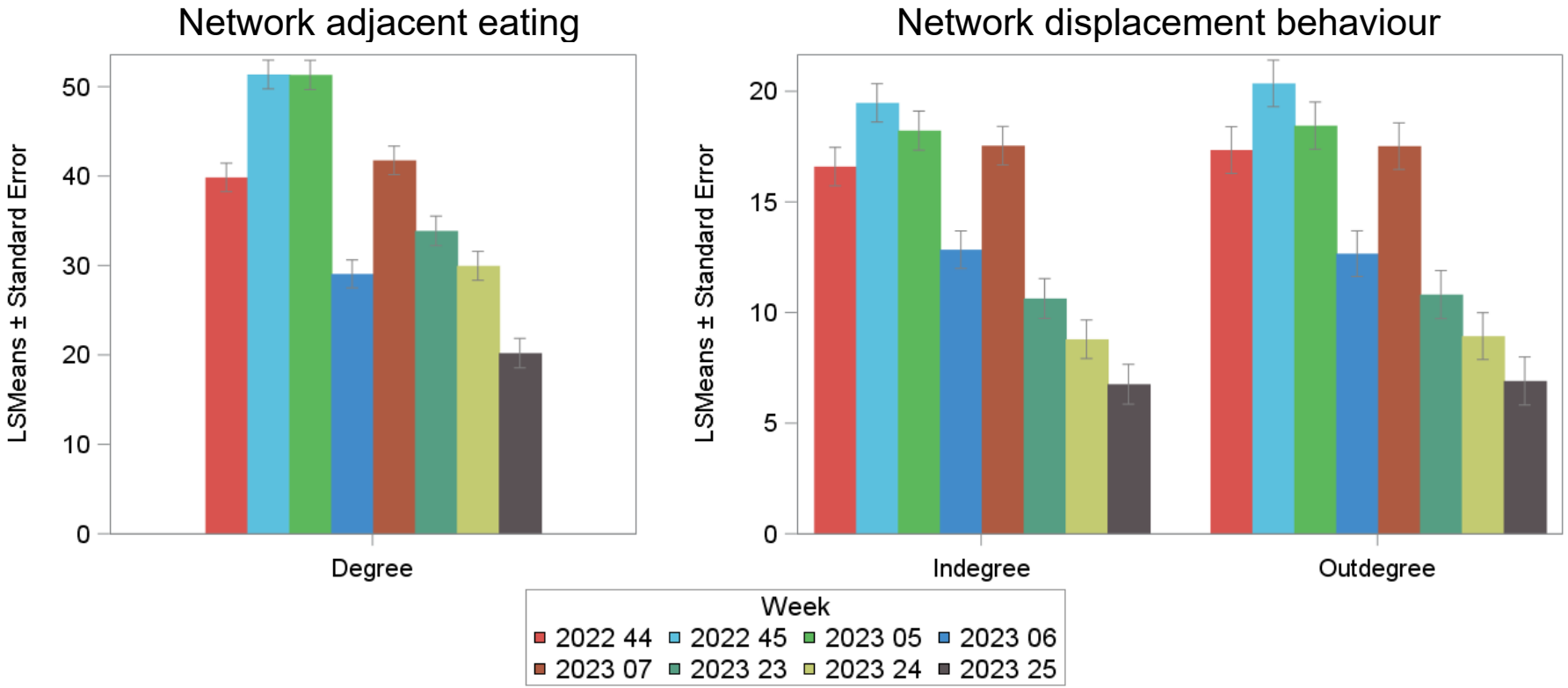
Statistical analysis

- Linear mixed models (proc mixed, SAS® 9.4)
- Response variable: Degree (NAE), Indegree or Outdegree (NDB)
- Fixed effects: Week (1 to 8)
  Compartment (1, 2, 3)
  Lactation number (1: 1, 2: 2, 3: ≥3)
  Lactation day (1: <105d, 2: 105d to 210d, 3: >210d)
  Body weight (1: <μ-SD, 2: μ-SD to μ+SD, 3: >μ+SD)
  Dominance index (1: <μ-SD, 2: μ-SD to μ+SD, 3: >μ+SD)
- Random effect: Subject

μ: Mean, SD: Standard deviation

Results

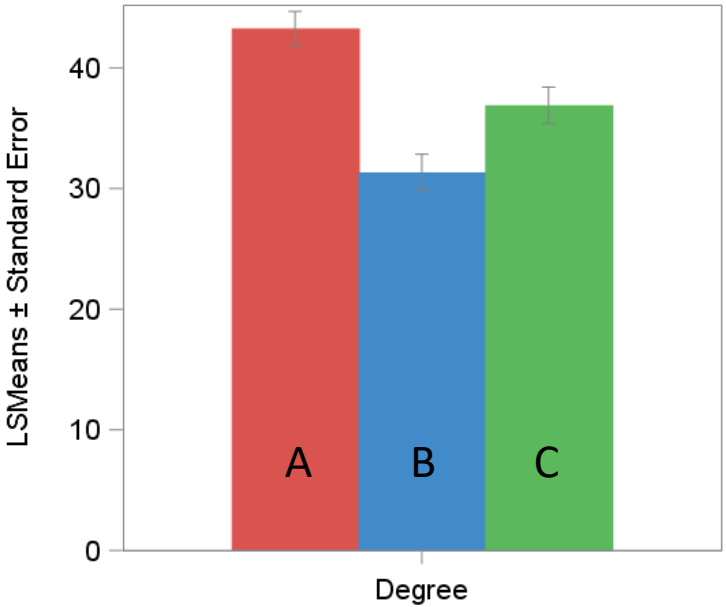
Effect of Week:



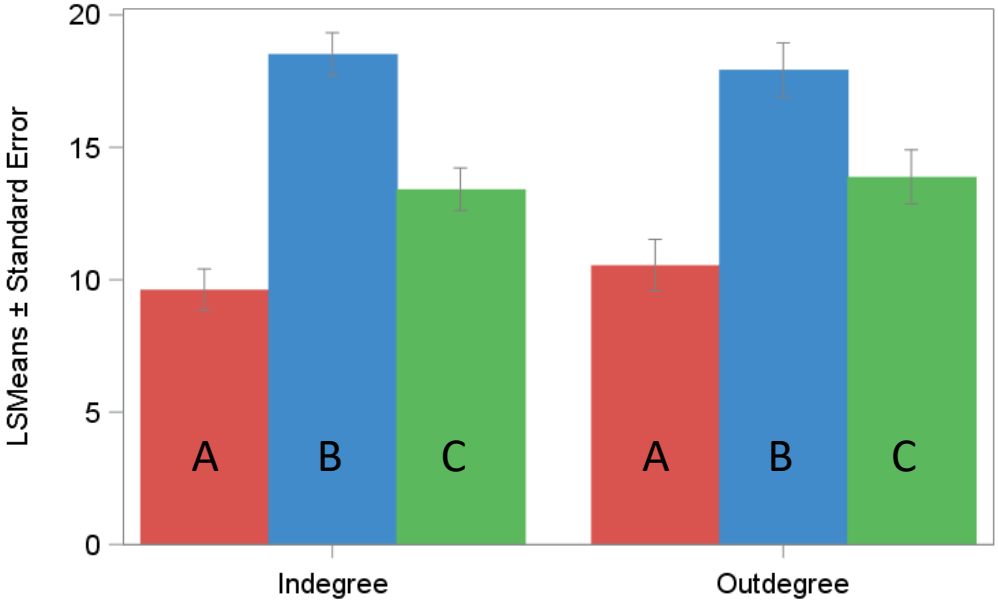
Results

Effect of Compartment (1, 2, 3):

Network adjacent eating



Network displacement behaviour

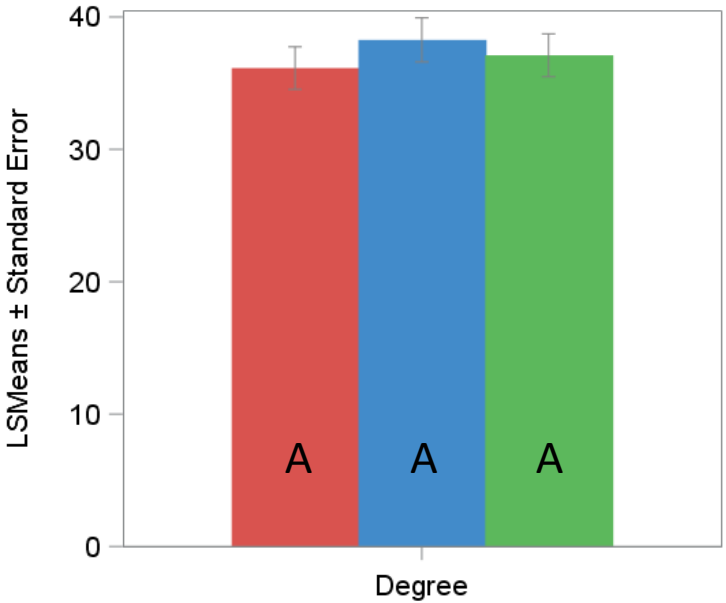


A, B, C: Different letters show significant ($p<0.05$) differences between goups

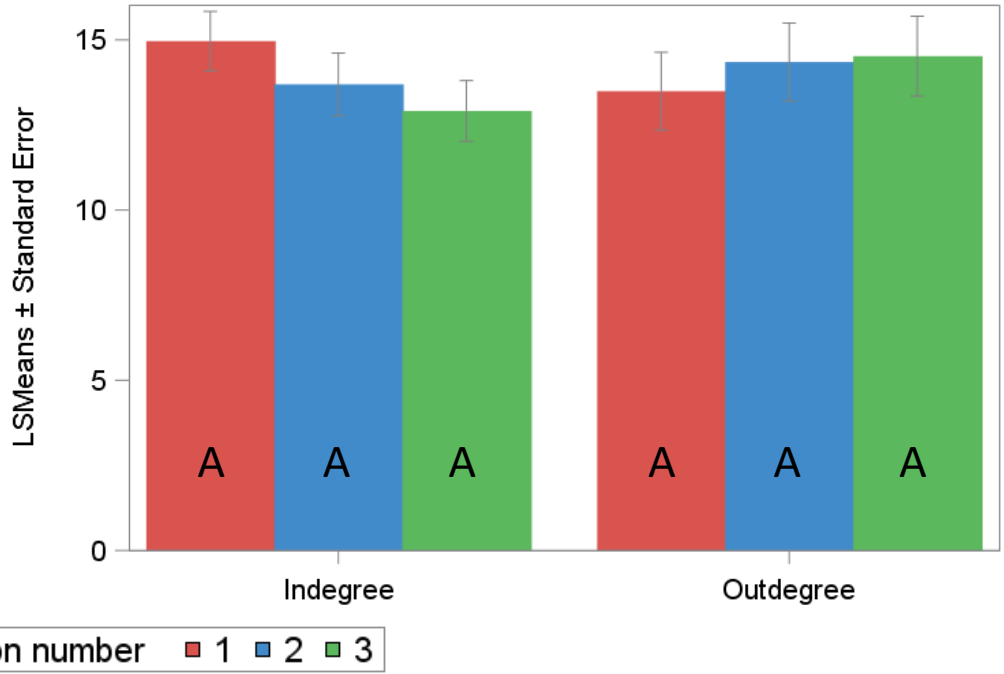
Results

Effect of Lactation number (1: 1, 2: 2, 3: ≥3) :

Network adjacent eating



Network displacement behaviour

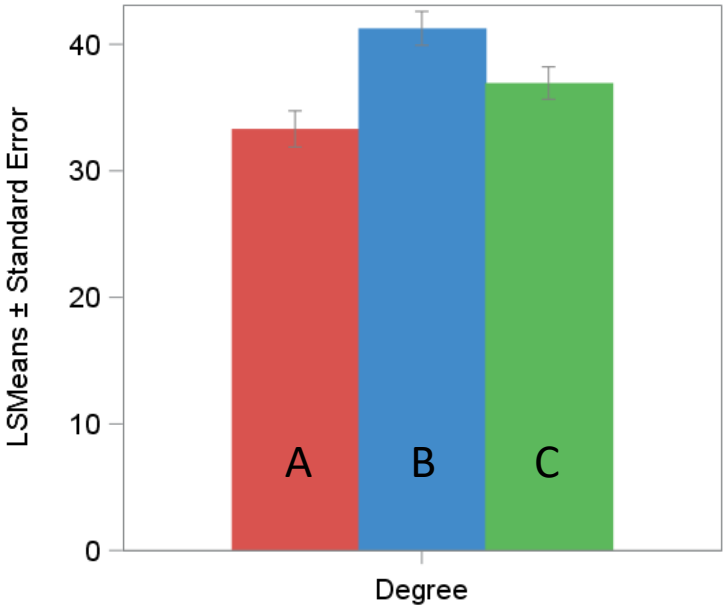


A, B, C: Different letters show significant ($p<0.05$) differences between goups

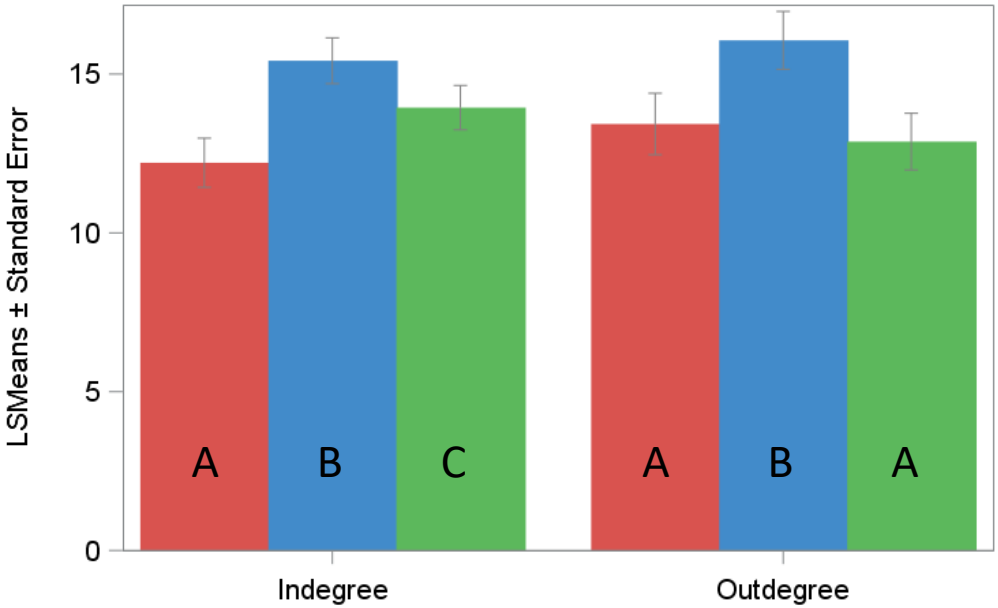
Results

Effect of Lactation day (1: <105d, 2: 105d to 210d, 3: >210d):

Network adjacent eating



Network displacement behaviour

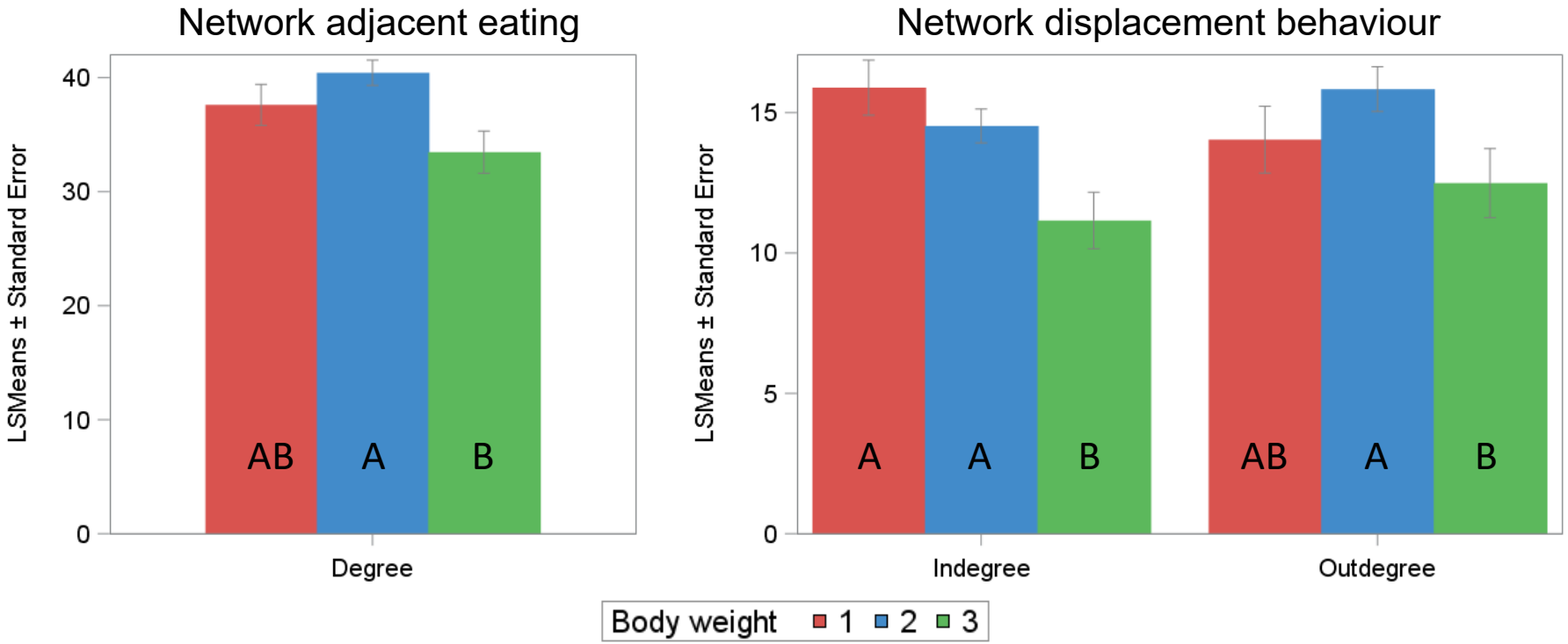


Lactation day 1 2 3

A, B, C: Different letters show significant ($p<0.05$) differences between goups

Results

Effect of Body weight (1: <μ-SD, 2: μ-SD to μ+SD, 3: >μ+SD):



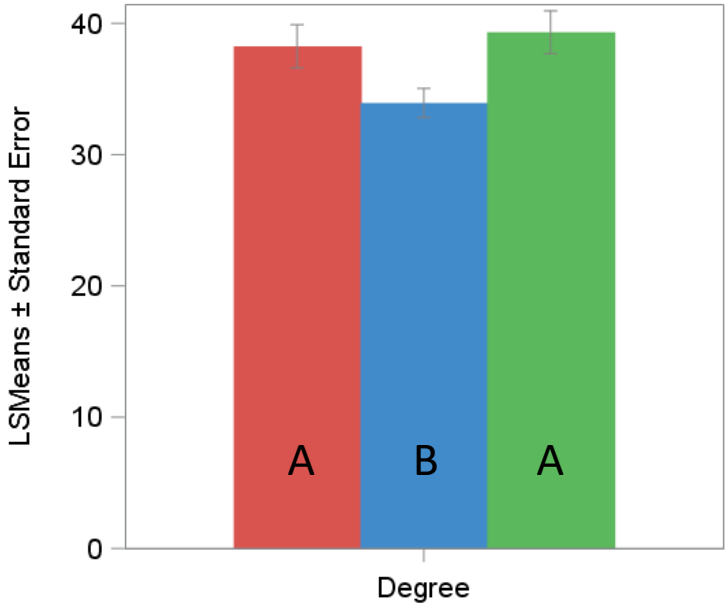
μ: Mean, SD: Standard deviation

A, B, C: Different letters show significant ($p<0.05$) differences between goups

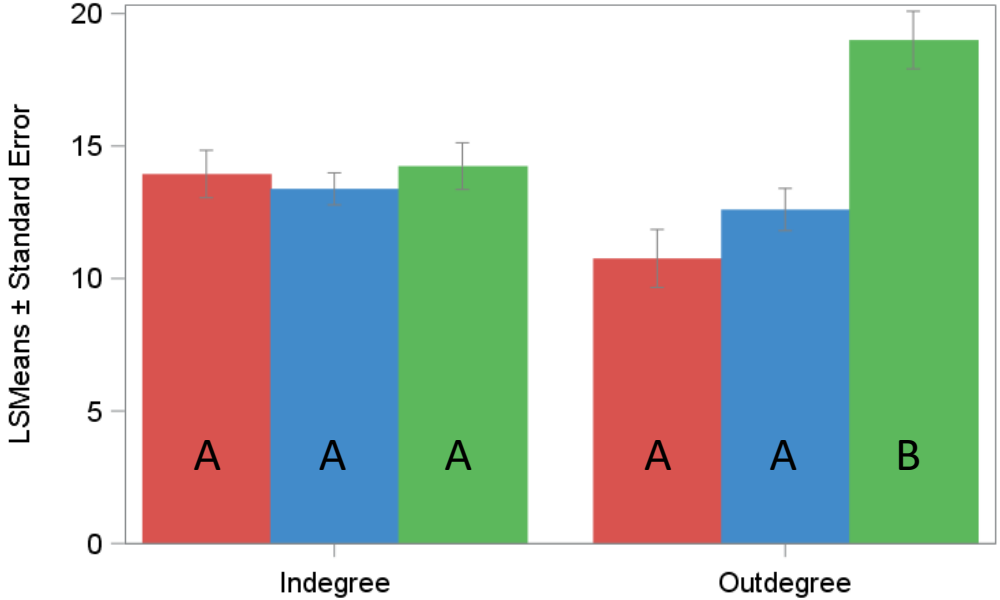
Results

Effect of Dominance index (1: <μ-SD, 2: μ-SD to μ+SD, 3: >μ+SD):

Network adjacent eating



Network displacement behaviour



μ: Mean, SD: Standard deviation

A, B, C: Different letters show significant ($p<0.05$) differences between goups

Conclusion

- Mid lactation highest number of contacts (NAE and NDB)
- Heavier animals lower number of contacts (NAE and NDB)
- Dominant animals highest number of active displacement
- Being target of displacement more random than active displacement

Outlook: Comparison with indoor positioning data

Thank you for your attention!

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Project manager

Federal Office for Agriculture and Food