

**Supplementary Table S1** Median values (25% – 75% quartile range) for Welfare Quality (WQ) measures in Year 0 as well as the respective change in Year 1 (difference Year 0 and Year 1) in Austrian dairy farms (n = 34)

WQ measures	Unit	WQ principle <sup>1</sup> / criteria <sup>2</sup>	Year 0		Difference Year 0 – Year 1	
			Median	25% – 75% quartile	Median	25% – 75% quartile
Very lean cows	%	P1 / C1	2.9	0.0 – 6.2	0.0	-3.1 – 2.9
Duration of lying down movement	sec	P2 / C3	5.9	5.5 – 6.1	-0.1	-0.6 – 0.2
Lying down movements with collisions	%	P2 / C3	33.3	12.5 – 42.9	-9.3	-27.4 – 8.7
Lying cows which lie partly/completely outside lying area	%	P2 / C3	4.2	0.0 – 13.9	0.1	-3.7 – 2.1
Cows with dirty lower legs	%	P2 / C3	42.9	27.1 – 57.2	4.9	-22.2 – 16.2
Cows with dirty udder	%	P2 / C3	62.9	54.5 – 75.7	-17.5	-28.7 – -3.3
Cows with dirty flank and upper legs	%	P2 / C3	40.0	27.3 – 65.7	-10.3	-19.9 – 12.9
Not lame cows	%	P3 / C6	60.6	50.0 – 74.3	-3.4	-10.5 – 4.9
Moderately lame cows	%	P3 / C6	20.8	16.6 – 27.0	1.5	-3.6 – 7.5
Severely lame cows	%	P3 / C6	13.5	9.1 – 24.6	2.3	-6.6 – 6.0
Cows with no hairless patch and no lesion	%	P3 / C6	38.9	30.6 – 48.5	26.4	18.5 – 34.0
Cows with at least one hairless patch and no lesion	%	P3 / C6	32.4	27.1 – 46.2	-15.1	-23.3 – -8.9
Cows with at least one lesion	%	P3 / C6	20.0	12.1 – 33.3	-10.6	-18.2 – 0.9
Frequency of coughing	per cow per 15 min	P3 / C7	0.1	0.1 – 0.2	0.0	-0.1 – 0.0
Cows with nasal discharge	%	P3 / C7	0.0	0.0 – 0.0	0.0	0.0 – 0.0
Cows with ocular discharge	%	P3 / C7	0.0	0.0 – 3.2	0.0	-2.9 – 0.0
Cows with increased respiratory rate	%	P3 / C7	0.0	0.0 – 0.0	0.0	0.0 – 0.0

Cows with diarrhoea	%	P3 / C7	6.9	3.8 – 18.3	5.9	-6.3 – 10.3
Cows with vulvar discharge	%	P3 / C7	0.0	0.0 – 3.1	0.0	0.0 – 0.0
Mastitis (milk somatic cell count > 400 000)	%	P3 / C7	7.2	3.2 – 12.3	1.9	-2.9 – 4.5
Mortality during the last 12 months	%	P3 / C7	0.0	0.0 – 3.3	0.0	-2.7 – 0.2
Dystocia	%	P3 / C7	2.8	0.0 – 5.5	0.0	-3.9 – 2.6
Downer cows	%	P3 / C7	2.8	0.0 – 6.0	0.0	-3.0 – 2.6
Frequency of headbutts	per cow per hour	P4 / C9	0.7	0.4 – 1.2	-0.1	-0.5 – 0.2
Frequency of other aggressive events (displacements, chasing, fighting, chasing-up)	per cow per hour	P4 / C9	0.3	0.2 – 0.7	0.0	-0.2 – 0.3
Cows that can be touched	%	P4 / C11	42.9	30.9 – 50.9	-4.5	-15.8 – 9.9
Cows that can be approached by 50 cm but not touched	%	P4 / C11	41.4	34.7 – 52.2	9.1	1.9 – 17.4
Cows that can be approached between 50 cm and 1 m	%	P4 / C11	10.3	5.7 – 19.3	-2.9	-8.8 – 0.0
Cows that can't be approached	%	P4 / C11	0.0	0.0 – 4.3	0.0	-3.9 – 0.0
Positive emotional state	WQ-score	P4 / C12	25.6	15.8 – 37.8	0.8	-16.3 – 9.8

<sup>1</sup> P: Welfare Quality principle; P1 Good feeding; P2 Good housing; P3 Good health; P4 Appropriate behaviour

<sup>2</sup> C: Welfare Quality criteria; C1 Absence of prolonged hunger; C3 Comfort around resting; C6 Absence of injuries; C7 Absence of disease; C9 Expression of social behaviours; C11 Good human-animal relationship; C12 Positive emotional state

**Table 2** Median values (25% – 75% quartile range) for Welfare Quality (WQ) criterion and principle scores in Year 0 and Year 1, as well as the respective change in Year 1 (difference Year 0 and Year 1) in Austrian dairy farms (n = 34)

Variable <sup>1</sup>	Description	Year 0		Year 1		Difference Year 0 – Year 1	
		Median	25% - 75% quartile	Median	25% - 75% quartile	Median	25% - 75% quartile
C1	Absence of prolonged hunger	78	62 - 100	80	68 - 100	0	-18 - 23
C2	Absence of prolonged thirst	100	3: 4 farms, 32: 4 farms, 60: 4 farms, 100: 20 farms	100	3: 5 farms 20: 1 farm 32: 4 farms 60: 3 farms 100: 21 farms	0	-68: 1 farm, -57: 1 farm, -40: 2 farms, 0: 29 farms, 68: 1 farm
C3	Comfort around resting	30	16 - 32	32	22 - 43	1	-4 - 18
C4	Thermal comfort <sup>2,3</sup>	100	-	100	-	0	-
C5	Ease of movement <sup>3</sup>	100	-	100	-	0	-
C6	Absence of injuries	35	23 - 41	36	30 - 43	5	-4 - 13
C7	Absence of disease	43	37 - 57	50	40 - 57	0	-8 - 16
C8	Absence of pain induced by management procedures	52	20: 1 farm, 28: 15 farms, 52: 18 farms	52	20: 1 farm 28: 15 farms 52: 18 farms	0	-
C9	Expression of social behaviours	64	46 - 81	64	52 - 78	1	-15 - 13
C10	Expression of other behaviours <sup>3</sup>	0	-	0	-	0	-
C11	Good human-animal relationship	64	56 - 74	69	61 - 76	3	-5 - 15
C12	Positive emotional state	25	16 - 36	30	13 - 40	-1	-10 - 16
P1 (C1-2)	Good feeding	71	45 - 100	72	37 - 92	0	-14 - 4

P2 (C3-5)	Good housing	56	47 - 57	57	51 - 64	1	-3 - 12
P3 (C6-8)	Good health	34	30 - 39	34	32 - 42	2	-2 - 7
P4 (C9-12)	Appropriate behaviour	19	15 - 24	24	19 - 30	0	-4 - 6

<sup>1</sup> C: Welfare Quality Criterion; P: Welfare Quality Principle

<sup>2</sup> As yet, no measure has been developed

<sup>3</sup> No between-farm variation regarding these criteria