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Does herd size affect animal welfare in dairy cattle?

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Background

- Structural changes lead to continuous increase of dairy herd sizes
  - Farm specialisation and intensification
  - Use of new technologies
- Changing consumer behaviour and awareness about animal welfare (Vanhonacker and Verbeke, 2014)

Average dairy herd sizes of selected EU countries

(Promar International, 2015)

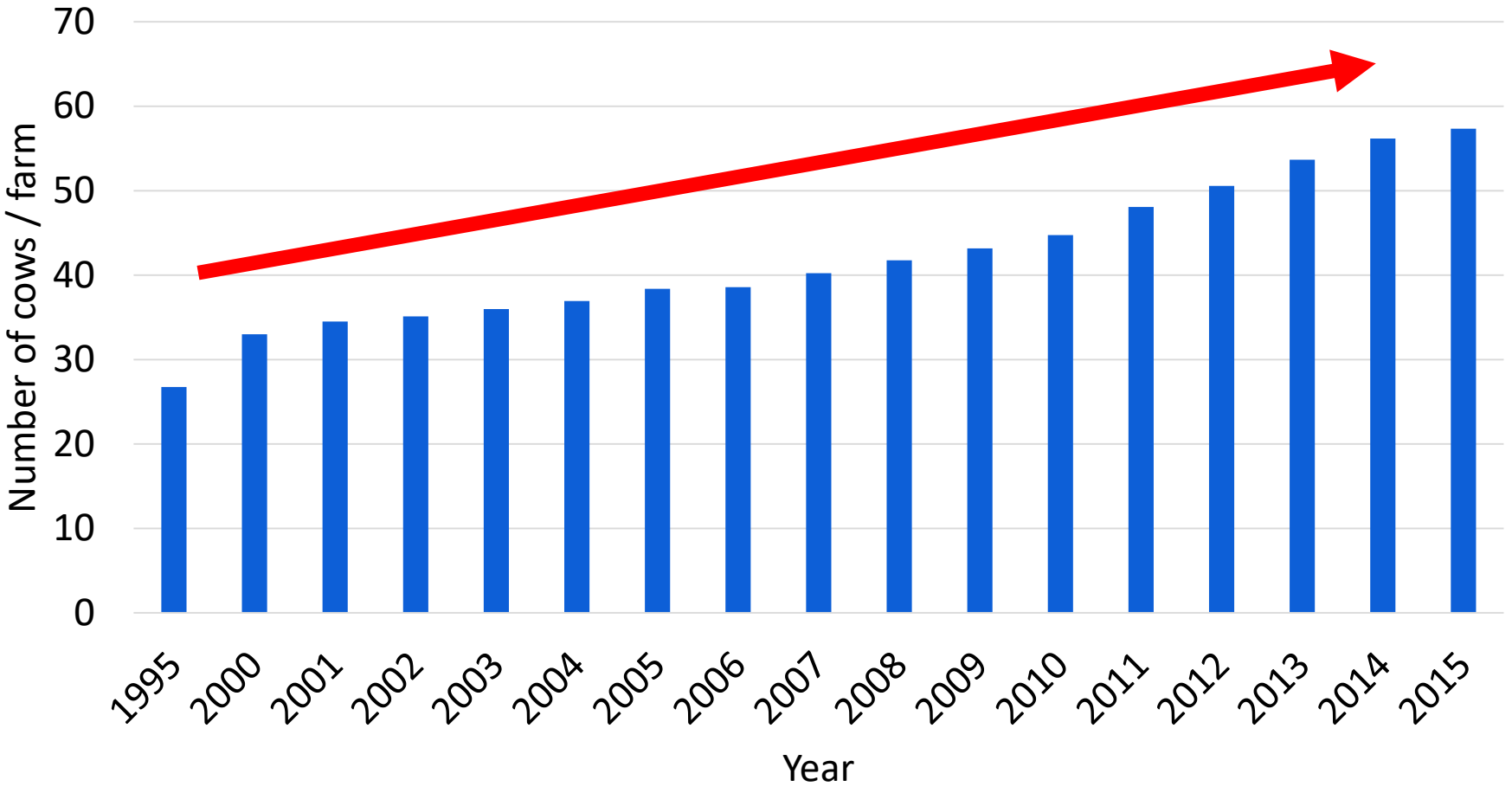
Country	2006	2013	% increase 2006-2013
Czech Republic	136	163	20
Denmark	94	152	62
UK	99	123	24
Netherlands	65	84	30
Sweden	44	64	47
Ireland	48	63	31
Italy	36	53	47
Germany	37	52	40
France	34	46	37
Spain	32	42	33

Average dairy herd sizes of selected EU countries

(Promar International, 2015)

Country	2006	2013	2020 (forecast low)	2020 (forecast high)
Czech Republic	136	163	197	217
Denmark	94	152	260	301
UK	99	123	179	191
Netherlands	65	84	109	128
Sweden	44	64	99	106
Ireland	48	63	84	102
Italy	36	53	61	85
Germany	37	52	73	76
France	34	46	68	72
Spain	32	42	68	74

Average herd size of dairy farms in Germany (1995 - 2015)



Statista, 2016

Herd sizes and pasturing

Herd size	No. of dairy cows	% of cows with pasture access
1 – 9	61,300	40.0
10 – 19	235,100	45.7
20 – 49	1,141,100	41.2
50 – 99	1,359,100	50.7
100 – 199	680,100	50.4
200 – 499	400,700	24.6
> 500	324,900	6.8
Total	**4,202,200**	**41.8**

Destatis, 2015

Available literature

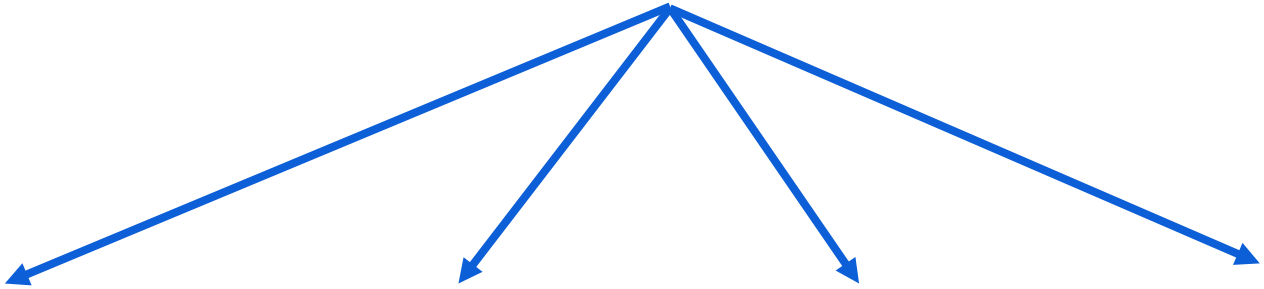
Reference	Indicator	Herd size	Herd number	Correlation
Waiblinger et al. (2003)	Avoidance	9 - 90	35	+
Archer et al. (2013)	Somatic cells	30 - 300	9,679	+
De Vries et al. (2014)	Lameness	10 - 211	194	+
Alvasen et al. (2013)	Mortality	20 - >100	6,898	+
Rodrigues et al. (2005)	Somatic cells	22 - 1838	180	-
Wenz et al. (2007)	Somatic cells	<100 / >500	1,013	-
Sieck et al. (2012)	Mortality	<40 - >200	3,603	-
Mülleder et al. (2007)	Social Interaction	21 - 55	80	-
Breuer et al. (2000)	Avoidance	100 - 200	35	0
Sogstad et al. (2005)	Lameness	28 +/- 12	57	0
Ivemeyer et al. (2011)	Somatic cells	10 - 58	46	0
Mee et al. (2008)	Mortality	<20 - >59	182,026	0

Objectives

Evaluate the animal welfare status on conventional dairy farms with different herd sizes

Materials and methods

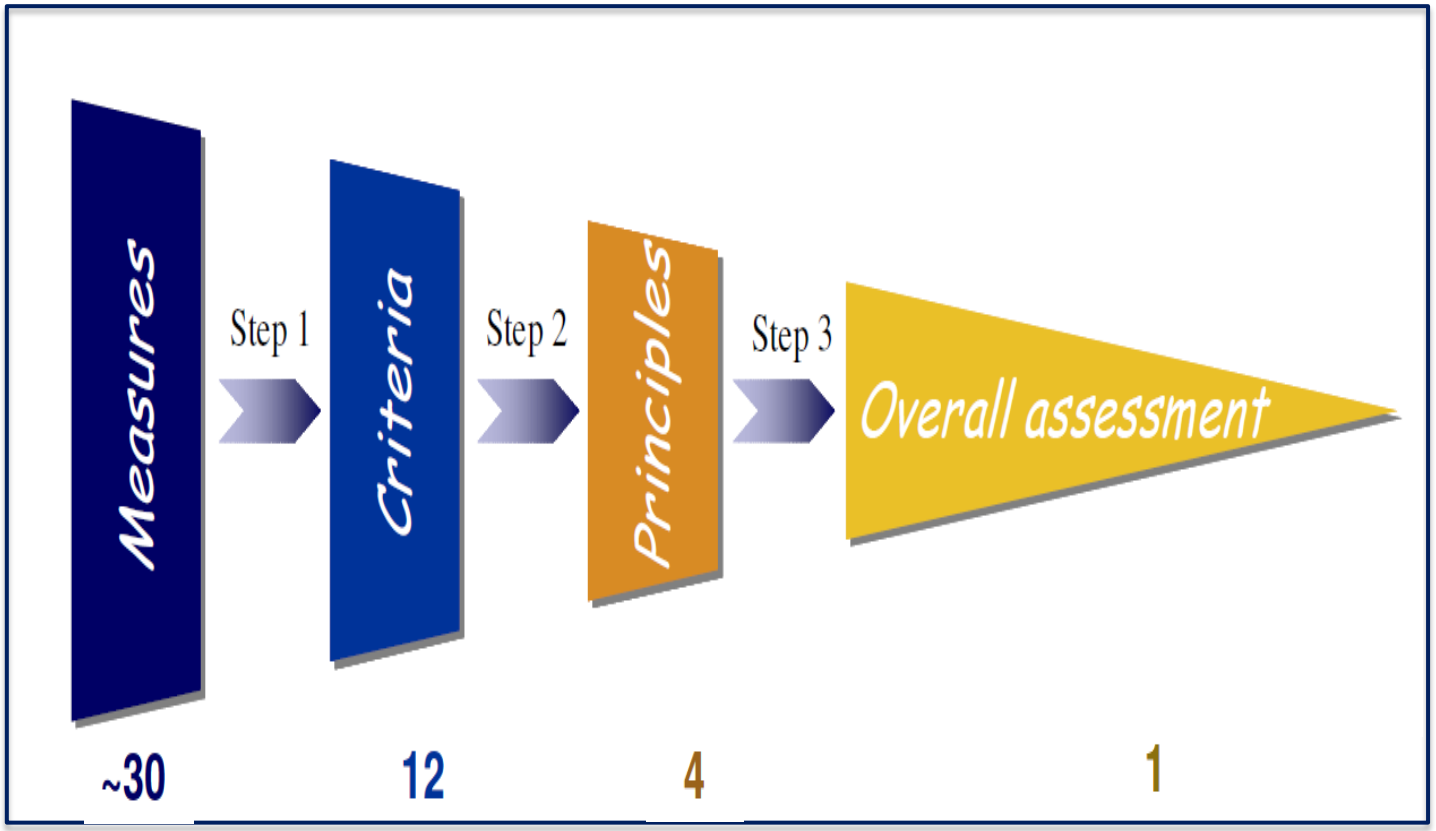
62 dairy farms



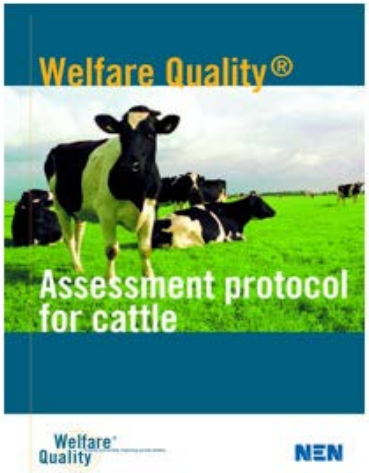
Group 1	Group 2	Group 3	Group 4
< 100 dairy cows (N = 17 farms)	100 – 299 dairy cows (N = 15 farms)	300 – 499 dairy cows (N = 16 farms)	> 500 dairy cows (N = 14 farms)

- Conventional farming
- Loose-housing
- < 6 h pasture
- Common systems in terms of flooring, cubicle bedding, barn design

Welfare Quality® (WQ) Assessment



- 2 assessments with 6 months in-between
  - Summer: April to September
  - Winter: Oktober to March



Welfare Quality® Assessment

Measures	Criteria	Principles	Evaluation
Body condition score	Absence of hunger	Feeding	
Water provision, cleanliness (…)	Absence of thirst		
Time to lie down, collisions (…)	Comfort around resting		
- - - - - - - - - - - - - - - - - - - -	Thermal comfort	Housing	
Loose house vs. tie stall	Ease of movement		
Integument alterations, lameness	Absence of injuries		Overall Score
Diarrhea, mastitis, coughing (…)	Absence of disease	Health	
Dehorning, tail docking	Absence of pain		
Head butts, displacements (…)	Social behavior		
Access to pasture	Other behavior	Behavior	
Avoidance distance	Human-animal-relation		
Qualitative behaviour assessment	Emotional state		

(Modified from Veissier et al., 2011)

Statistical analysis

- GLIMMIX procedure for generalized linear mixed models (SAS, version 9.3)
- $Y_{ijk} = \mu + a_i + b_j + c_{ij} + d_k + \varepsilon_{ijk}$
  - Y_{ijk} = principles/ measures
  - μ = overall mean
  - a_i = fixed effect of group$_i$ (G1, G2, G3, G4)
  - b_j = fixed effect of farm visit$_j$ (1, 2)
  - c_{ij} = interaction between group$_i$ and farm visit$_j$
  - d_k = random effect of the farm$_k$
  - ε_{ijk} = residual error
- Data transformations prior to analysis

Results and discussion

Principles
„Good Feeding“
„Good Husbandry“
„Good Health“
„Appropriate Behaviour“

Selected Measures Feeding
- Body Condition Score -

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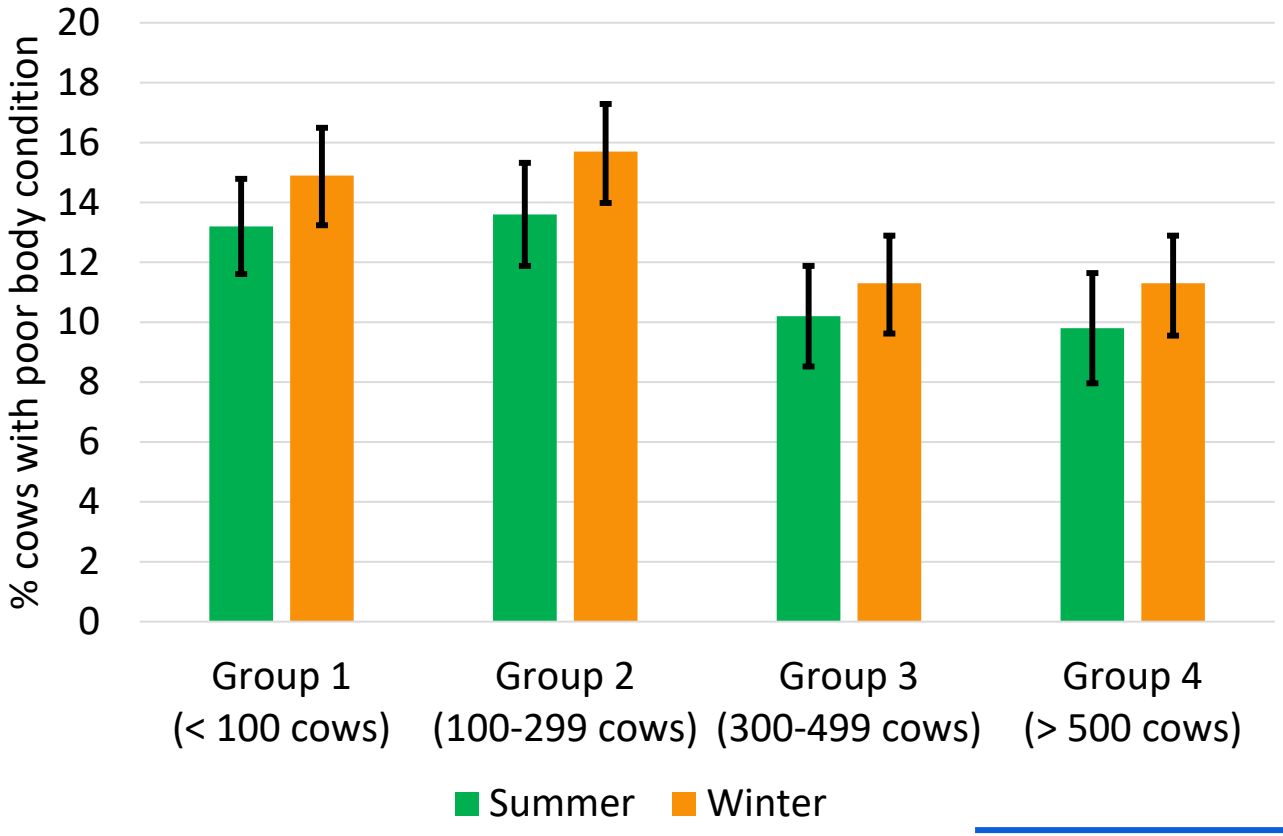
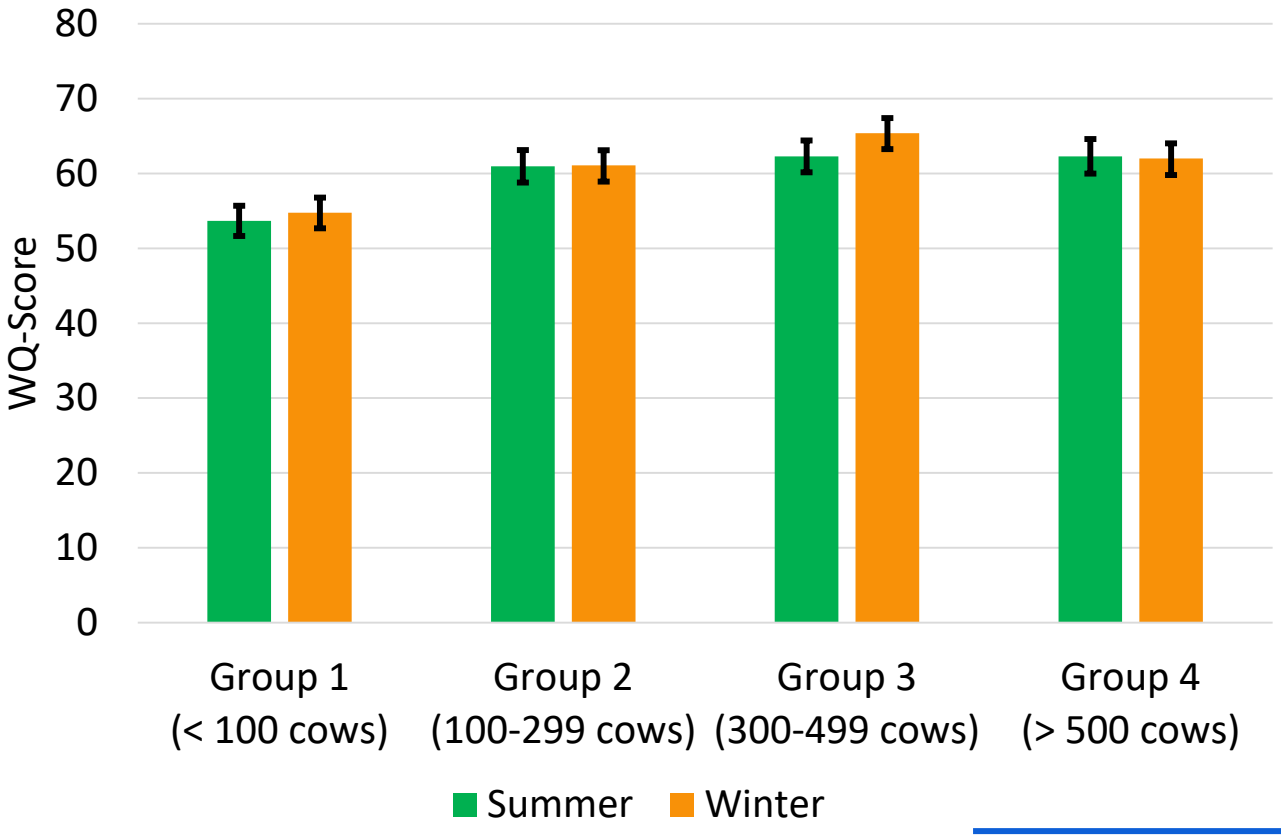
- Body Condition Score -



	P values
Group	n.s.
Season	n.s.
Interaction	n.s.

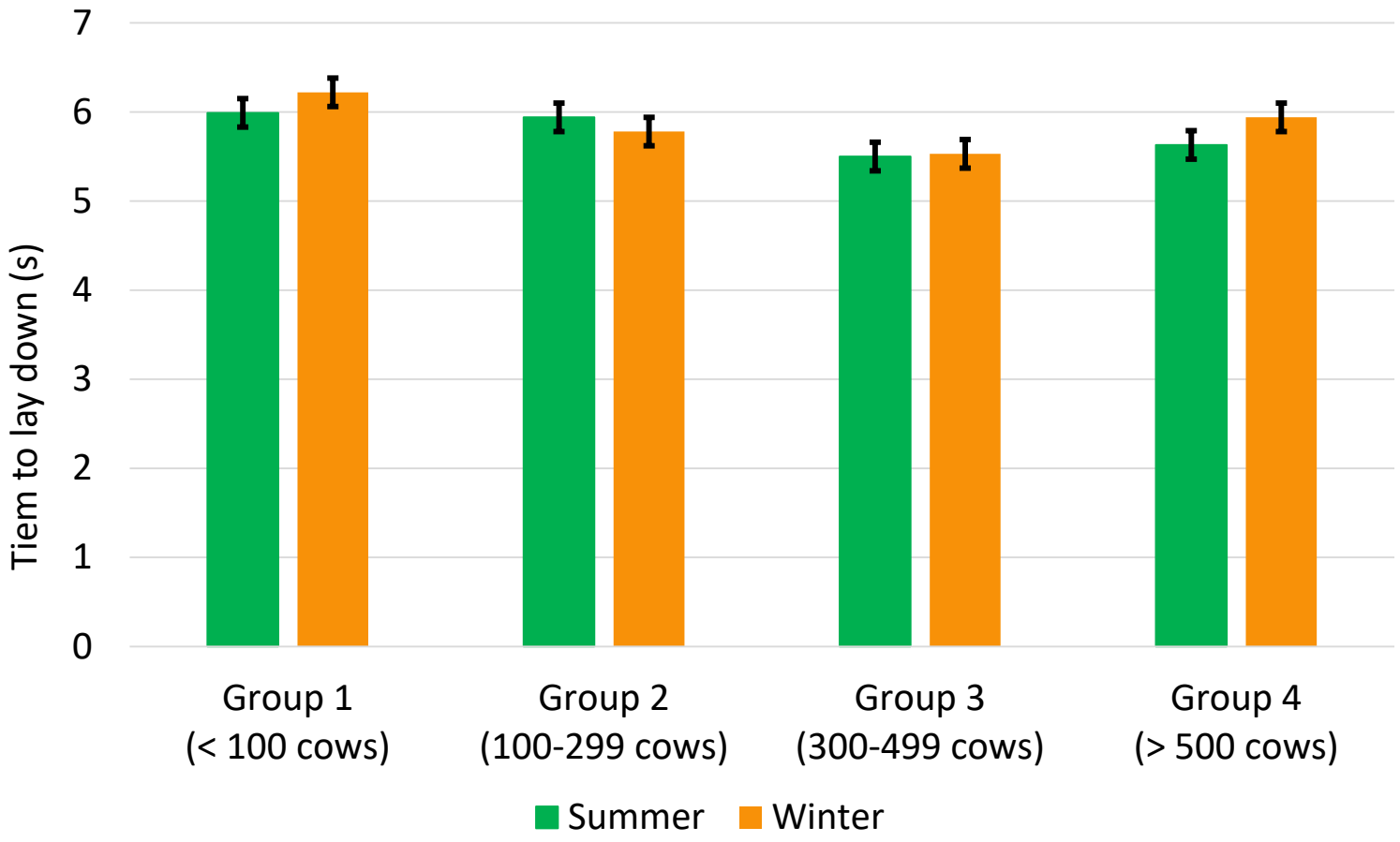
Principle „Good Feeding“



	P values
Group	n.s.
Season	n.s.
Interaction	n.s.

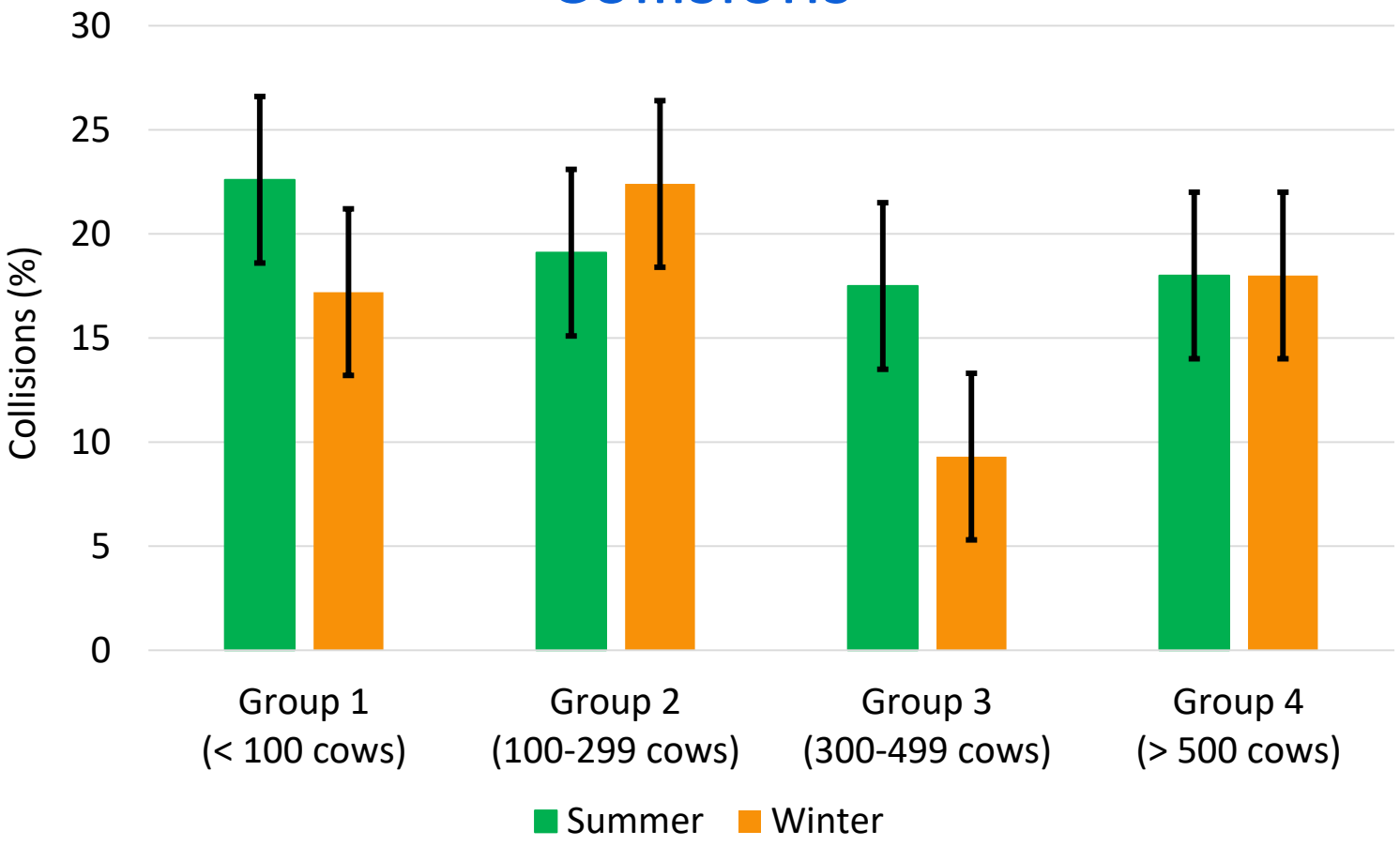
Selected Measures Husbandry
- Time to lay down -

Time to lay down



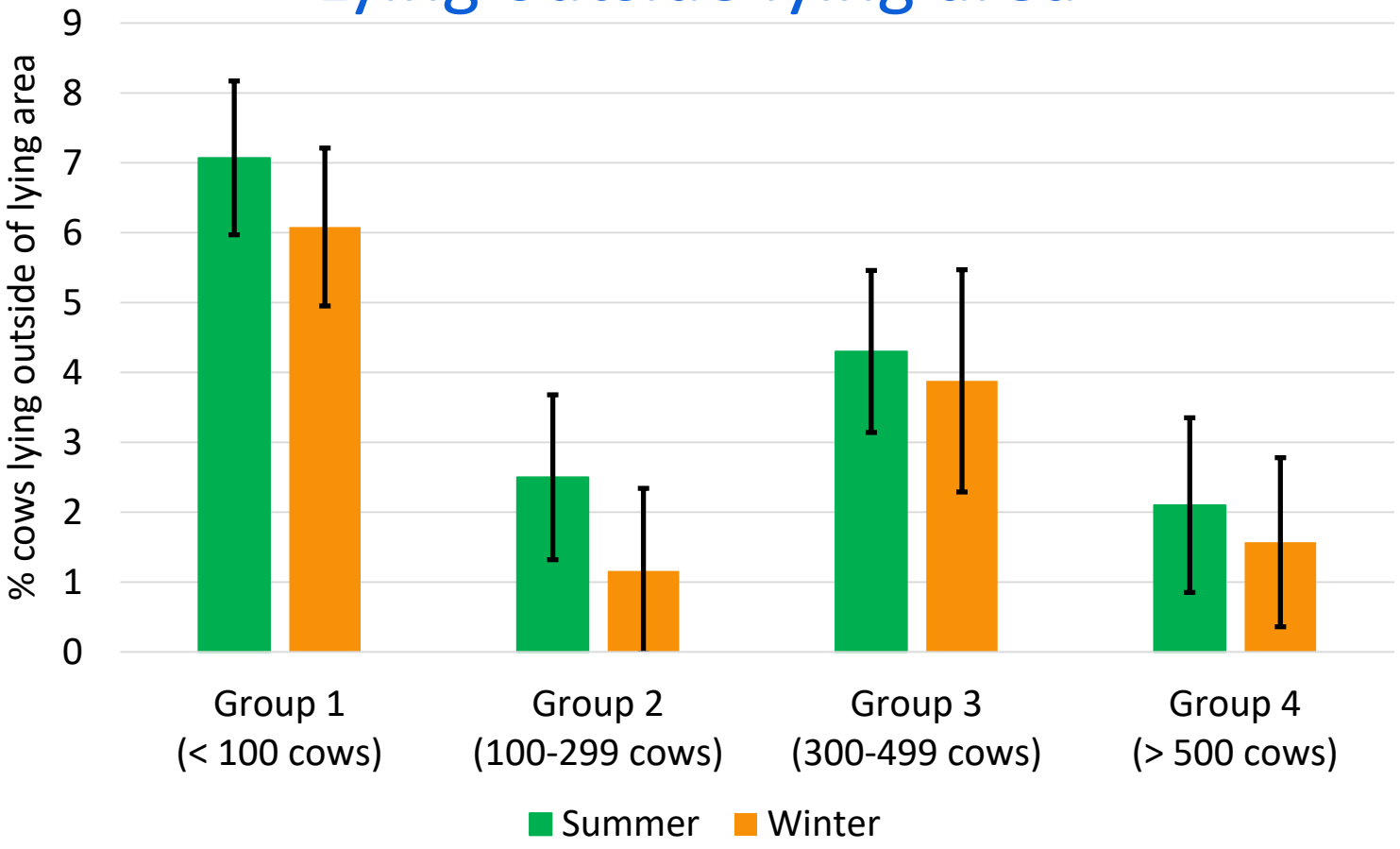
	P values
Group	< 0.05
Season	n.s.
Interaction	n.s.

Selected Measures Husbandry
- Collisions -



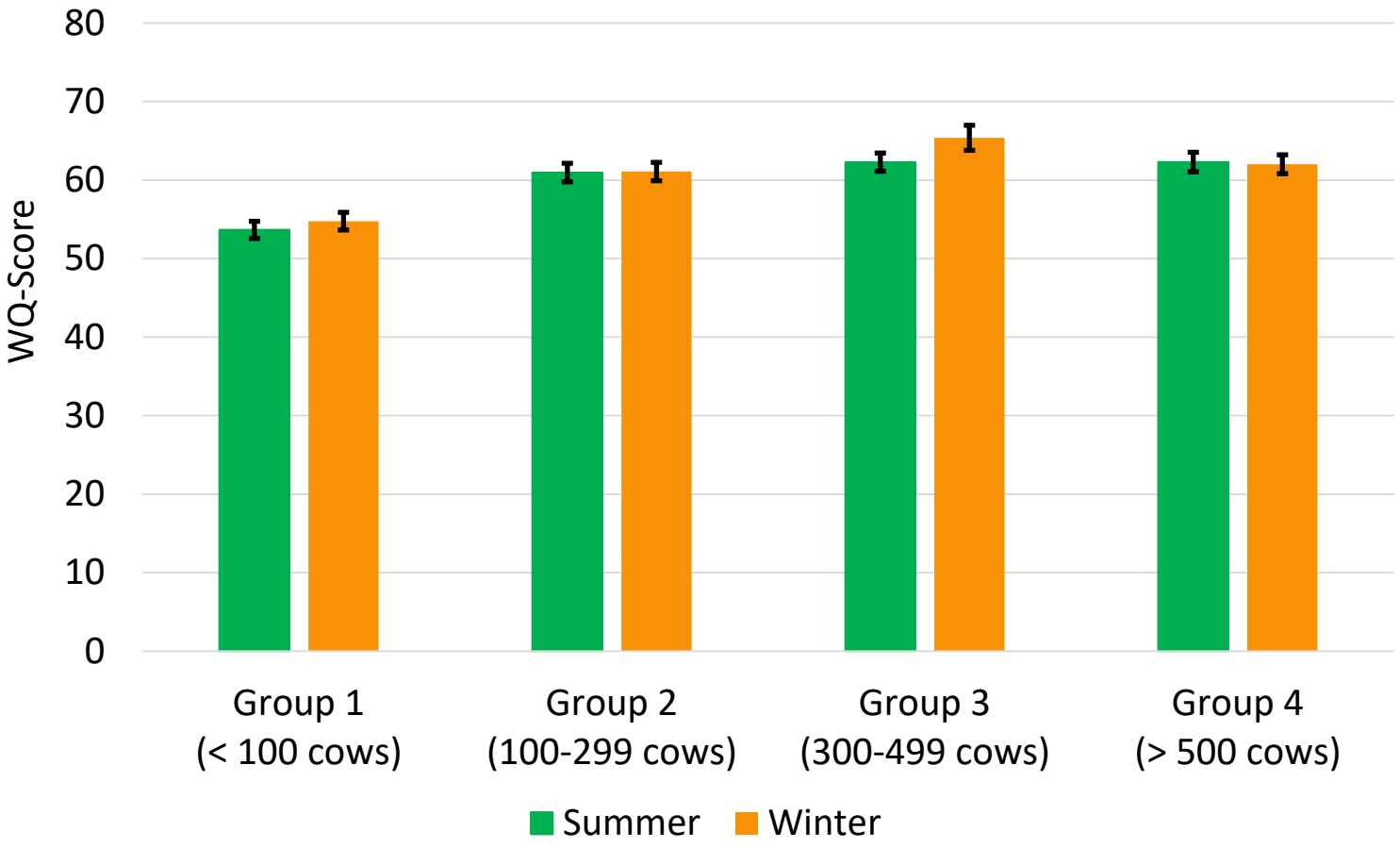
	P values
Group	n.s.
Season	< 0.001
Interaction	< 0.001

Selected Measures Husbandry
- Lying outside lying area -



	P values
Group	< 0.001
Season	< 0.001
Interaction	n.s.

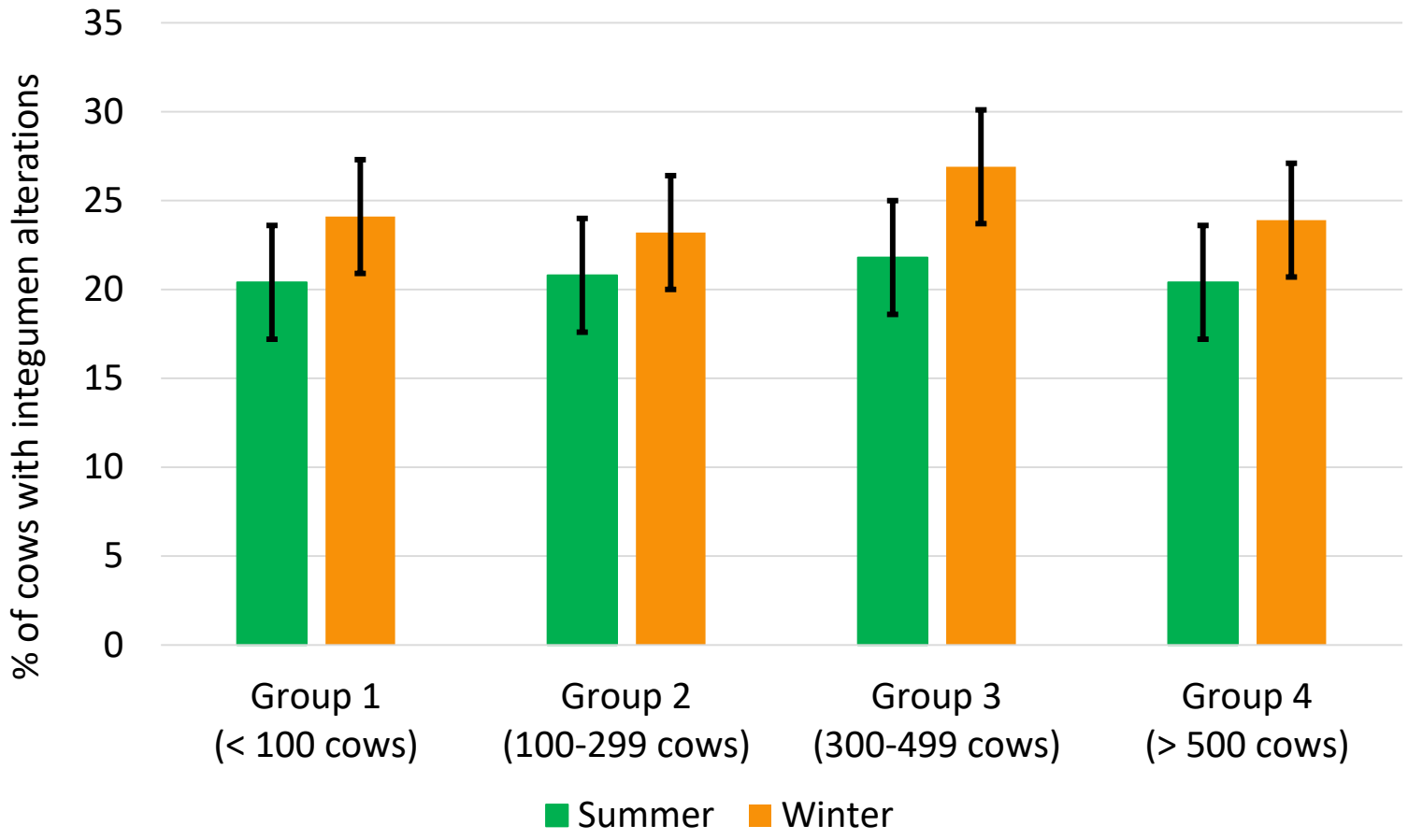
Principle „Good Husbandry“



	P values
Group	< 0.001
Season	n.s.
Interaction	n.s.

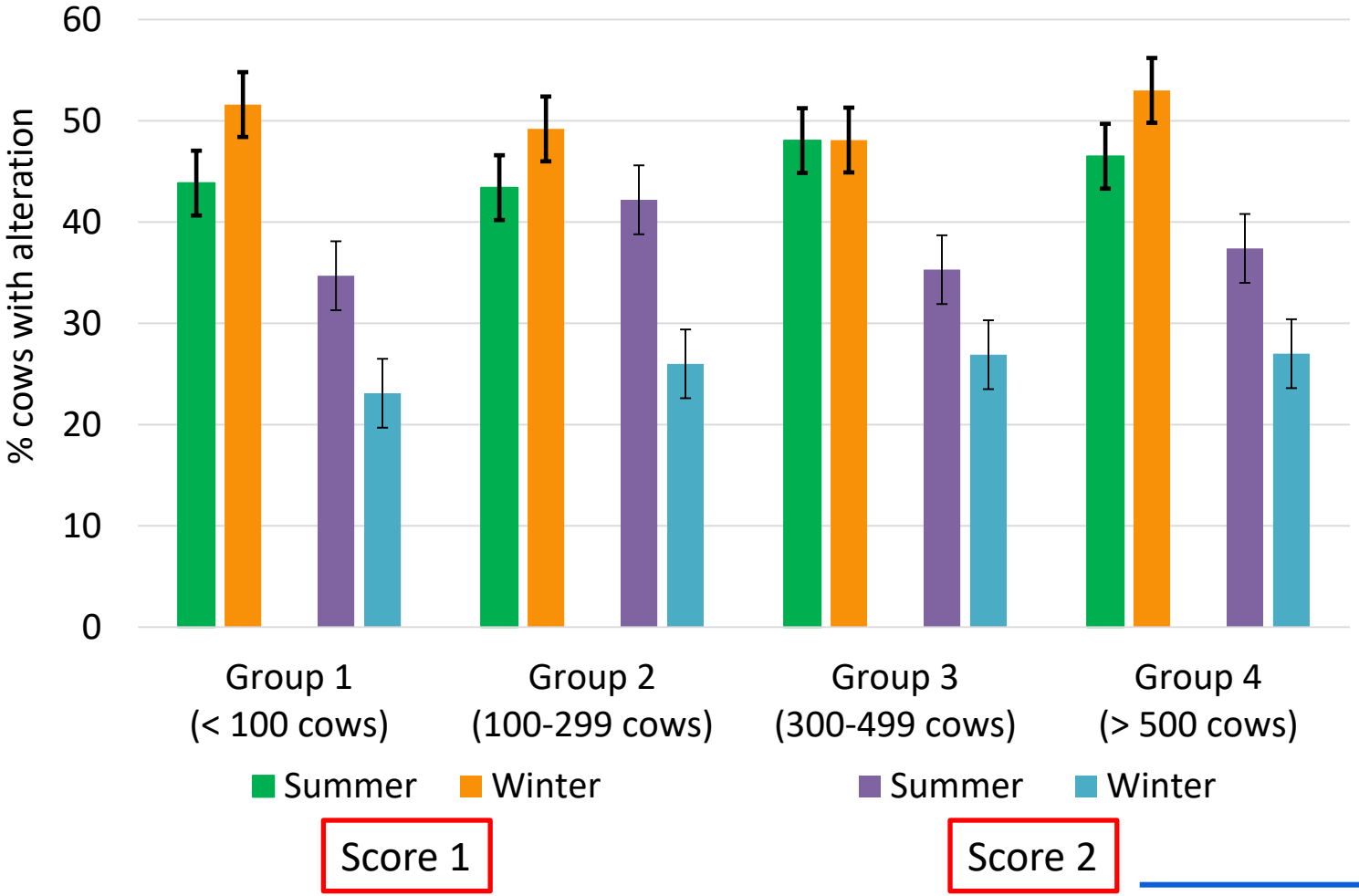
Health
- Integument alterations -

Integument alterations



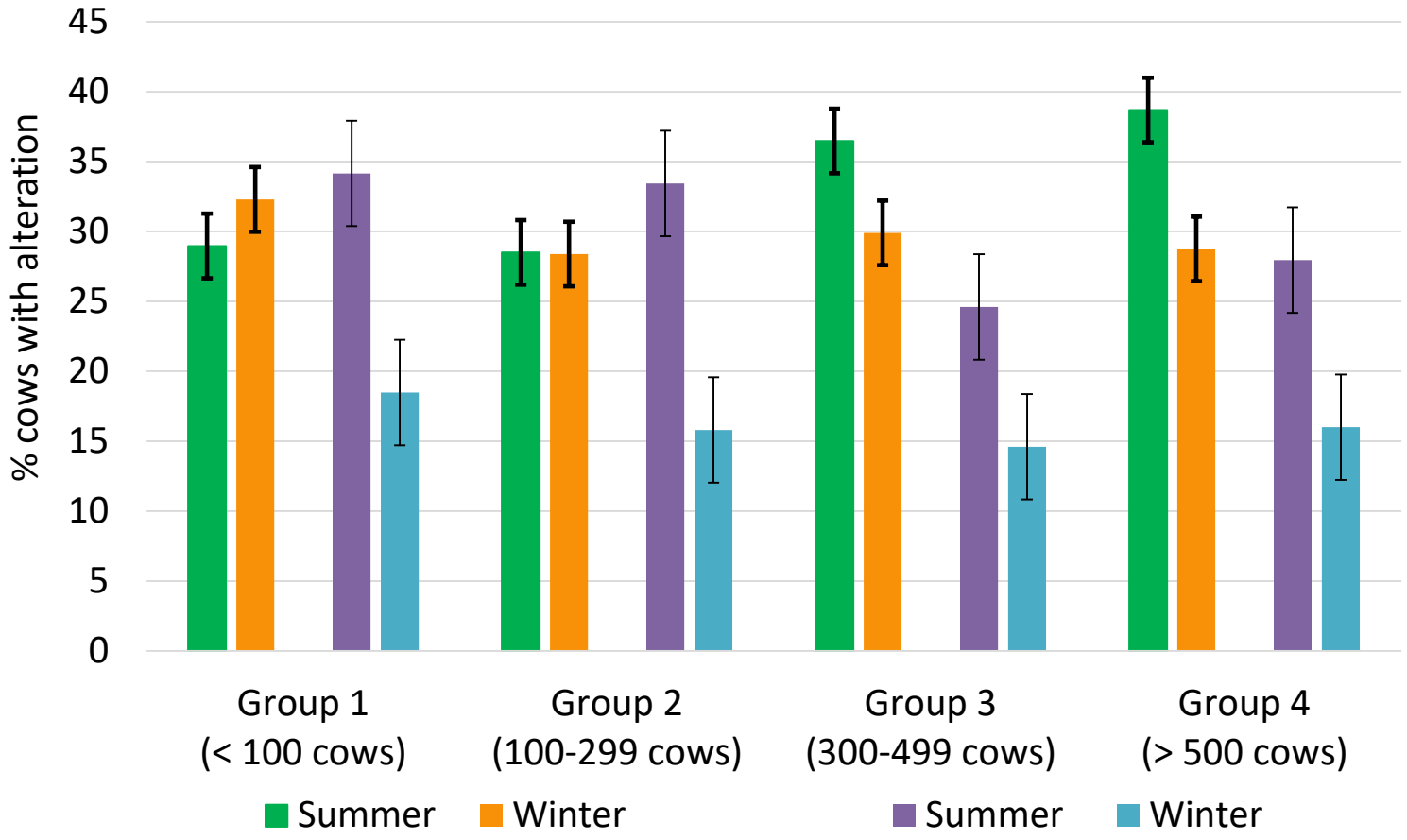
	P values
Group	n.s.
Season	< 0.001
Interaction	n.s.

Integument alterations



	P values
Group	n.s.
Season	< 0.001
Interaction	n.s.

Lameness



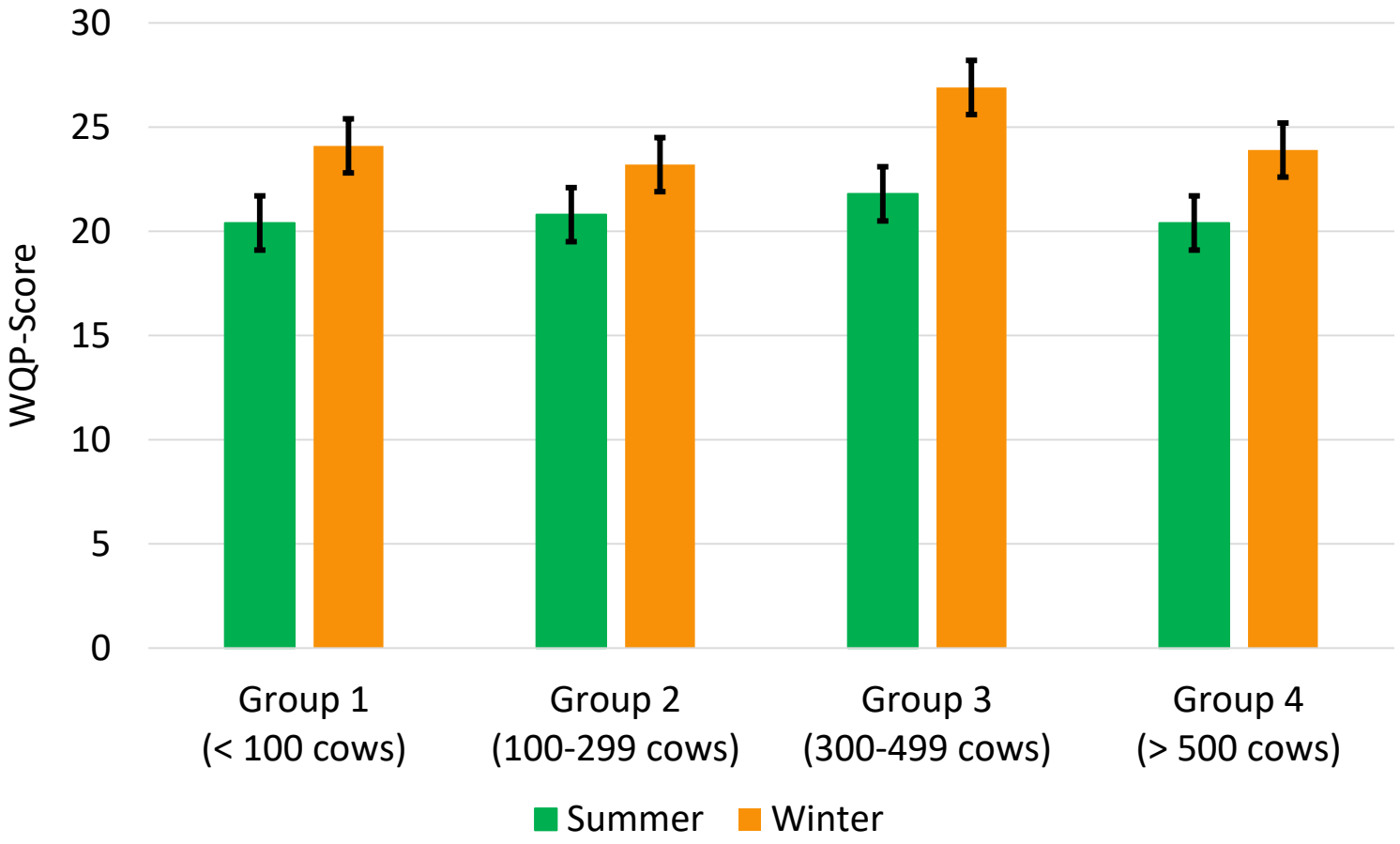
Score 1

	P values
Group	n.s.
Season	< 0.001
Interaction	n.s.

Score 2

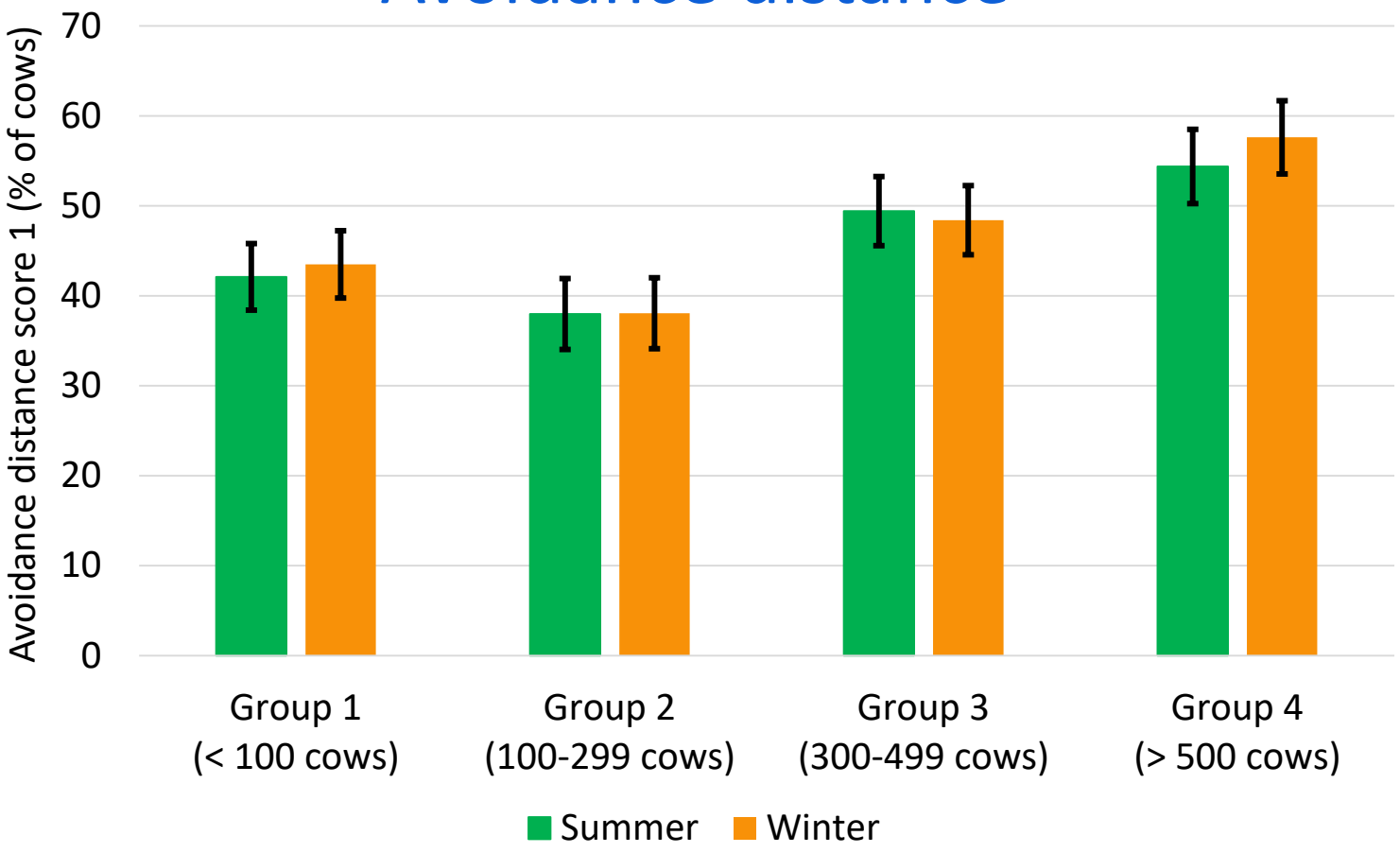
	P values
Group	n.s.
Season	n.s.
Interaction	<

Principle „Good Health“



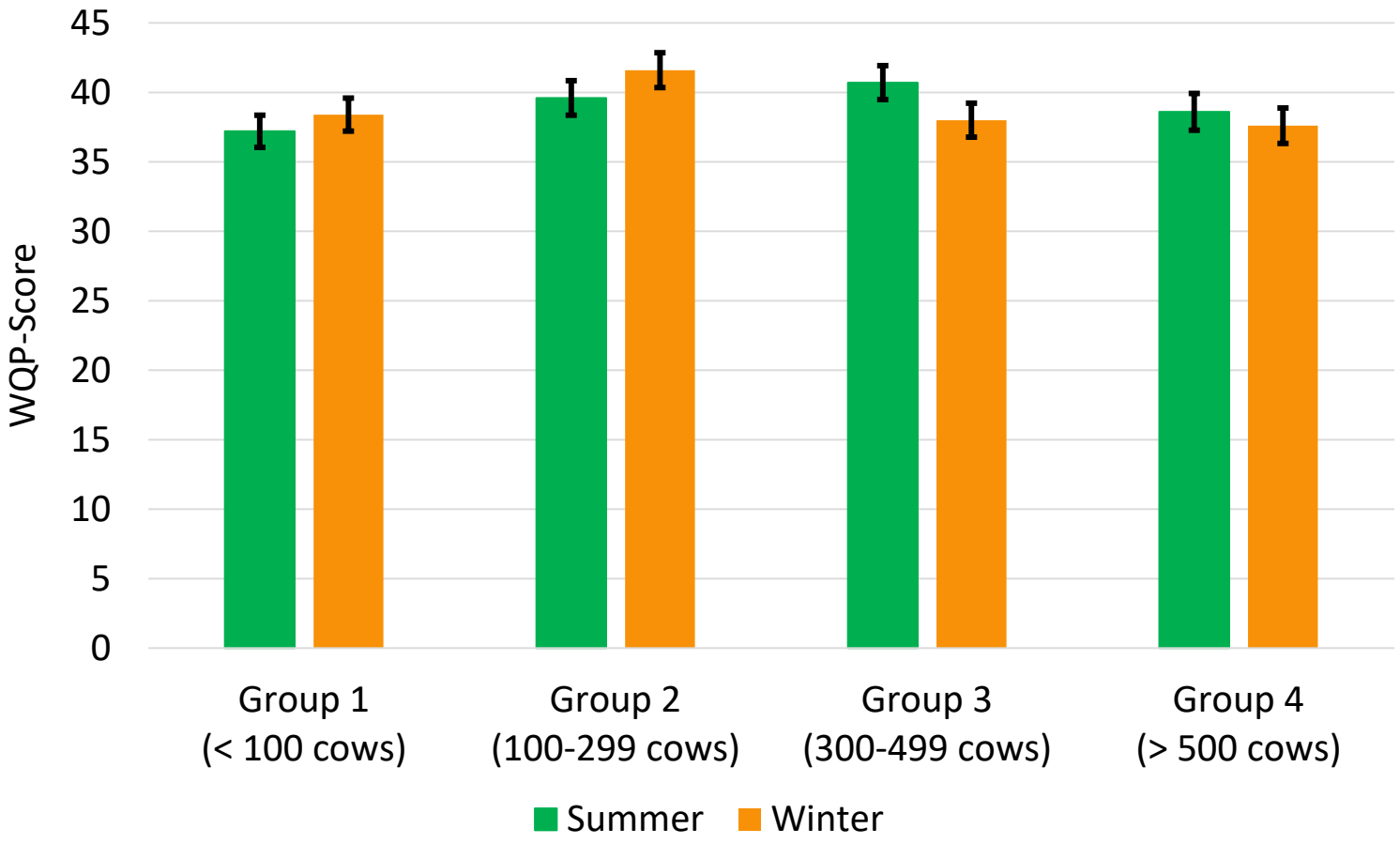
	P values
Group	n.s.
Season	< 0.001
Interaction	n.s.

Selected Measures Behaviour
- Avoidance distance -



	P values
Group	< 0.001
Season	n.s.
Interaction	n.s.

Principle „Appropriate Behaviour“



	P values
Group	n.s.
Season	n.s.
Interaction	n.s.

Overall Classification

Group	Season	excellent	improved	acceptable	not classified
Group 1 < 100 cows	Summer	0	22	78	0
	Winter	0	38	56	6
Group 2 100-299 cows	Summer	0	7	93	0
	Winter	0	7	86	7
Group 3 300-499 cows	Summer	0	31	69	0
	Winter	0	44	56	0
Group 4 < 500 cows	Summer	0	38	62	0
	Winter	0	38	62	0

Conclusions

- Overall Welfare classification not different between herd sizes
- Welfare level generally low (classification scheme!)
- At principle level:
  - Herd size effects only on „Good Husbandry“ (Smallest herd size worst)
  - „Good Health“ only different between seasons

Thanks for your attention !