6. Supplementary material

Table S1. Summary statistics for categorical explanatory variables from two years data of 7021 observations of 4721 ewes from 10 farms in Great Britain.

Variable	Category	Number of observations	% of observations	Total observations‡
Acute mastitis	No	6840	97.42	7021
	Yes	181	2.58	
Intramammary mass detected in pregnancy	No	5525	95.26	5800
	Yes	275	4.74	
Intramammary mass detected in lactation	No	4537	89.01	5093
	Yes	556	10.92	
Intramammary mass detected in the previous lactation	No	1533	21.83	7021
	Yes	71	1.01	
	Don't know	5417	77.15	
Breed	Lleyn	4437	64.30	6901
	Crossbreeds	1494	21.65	
	Charollais	513	7.43	
	Texel	457	6.62	
Body condition score in pregnancy	3	2606	38.00	6857
	Below 3	2583	37.67	
	Above 3	1668	24.33	
Body condition score in lactation	3	1539	25.58	6017
	Below 3	3266	54.28	
	Above 3	1212	20.14	
Woolly udder	No	4838	93.92	5151
	Yes	313	6.47	
Teat position score	1 ↓	28	0.56	5030
	2	1460	29.02	
	3	2590	51.49	
	4	946	18.81	
	5 ↑	6	0.12	
	6	0	0.00	
	7	0	0.00	
Teat angle score	1 ↓	4	0.08	5017
	2 ↓	14	0.28	
	3	166	3.31	
	4	1445	28.80	
	5	2054	40.94	
	6	996	19.85	
	7	328	6.54	
	8 ↑	38	0.76	
	9 ↑	2	0.04	
Udder drop score	1	0	0.00	5018
	2 ↓	1	0.02	
	3 ↓	7	0.14	
	4 ↓	27	0.54	
	5	114	2.27	
	6	797	15.88	
	7	3290	65.56	
	8	764	15.23	

	9 ↑	18	0.36	
Degree of separation of udder halves score	1	344	7.08	4860
	2	853	17.55	
	3	1314	27.04	
	4	1059	21.79	
	5	858	17.65	
	6	367	7.55	
	7 ↑	61	1.26	
	8 ↑	4	0.08	
	9	0	0.00	
Non-traumatic teat lesions	None	4788	94.18	5084
	At least 1 teat	296	5.82	
Traumatic teat lesions	None	4884	96.07	5084
	At least 1 teat	200	3.93	
Number of lambs reared	1	2370	40.18	5898
	≥ 2	3528	59.82	
Dietary energy during pregnancy	Adequate	5923	94.03	6299
	Overfed	286	4.54	
	Underfed	90	1.43	
Dietary protein during pregnancy	Adequate	5960	94.62	6299
	Overfed	219	3.48	
	Underfed	120	1.91	
Dietary energy during lactation	Adequate	3130	51.55	6072
	Overfed	83	1.35	
	Underfed	2859	47.08	
Dietary protein during lactation	Adequate	4843	79.76	6072
	Overfed	31	0.51	
	Underfed	1198	19.73	
Age at lambing in years	1	437	7.85	5570
	2	1433	25.73	
	3	1418	25.46	
	4	924	16.59	
	5 - 7	1308	23.48	
	> 7	50	0.90	

‡ Where total observations do not equal 7021, data were unavailable for all ewes.
↓ indicates where categories were merged with the category below.
↑ indicates where categories were merged with the category above.

Table S2. Summary statistics for continuous explanatory variables from two years data of 7021 observations of 4721 ewes from 10 farms in Great Britain.

Variable	**Minimum**	**Maximum**	**Mean**	**SD**	**N**
Udder width (cm)	5.00	26.00	13.14	2.01	5009
Teat length (cm)	1.00	6.00	2.39	0.48	5049
Litter birth weight (kg)	1.00	23.90	6.24	2.37	5250
Litter daily live weight gain (kg)	0.05	1.34	0.52	0.17	5111
Lamb birth weight (kg)	0.50	9.00	3.85	0.92	9221
Lamb ≈ 8 week weight (kg)	7.00	53.00	24.17	5.13	8794
Days in milk (at examination in lactation)	4	124	69.79	17.31	4722
Lamb age when weighed at ≈ 8 weeks (days)	14	96	60.98	11.19	5649
Flock % of intramammary masses in pregnancy	1.40	17.60	4.47	2.87	5908
Flock % of intramammary masses in lactation	4.40	41.20	9.42	5.59	5908

Table S3. Dietary energy and protein by adequacy of amount fed to 3021 and 3278 pregnant ewes and 2936 and 3136 lactating ewes by farm and year.

Farm	**P Energy**			**P Protein**			**L Energy**			**L Protein**		
	UnF	Adq	OvF	UnF	Adq	OvF	UnF	Adq	OvF	UnF	Adq	OvF
Year 1												
A	0	279	0	0	279	0	171	105	0	171	105	0
B	35	0	70	35	0	70	103	0	0	48	55	0
C	7	49	0	0	56	0	34	0	21	34	21	0
D	0	39	0	0	39	0	36	31	0	67	0	0
E	48	37	0	85	0	0	48	27	0	75	0	0
F	0	1493	0	0	1493	0	695	685	0	31	1349	0
G	0	27	67	0	94	0	27	67	0	27	67	0
H	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
I	0	870	0	0	870	0	548	338	0	548	338	0
% of total ewes	**2.5**	**76.6**	**3.8**	**3.3**	**77.6**	**1.9**	**45.5**	**34.3**	**0.6**	**27.4**	**53.0**	**0**
Total ewes	***3021***						***2936***					
Year 2												
A	0	317	0	0	317	0	211	92	0	0	303	0
B	0	0	149	0	0	149	77	57	0	77	57	0
C	0	50	0	0	50	0	47	0	0	47	0	0
D	0	88	0	0	88	0	0	53	31	53	31	0
E	0	76	0	0	76	0	1	38	31	1	38	31
F	0	1485	0	0	1485	0	861	524	0	19	1366	0
I	0	1113	0	0	1113	0	0	1113	0	0	1113	0
J	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
% of total ewes	**0**	**92.8**	**4.4**	**0**	**92.8**	**4.4**	**35.5**	**55.7**	**1.8**	**5.8**	**86.3**	**0.9**
Total ewes	***3278***						***3136***					

P: Pregnancy; L: Lactation; UnF: Underfed; Adq: Adequate; Ovf: Overfed; NA: Data not available for this farm. Note: where scanning data and / or litter size data were unavailable ewes could not be assigned as Unf, Adq, or OvF.

Table S4. Three-level binary logistic model of factors associated with forward pointing teat position (teat positions 1 and 2) in 3871 observations of 3050 ewes.

Variable	**Category**	***N* affected**	**% affected**	**OR**	**Lower 95% CI**	**Upper 95% CI**
Age at lambing (yrs.)	1	89	29.18	Reference		
	2	277	27.18	1.08	0.78	1.47
	3	305	30.20	1.18	0.85	1.64
	4	156	30.23	1.03	0.72	1.48
	5 -7	300	31.75	1.15	0.82	1.61
	> 7	1	2.78	**0.06**	**0.008**	**0.504**
IMM when pregnant	No	1008	28.80	Reference		
	Yes	139	34.58	**1.45**	**1.13**	**1.87**
Acute mastitis	No	1102	28.91	Reference		
	Yes	45	47.87	**2.17**	**1.25**	**3.78**
Breed	Lleyn	843	30.65	Reference		
	Crossbreeds	160	29.68	0.89	0.67	1.18
	Charollais	91	22.98	**0.30**	**0.19**	**0.47**
	Texel	52	24.64	**0.57**	**0.36**	**0.91**
Degree of separation of udder halves	3	318	30.78	Reference		
	6 - 8	122	36.31	1.14	0.86	1.52
	5	191	28.17	0.90	0.71	1.13
	4	275	33.29	1.12	0.91	1.38
	2	127	19.07	**0.57**	**0.44**	**0.73**
	1	49	18.63	**0.58**	**0.40**	**0.83**
Teat angle	5	437	27.28	Reference		
	7 - 9	94	35.47	**1.92**	**1.40**	**2.62**
	6	221	28.63	1.14	0.92	1.40
	4	346	30.65	1.02	0.85	1.24
	3 - 1	49	36.57	0.92	0.60	1.41
Pregnancy protein	Adequate	1044	29.76	Reference		
	Overfed	45	25.57	**1.78**	**1.05**	**3.03**
	Underfed	27	33.75	1.15	0.60	2.21
Lactation energy	Adequate	485	32.44	Reference		
	Overfed	10	17.24	**2.79**	**1.10**	**7.05**
	Underfed	624	27.53	**0.46**	**0.38**	**0.56**
Lactation protein	Adequate	821	29.34	Reference		
	Overfed	0				
	Underfed	298	29.80	**2.31**	**1.78**	**2.99**
		Overall mean	**Affected mean**			
Udder width (cm)		13.14	13.62	**1.24**	**1.18**	**1.30**
Teat length (cm)		2.39	2.43	**1.20**	**1.01**	**1.42**
Days in milk		69.79	69.13	**0.99**	**0.983**	**0.995**
		Variance	SD			
Random effects	Farm	1.00	1.00			
	Ewe	1.31	1.11			
	Year					

N: Number; OR: Odds ratio; CI: Confidence interval; IMM: Intramammary mass; SD: Standard deviation; Reference: baseline category for comparison. Where categories are in **bold** they are statistically different from the reference category at $P < 0.05$.

Table S5. Three-level mixed effect continuous outcome model of factors associated with increasing teat angle in 3826 observations of 3006 ewes.

Variable	Category	*N*	Mean	Coefficient	Lower 95% CI	Upper 95% CI
Udder width (cm)		5009		**-0.03**	**-0.05**	**-0.02**
Teat length (cm)		5049		**-0.35**	**-0.41**	**-0.29**
Days in milk		4722		**0.01**	**0.004**	**0.008**
Litter DLWG (kg)		5111		**-0.22**	**-0.44**	**-0.01**
Non-traumatic teat lesions	None	4717	5.00	Reference		
	At least 1 teat	296	4.56	**-0.31**	**-0.42**	**-0.20**
Traumatic teat lesions	None	4815	4.98	Reference		
	At least 1 teat	198	4.68	**-0.36**	**-0.50**	**-0.22**
IMM when lactating	No	4475	4.95	Reference		
	Yes	539	5.16	**0.14**	**0.05**	**0.23**
Acute mastitis	No	4893	4.97	Reference		
	Yes	124	5.03	**-0.27**	**-0.47**	**-0.06**
Teat position	3	2577	5.03	Reference		
	1 - 2	1488	4.95	-0.01	-0.07	0.05
	4 - 5	948	4.84	**-0.20**	**-0.27**	**-0.12**
Udder drop		5018		**-0.08**	**-0.13**	**-0.03**
BCS when pregnant	3	1637	5.00	Reference		
	Below 3	2022	4.75	**-0.12**	**-0.19**	**-0.05**
	Above 3	1265	5.28	**0.11**	**0.03**	**0.18**
BCS when lactating	3	1225	4.95	Reference		
	Below 3	2663	4.92	**0.11**	**0.05**	**0.18**
	Above 3	1126	5.13	0.03	-0.05	0.11
Breed	Lleyn	3532	4.95	Reference		
	Crossbreeds	678	4.54	-0.02	-0.15	0.11
	Charollais	450	5.57	**0.96**	**0.63**	**1.29**
	Texel	314	5.32	**0.52**	**0.19**	**0.84**
Age at lambing (yrs.)	1	386	5.02	Reference		
	2	1255	5.04	-0.09	-0.21	0.02
	3	1134	4.96	-0.08	-0.20	0.04
	4	627	5.07	-0.02	-0.15	0.12
	5 - 7	1096	4.81	**-0.17**	**-0.29**	**-0.04**
	> 7	42	5.31	0.13	-0.19	0.45
Pregnancy protein	Adequate	4256	4.92	Reference		
	Overfed	195	5.56	0.06	-0.43	0.54
	Underfed	109	5.66	**0.92**	**0.48**	**1.37**
Pregnancy energy	Adequate	4221	4.92	Reference		
	Overfed	254	5.47	-0.18	-0.55	0.19
	Underfed	85	5.56	**-0.57**	**-0.99**	**-0.15**

Lactation protein	Adequate	3347	4.96	Reference		
	Overfed	28	5.18	**0.58**	**0.08**	**1.08**
	Underfed	1121	4.98	**-0.19**	**-0.29**	**-0.09**
Lactation energy	Adequate	1789	4.96	Reference		
	Overfed	73	5.10	**-0.62**	**-0.92**	**-0.32**
	Underfed	2634	4.96	**0.17**	**0.09**	**0.25**
		Variance	SD			
Random effects	Farm	0.03	0.02			
	Ewe	0.24	0.02			
	Year	0.47	0.02			

N: Number; CI: Confidence interval; DLWG: Daily live weight gain; IMM: Intramammary mass; BCS: Body condition score; SD: Standard deviation; Reference: baseline category for comparison.
Where categories are in **bold** they are statistically different from the reference category at $P < 0.05$.

Table S6. Three-level mixed effect continuous outcome model of factors associated with increasing udder drop (9 (least pendulous) – 1 (most pendulous)) in 3901 observations of 3067 ewes.

Variable	Category	*N*	Mean	Coefficient	Lower 95% CI	Upper 95% CI
Udder width (cm)		5009		**-0.12**	**-0.13**	**-0.11**
Age at lambing (yrs.)		5570		**-0.13**	**-0.14**	**-0.11**
Days in milk		4722		**-0.003**	**-0.005**	**-0.001**
Litter BW (kg)		5250		**-0.02**	**-0.03**	**-0.01**
Teat length (cm)		5049		**-0.13**	**-0.17**	**-0.09**
Teat angle		5017		**-0.03**	**-0.05**	**-0.01**
Teat position	3	2580	6.96	Reference		
	1 - 2	1488	6.81	**-0.06**	**-0.10**	**-0.02**
	4 - 5	946	7.06	**0.05**	**0.002**	**0.092**
Breed	Lleyn	3533	6.92	Reference		
	Crossbreeds	679	7.05	**0.09**	**0.01**	**0.17**
	Charollais	450	6.82	-0.09	-0.35	0.17
	Texel	314	7.06	0.00	-0.20	0.20
IMM when pregnant	No	4706	6.95	Reference		
	Yes	222	6.69	**-0.14**	**-0.22**	**-0.06**
IMM when lactating	No	4475	6.96	Reference		
	Yes	540	6.73	**-0.16**	**-0.21**	**-0.10**
Pregnancy protein	Adequate	4258	6.93	Reference		
	Overfed	195	6.77	**-0.30**	**-0.52**	**-0.07**
	Underfed	109	6.88	-0.03	-0.21	0.15
Lactation protein	Adequate	3347	6.94	Reference		
	Overfed	28	7.43	**0.34**	**0.09**	**0.59**
	Underfed	1123	6.86	**-0.09**	**-0.14**	**-0.04**
		Variance	SD			
Random effects	Farm	0.03	0.01			
	Ewe	0.08	0.01			
	Year	0.20	0.01			

N: Number; CI: Confidence interval; BW: Birth weight; IMM: Intramammary mass; SD: Standard deviation; Reference: baseline category for comparison. Where categories are in **bold** they are statistically different from the reference category at $P < 0.05$.

Table S7. Three-level mixed effect continuous outcome model of factors associated with increasing degree of separation of udder halves in 4426 observations of 3295 ewes.

Variable	**Category**	***N***	**Mean**	**Coefficient**	**Lower 95% CI**	**Upper 95% CI**
Udder width (cm)		5009		**0.14**	**0.12**	**0.16**
Days in milk		4722		**0.02**	**0.017**	**0.020**
BCS when pregnant	3	1598	3.67	Reference		
	Below 3	1930	3.32	**-0.23**	**-0.32**	**-0.15**
	Above 3	1243	3.66	**0.21**	**0.11**	**0.30**
Breed	Lleyn	3448	3.73	Reference		
	Crossbreeds	639	2.95	**-0.27**	**-0.45**	**-0.08**
	Charollais	434	2.86	0.08	-0.36	0.52
	Texel	297	3.40	0.28	-0.24	0.80
Teat position	3	2534	3.55	Reference		
	1 - 2	1389	3.73	0.08	-0.004	0.16
	4 - 5	934	3.12	**-0.24**	**-0.33**	**-0.14**
IMM when lactating	No	4345	3.57	Reference		
	Yes	512	3.13	**-0.33**	**-0.45**	**-0.21**
Pregnancy protein	Adequate	4130	3.59	Reference		
	Overfed	189	3.14	0.14	-0.34	0.62
	Underfed	104	3.15	**-0.41**	**-0.74**	**-0.07**
		Variance	SD			
Random effects	Farm	0.28	0.13			
	Ewe	0.76	0.04			
	Year	0.84	0.03			

N: Number; CI: Confidence interval; BCS: Body condition score; IMM: Intramammary mass; SD: Standard deviation; Reference: baseline category for comparison. Where categories are in **bold** they are statistically different from the reference category at $P < 0.05$.

Table S8. Three-level mixed effect continuous outcome model of factors associated with increasing udder width (cm) in 3749 observations of 2922 ewes.

Variable	**Category**	***N***	**Mean**	**Coefficient**	**Lower 95% CI**	**Upper 95% CI**
Days in milk		4722		**-0.02**	**-0.03**	**-0.02**
Litter DLWG (kg)		5111		**2.65**	**2.34**	**2.96**
Teat length (cm)		5049		**0.26**	**0.16**	**0.36**
Udder drop		5018		**-0.89**	**-0.97**	**-0.81**
Teat angle		5017		**-0.19**	**-0.24**	**-0.14**
Degree of separation of udder halves		4860		**0.20**	**0.17**	**0.24**
Teat position	3	2575	13.1	Reference		
	1 - 2	1481	13.6	**0.32**	**0.22**	**0.43**
	4 - 5	948	12.5	**-0.20**	**-0.32**	**-0.08**
Breed	Lleyn	3534	13.4	Reference		
	Crossbreeds	678	12.9	**0.51**	**0.29**	**0.74**
	Charollais	440	12.2	-0.98	-2.13	0.18
	Texel	314	12.0	-0.21	-1.14	0.72
Age at lambing (yrs.)	1	386	12.0	Reference		
	2	1257	12.8	**0.58**	**0.39**	**0.77**
	3	1132	13.3	**0.67**	**0.47**	**0.87**
	4	626	13.7	**0.81**	**0.59**	**1.03**
	5 - 7	1092	13.7	**0.67**	**0.46**	**0.88**
	> 7	40	13.0	**0.66**	**0.15**	**1.17**
Non-traumatic teat lesions	None	4711	13.2	Reference		
	At least 1 teat	296	12.6	**-0.29**	**-0.49**	**-0.10**
Traumatic teat lesions	None	4810	13.1	Reference		
	At least 1 teat	197	13.5	**0.25**	**0.01**	**0.48**
Pregnancy protein	Adequate	4257	13.3	Reference		
	Overfed	189	12.4	-0.25	-0.96	0.46
	Underfed	108	11.8	**0.78**	**0.17**	**1.38**
Lactation protein	Adequate	3343	13.4	Reference		
	Overfed	28	11.8	**1.32**	**0.56**	**2.07**
	Underfed	1118	12.8	-0.10	-0.25	0.05
		Variance	SD			
Random effects	Farm	0.55	0.27			
	Ewe	0.24	0.07			
	Year	1.67	0.07			

N: Number; CI: Confidence interval; DLWG: Daily live weight gain; SD: Standard deviation; Reference: baseline category for comparison. Where categories are in **bold** they are statistically different from the reference category at $P < 0.05$.

Table S9. Three-level mixed effect continuous outcome model of factors associated with increasing teat length (cm) in 4476 observations of 3343 ewes.

Variable	Category	*N*	Mean	Coefficient	Lower 95% CI	Upper 95% CI
Udder width (cm)		5009		**0.03**	**0.02**	**0.03**
Age at lambing (yrs.)		5570		**0.03**	**0.02**	**0.04**
Days in milk		4722		**-0.0012**	**-0.0021**	**-0.0002**
Teat angle		5017		**-0.09**	**-0.10**	**-0.05**
Udder drop		5018		**-0.08**	**-0.10**	**-0.05**
Teat position	3	2579	2.36	Reference		
	1 - 2	1486	2.42	**0.04**	**0.02**	**0.07**
	4 - 5	949	2.39	-0.03	-0.06	0.01
BCS when pregnant	3	1654	2.33	Reference		
	Below 3	2028	2.48	**0.08**	**0.05**	**0.11**
	Above 3	1668	2.30	**-0.07**	**-0.11**	**-0.04**
BCS when lactating	3	1227	2.36	Reference		
	Below 3	2673	2.42	**0.03**	**0.003**	**0.061**
	Above 3	1146	2.34	0.01	-0.02	0.05
Breed	Lleyn	3565	2.32	Reference		
	Crossbreeds	677	2.57	**0.13**	**0.06**	**0.19**
	Charollais	450	2.54	0.17	-0.13	0.47
	Texel	314	2.56	-0.02	-0.21	0.17
Non-traumatic teat lesions	None	4751	2.37	Reference		
	At least 1 teat	296	2.65	**0.17**	**0.12**	**0.23**
Traumatic teat lesions	None	4848	2.38	Reference		
	At least 1 teat	199	2.55	**0.07**	**0.01**	**0.13**
IMM when lactating	No	4498	2.38	Reference		
	Yes	548	2.42	**-0.05**	**-0.09**	**-0.01**
Pregnancy protein	Adequate	4288	2.36	Reference		
	Overfed	195	2.56	0.05	-0.15	0.24
	Underfed	109	2.69	**0.20**	**0.06**	**0.35**
Lactation protein	Adequate	3376	2.35	Reference		
	Overfed	28	2.43	-0.06	-0.26	0.13
	Underfed	1121	2.50	**-0.05**	**-0.09**	**-0.01**
		Variance	SD			
Random effects	Farm	0.04	0.02			
	Ewe	0.07	0.01			
	Year	0.11	0.00			

N: Number; CI: Confidence interval; BCS: Body condition score; IMM: Intramammary mass; SD: Standard deviation; Reference: baseline category for comparison. Where categories are in **bold** they are statistically different from the reference category at $P < 0.05$.

Table S10. Three-level binary logistic model of factors associated with non-traumatic teat lesions in 4721 observations of 3486 ewes.

Variable	Category	*N* affected	% affected	OR	Lower 95% CI	Upper 95% CI
Number of lambs reared	1	85	4.45	Reference		
	≥ 2	194	7.06	**4.05**	**2.26**	**7.26**
IMM when lactating	No	246	5.44	Reference		
	Yes	50	8.99	**1.53**	**1.06**	**2.20**
Breed	Lleyn	143	4.00	Reference		
	Crossbreeds	71	10.46	**1.54**	**1.05**	**2.26**
	Charollais	41	9.03	1.57	0.94	2.63
	Texel	35	10.67	1.55	0.88	2.73
Teat angle	5	73	3.56	Reference		
	7 - 9	15	4.45	0.89	0.48	1.66
	6	33	3.32	0.83	0.53	1.29
	4	158	10.93	**2.88**	**2.09**	**3.95**
	3 - 1	17	9.24	1.80	0.98	3.34
Lactation energy	Adequate	88	4.86	Reference		
	Overfed	12	16.22	0.87	0.24	3.18
	Underfed	170	6.39	**0.36**	**0.20**	**0.64**
Lactation protein	Adequate	144	4.24	Reference		
	Overfed	9	32.14	**8.65**	**1.74**	**43.09**
	Underfed	117	10.42	1.45	0.99	2.11
		Overall mean	**Affected mean**			
Teat length (cm)		2.39	2.65	**2.50**	**1.93**	**3.24**
Udder width (cm)		13.14	12.62	**0.84**	**0.783**	**0.898**
		Variance	SD			
Random effects	Farm	1.00	1.00			
	Ewe	1.66	1.34			
	Year					

N: Number; OR: Odds ratio; CI: Confidence interval; IMM: Intramammary mass; SD: Standard deviation; Reference: baseline category for comparison. Where categories are in **bold** they are statistically different from the reference category at $P < 0.05$.

Table S11. Three-level binary logistic model of factors associated with traumatic teat lesions in 4496 observations of 3350 ewes.

Variable	Category	*N* affected	% affected	OR	Lower 95% CI	Upper 95% CI
Number of lambs reared	1	62	3.25	Reference		
	≥ 2	134	4.88	**1.66**	**1.19**	**2.32**
IMM when lactating	No	152	3.36	Reference		
	Yes	48	8.63	**2.69**	**1.85**	**3.92**
Breed	Lleyn	133	3.72	Reference		
	Crossbreeds	9	1.33	**0.37**	**0.16**	**0.82**
	Charollais	41	9.03	**2.44**	**1.59**	**3.74**
	Texel	16	4.88	1.75	0.98	3.14
Teat angle	5	63	3.07	Reference		
	7 - 9	10	2.97	0.55	0.26	1.15
	6	23	2.31	0.65	0.39	1.07
	4	98	6.78	**2.54**	**1.79**	**3.60**
	3 - 1	4	2.17	0.73	0.22	2.43
		Overall mean	**Affected mean**			
Teat length (cm)		2.39	2.55	**1.62**	**1.20**	**2.19**
Age at lambing (yrs.)		3.4	3.1	**0.77**	**0.68**	**0.87**
Days in milk		69.79	61.87	**0.98**	**0.98**	**0.99**
		Variance	SD			
Random effects	Farm	1.00	1.00			
	Ewe	1.17	1.42			
	Year					

N: Number; OR: Odds ratio; CI: Confidence interval; IMM: Intramammary mass; SD: Standard deviation; Reference: baseline category for comparison. Where categories are in **bold** they are statistically different from the reference category at $P < 0.05$.

Table S12. Two-level mixed effect continuous outcome model of factors associated with increasing body condition score in pregnancy in year 2 in 1361 ewes.

Variable	**Category**	***N***	**Year 2 Mean pregnant BCS**	**Coefficient**	**Lower 95% CI**	**Upper 95% CI**
Year 1 BCS when pregnant	3	657	3.24	Reference		
	Below 3	647	2.99	**-0.43**	**-0.56**	**-0.31**
	Above 3	267	3.57	**0.30**	**0.11**	**0.48**
Year 1 BCS when lactating	3	443	3.22	Reference		
	Below 3	626	3.05	**-0.18**	**-0.32**	**-0.05**
	Above 3	400	3.39	**0.27**	**0.12**	**0.42**
Age year 2 (yrs.)	2	249	3.19	Reference		
	3	440	3.28	**0.34**	**0.16**	**0.52**
	4	329	3.36	**0.39**	**0.20**	**0.58**
	5 - 7	440	2.99	**-0.28**	**-0.46**	**-0.10**
	> 7	14	3.11	-0.44	-1.07	0.19
Year 2 IMM when pregnant	No	1498	3.20	Reference		
	Yes	100	3.10	**-0.29**	**-0.52**	**-0.06**
		Variance	SD			
Random effects	Farm	0.56	0.33			
	Ewe	1.10	0.04			

BCS: Body condition score; *N:* Number; IMM: Intramammary mass; CI: Confidence interval; SD: Standard deviation; Reference: baseline category for comparison. Where categories are in **bold** they are statistically different from the reference category at $P < 0.05$.

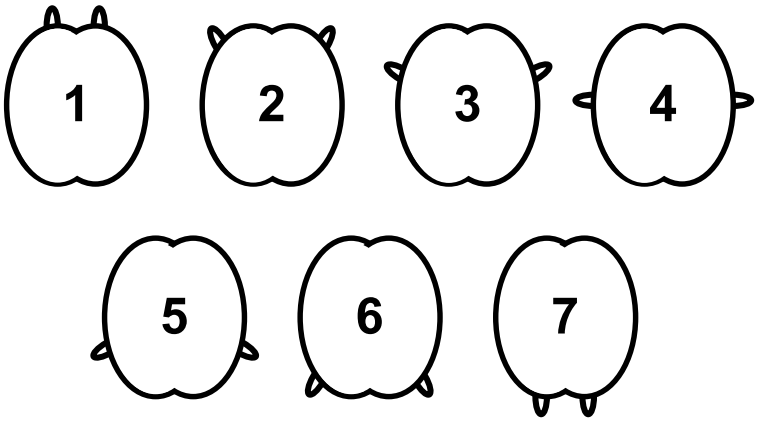
Table S13. Three-level mixed effect continuous outcome model of factors associated with increasing body condition score in lactation in 4599 observations of 3410 ewes.

Variable	**Category**	***N***	**Mean**	**Coefficient**	**Lower 95% CI**	**Upper 95% CI**
Days in milk		4722		**0.02**	**0.016**	**0.024**
Number of lambs reared	1	2169	2.80	Reference		
	≥ 2	3301	2.57	**-0.33**	**-0.608**	**-0.052**
Age at lambing (yrs.)	1	395	2.90	Reference		
	2	1294	2.72	-0.06	-0.23	0.12
	3	1318	2.73	0.15	-0.03	0.33
	4	855	2.71	0.14	-0.06	0.33
	5 - 7	1207	2.46	**-0.31**	**-0.49**	**-0.13**
	> 7	47	2.63	**-0.50**	**-0.99**	**-0.02**
BCS when pregnant	3	2239	2.65	Reference		
	Below 3	2182	2.44	**-0.39**	**-0.49**	**-0.29**
	Above 3	1461	3.02	**0.46**	**0.35**	**0.57**
Pregnancy energy	Adequate	5192	2.63	Reference		
	Overfed	257	3.31	**0.50**	**0.03**	**0.97**
	Underfed	85	2.89	-0.38	-0.94	0.19
Lactation protein	Adequate	4294	2.61	Reference		
	Overfed	28	2.57	**-1.37**	**-2.14**	**-0.59**
	Underfed	1138	2.82	**1.26**	**1.11**	**1.42**
Lactation energy	Adequate	2708	2.68	Reference		
	Overfed	74	3.14	**1.60**	**1.11**	**2.08**
	Underfed	2678	2.62	**-0.46**	**-0.76**	**-0.17**
		Variance	SD			
Random effects	Farm	0.50	0.24			
	Ewe	0.31	0.06			
	Year	1.73	0.06			

BCS: Body condition score; *N:* Number; CI: Confidence interval; SD: Standard deviation; Reference: baseline category for comparison. Where categories are in **bold** they are statistically different from the reference category at $P < 0.05$.

Figure S1. Linear scoring system of udder conformation traits (adapted from Casu et al; 2006).

Teat position - The placement of the teats on the udder on a horizontal plane.

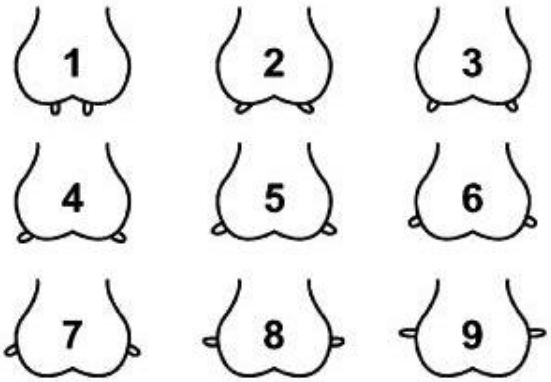


Ewe is facing ↑

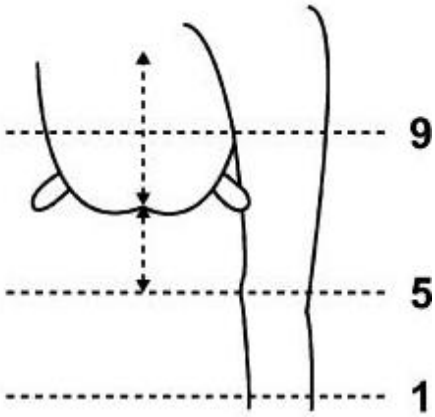
1 = Forward pointing

7 = Backwards pointing

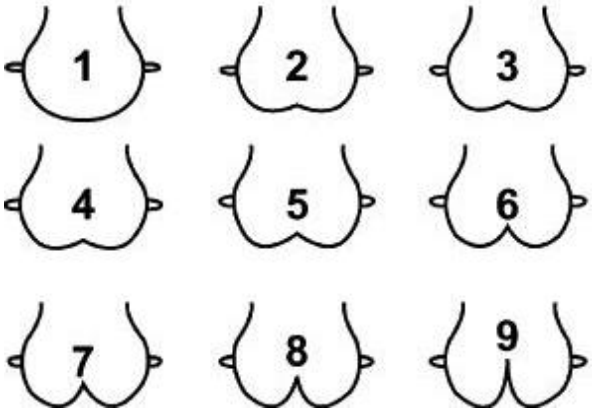
Teat Angle - The placement of the teats on the udder on a vertical plane.



Udder Drop – The distance from the ventral abdominal wall to the udder cleft when viewed from behind.



Degree of separation of udder halves



Figures S2.1 – S2.14

Goodness-of-fit plots

Figures S2.1 – S2.8. Continuous outcome models - Residual plots

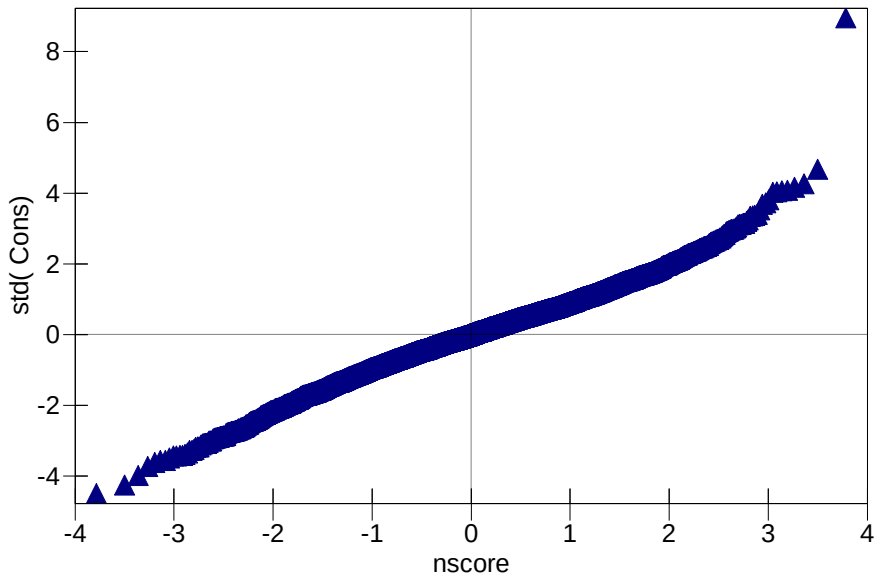


Figure S2.1. Lamb daily live weight gain (kg)

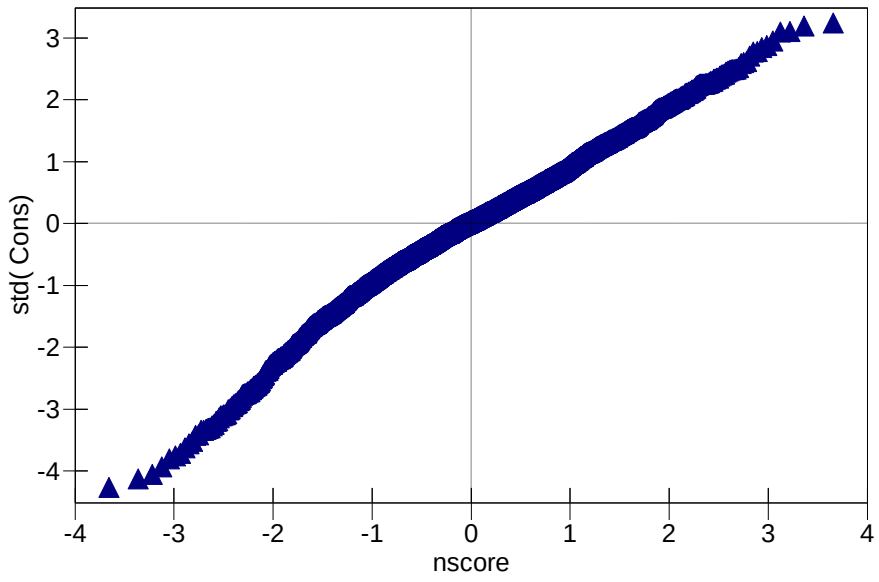


Figure S2.2. Udder drop score

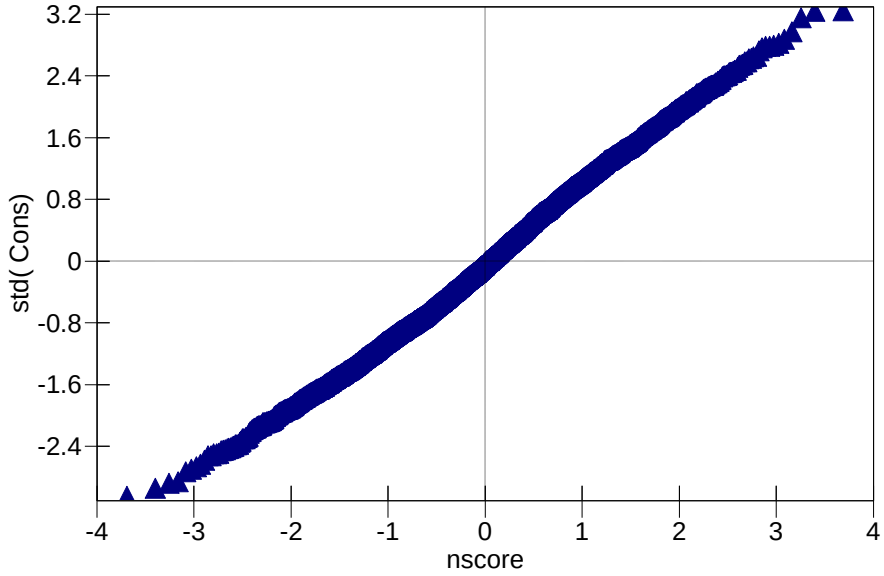


Figure S2.3. Degree of separation of udder halves score

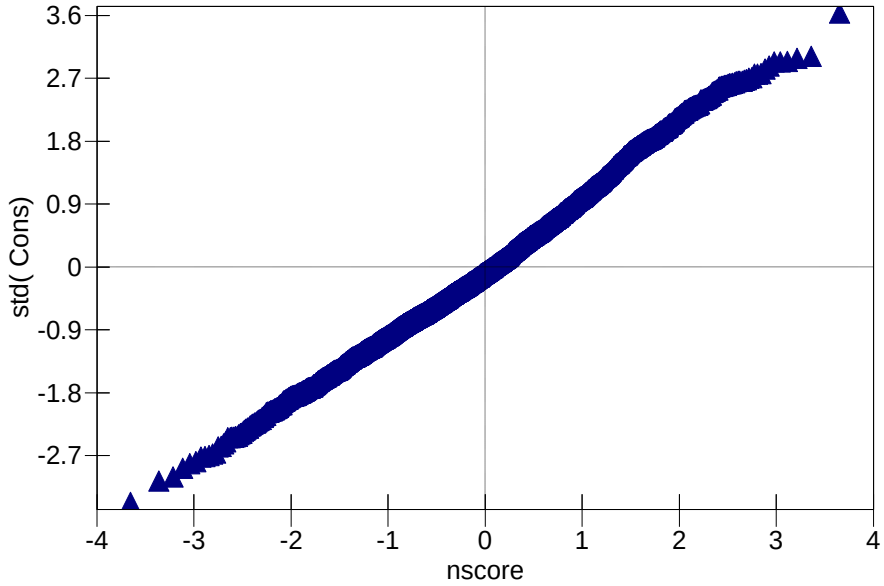


Figure S2.4. Teat angle score

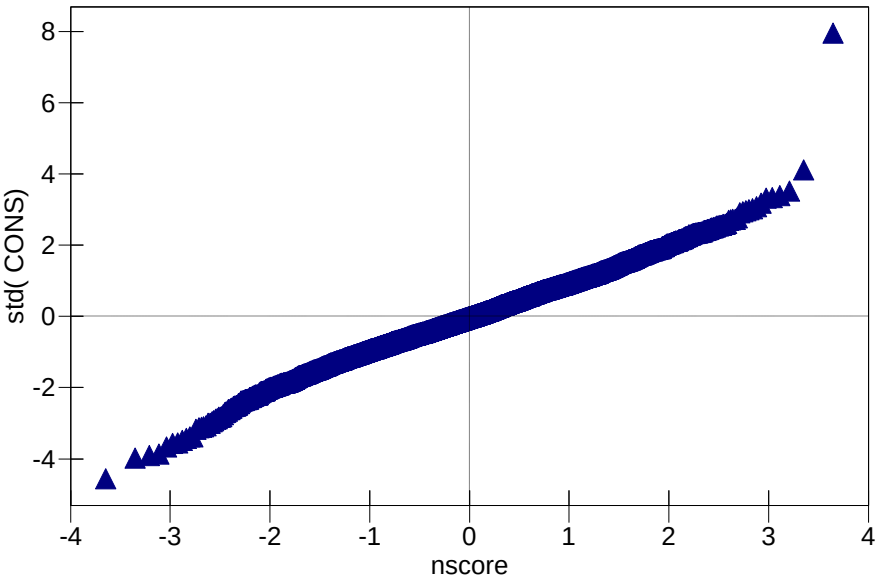


Figure S2.5. Udder width (cm)

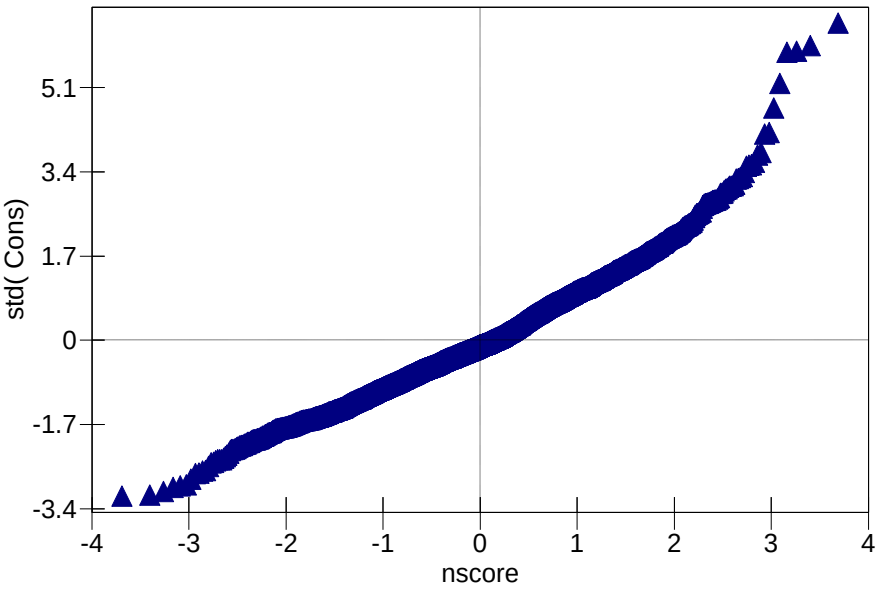


Figure S2.6. Teat length (cm)

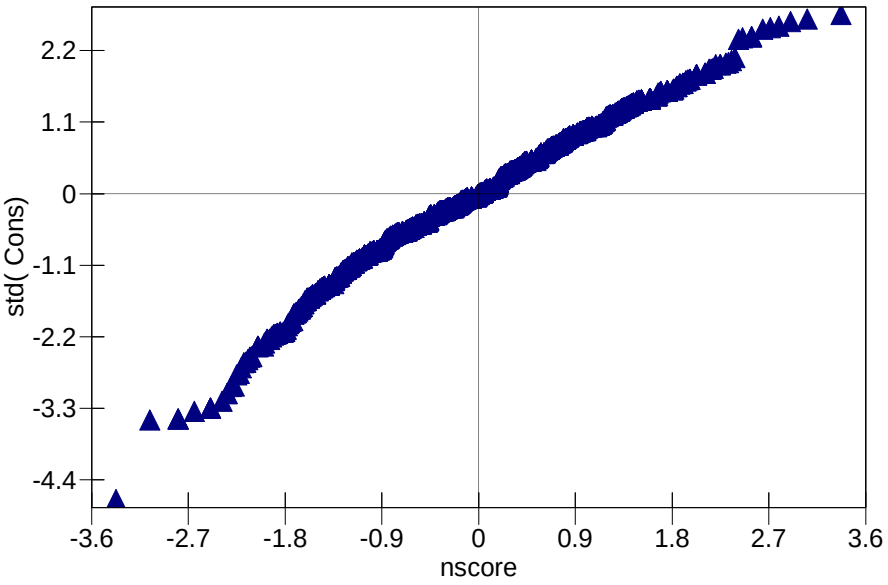


Figure S2.7. BCS in pregnancy in year 2

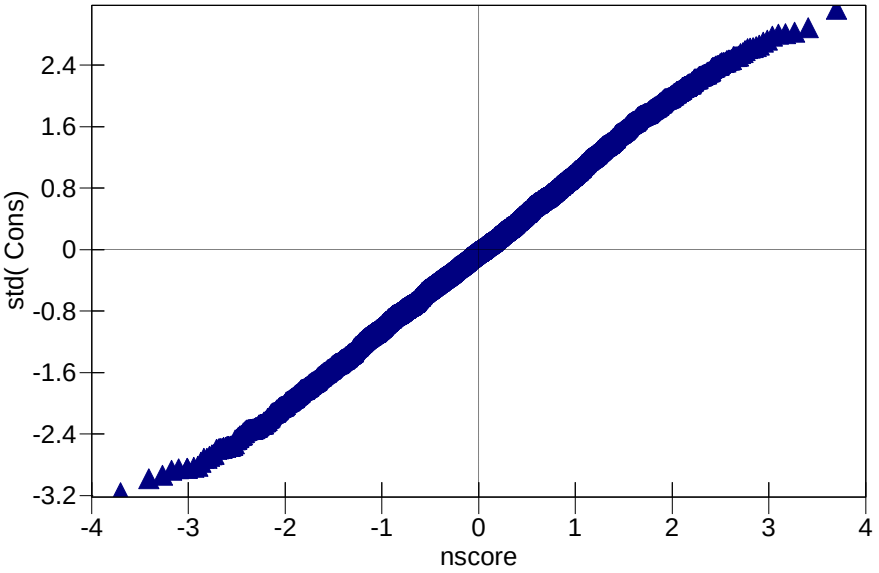


Figure S2.8. BCS in lactation

Figures S2.9 – S2.14. Binomial models - Observed versus predicted results (Hosmer-Lemeshow method).

Abbreviations:

Obs: Observed; Pred: Predicted

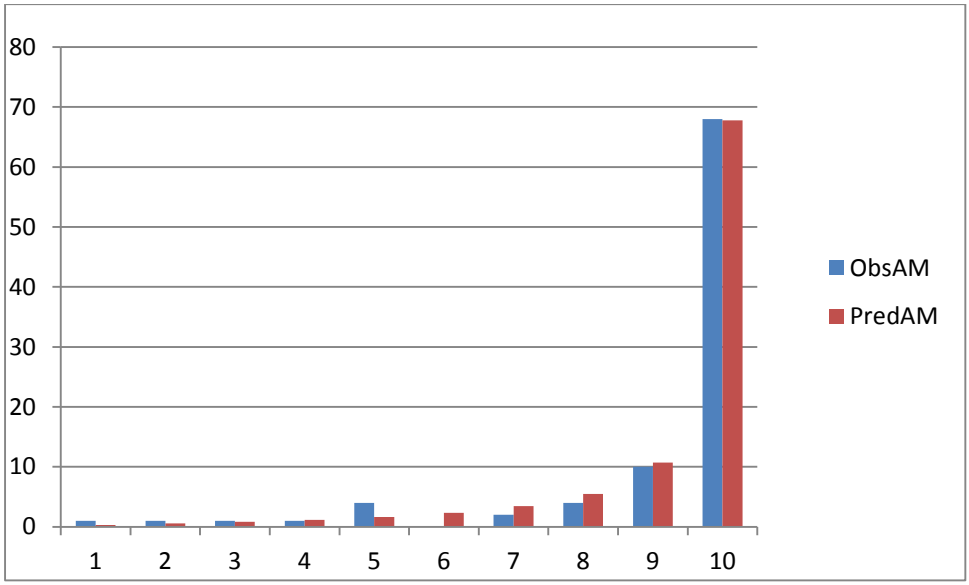


Figure S2.9. Acute mastitis (AM)

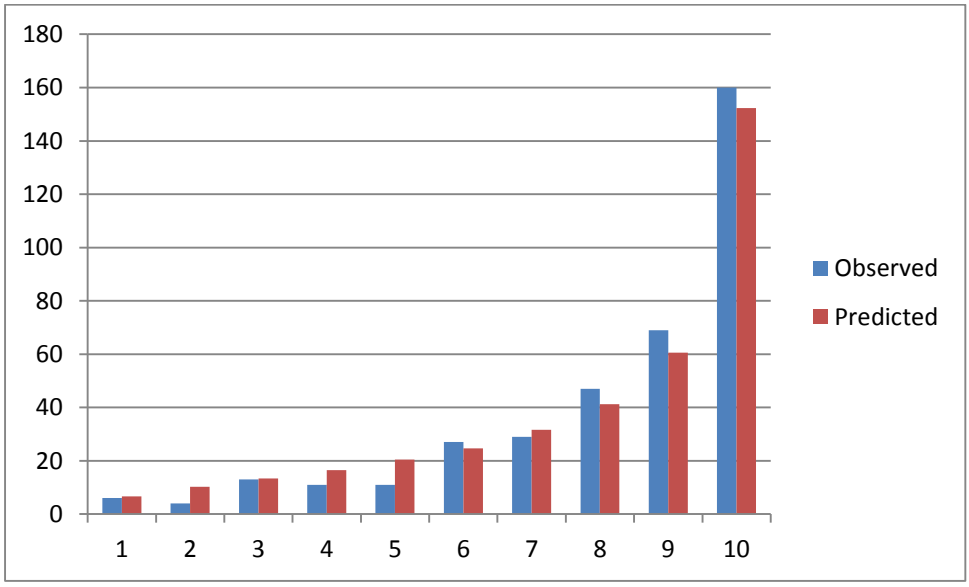


Figure S2.10. Intramammary masses in lactation

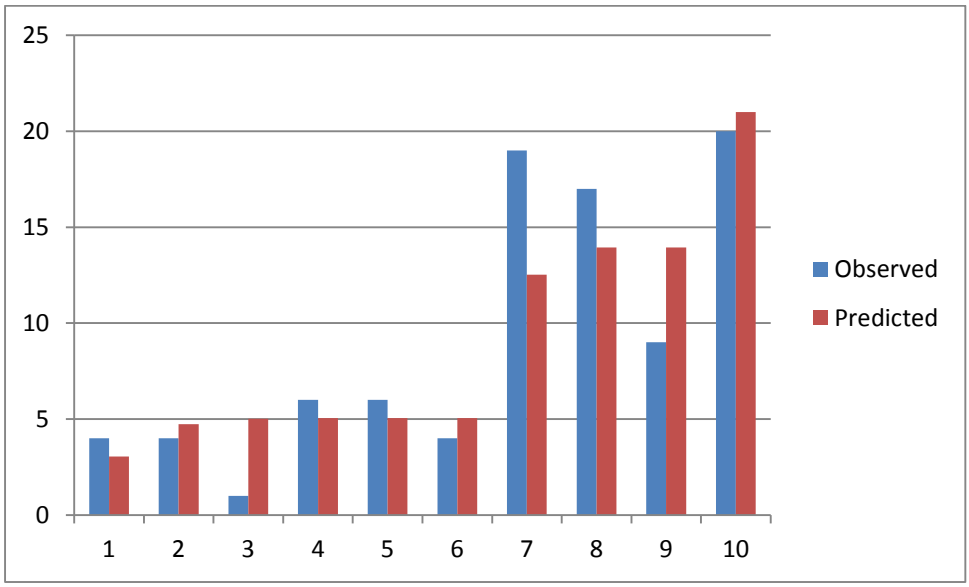


Figure S2.11. Intramammary masses in pregnancy in year 2

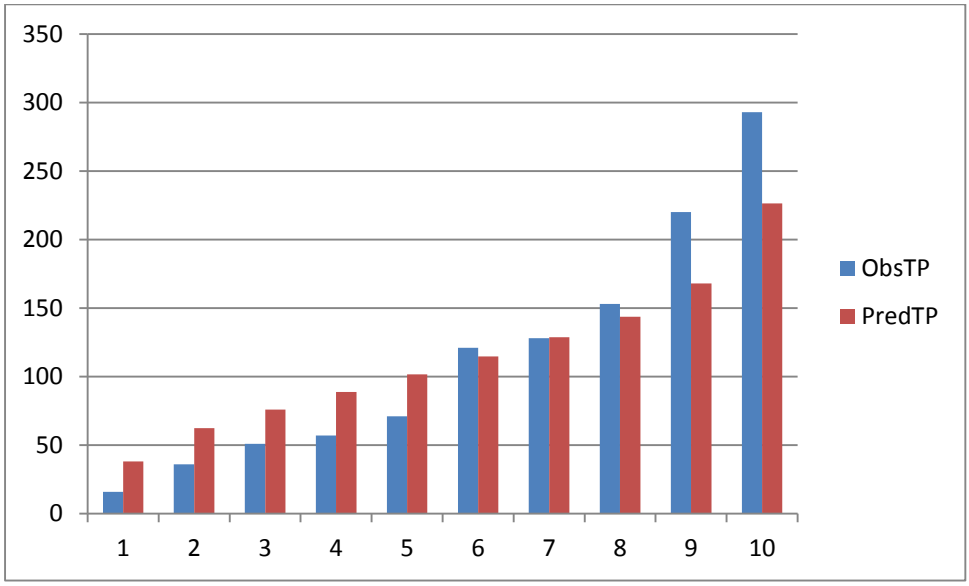


Figure S2.12. Forward pointing teat position (TP)

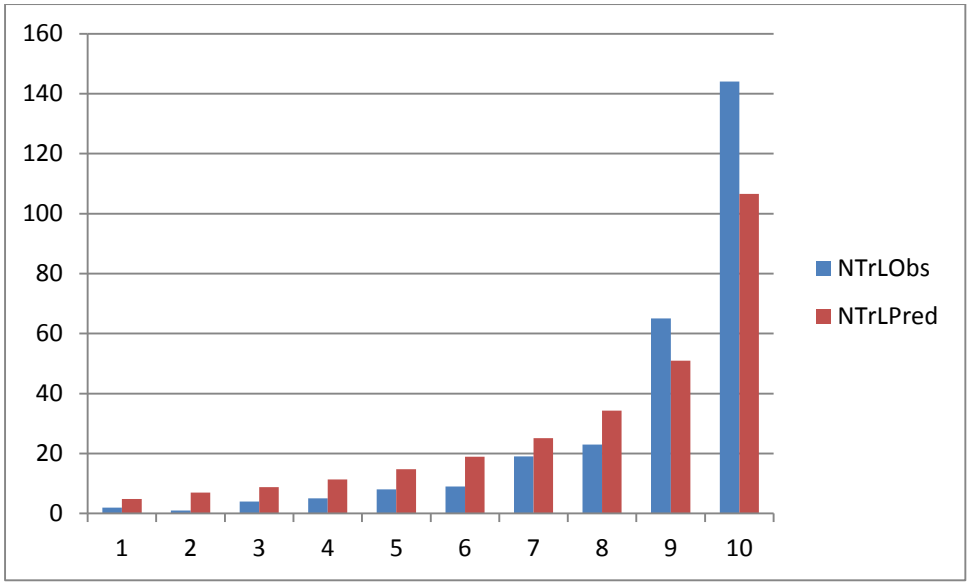


Figure S2.13. Non-traumatic teat lesions (NTrL)

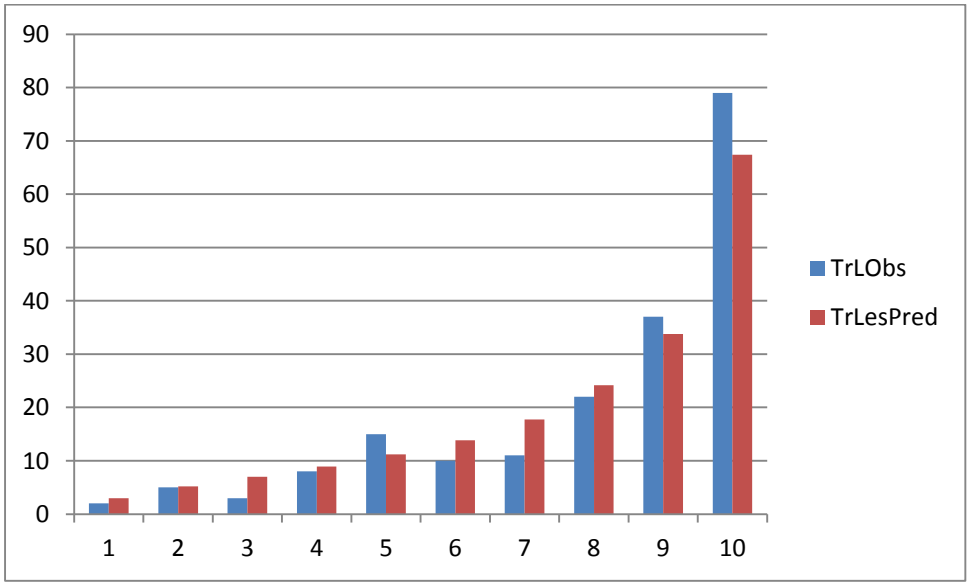


Figure S2.14. Traumatic teat lesions (TrL)