UNIKASSEL VERSITÄT | ORGANIC AGRICULTURAL SCIENCES

Longitudinal assessment of health indicators in four organically kept laying hen flocks of Lohmann brown and Coffee&Cream genetics

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How it started

A good health is one of the important preconditions for positive welfare!

Indicators like feather damage, skin lesions, keel bone damage or footpad lesions are present in high prevalence in most laying hen flocks! (Göransson et al. 2023, Bonefous 2022, Jung et al . 2020)

1. Is there a difference between genetics?
2. Is there a specific life-time for the occurrence of certain diseases?
3. Is there a temporal relationship between specific diseases?
4. To what extent is there a cumulation of diseases in an individual animal?

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Animals, Materials and Methods

Year 2018 – 2022

Barn and mobile house

2x Lohmann Brown, 2x Coffee & Cream

Flock size 600

150 hens individual marked, exept in the first flock where N was 62

Four-weekly assessment interval

Health indicators, weight

Laying performance, mortality

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Assessed indicators and definitions of scores

Indicator	Score 0	Score 1	Score 2
Comb (only lesions)	No lesions	Lesions	-
Eye	Healthy clear	Swollen, dully or purulent	-
Beak	Intact, clean no discharge	Torn, broken, overlong, discharge or dirty nostrils	-
Back plumage Cloaca plumage	No featherless areas, almost up to 2 single feathers missing	Featherless area ≤ 5 cm	Featherless area > 5 cm
Back skin Cloaca skin	Intact	Max. 2 lesions ≤ 1 cm	3 or more lesions ≤ 1 cm or lesion > 1 cm
Keel bone	Straight, smooth	Palpable callus, dislocation, deformation ≤ 1 cm	Deformation > 1 cm
Keel bone tip	Intact	Any deformation, callus	-
Toe	Intact	Lesion, amputation	-
Footpad	Intact	Hyperceratosis, Ulceration	Bumble foot

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Age and number of hens per flock and assessment

	LB1		LB2		CC1		CC2	
Assessment	Age (weeks)	N	Age (weeks)	N	Age (weeks)	N	Age (weeks)	N
1	18	60	19	146	17	150	18	148
2	22	39	24	130	22	114	22	115
3	27	56	28	132	26	119	26	112
4	31	55	33	119	31	118	31	116
5	35	52	38	105	35	112	35	111
6	39	53	42	118	39	119	39	118
7	46	54	46	99	44	106	44	106
8	50	45	51	112	48	73	49	101
9	54	44	56	104	51	107	53	92
10	59	46	60	109	56	91	56	104
11	71	42	65	112	61	29	61	90
12			69	78			66	95
13			74	84			72	84
14			79	61				

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Statistical analysis

All statistics were carried out in R 4.0.2. version 2020 using the packages for 1.+3. *ggplot2*, *tidyverse, lmerTest* for 2. *survival* for 4. *geepack*

1. Line-plots + GLMM with binomial family (logit link) Y= Genetic + (1 | Flock) + (1 | Assessment), 4186 observations
2. Line-plots, Kaplan-Meier curves
3. Barplots
4. Boxplots, threshold <- quantile(cummulation$Sum, 0.75, na.rm = TRUE)

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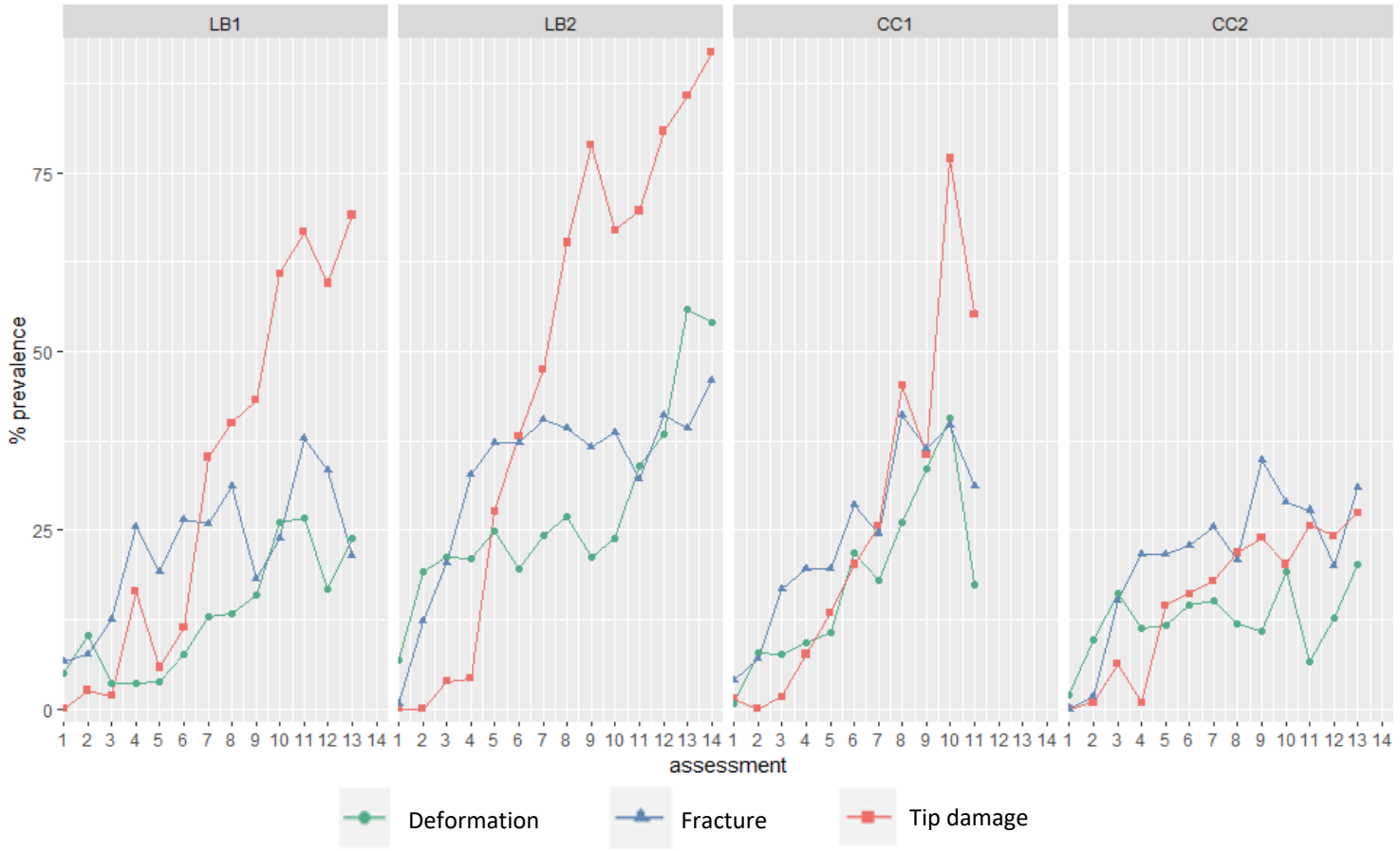
1. Differences between genetics: keel bone damage



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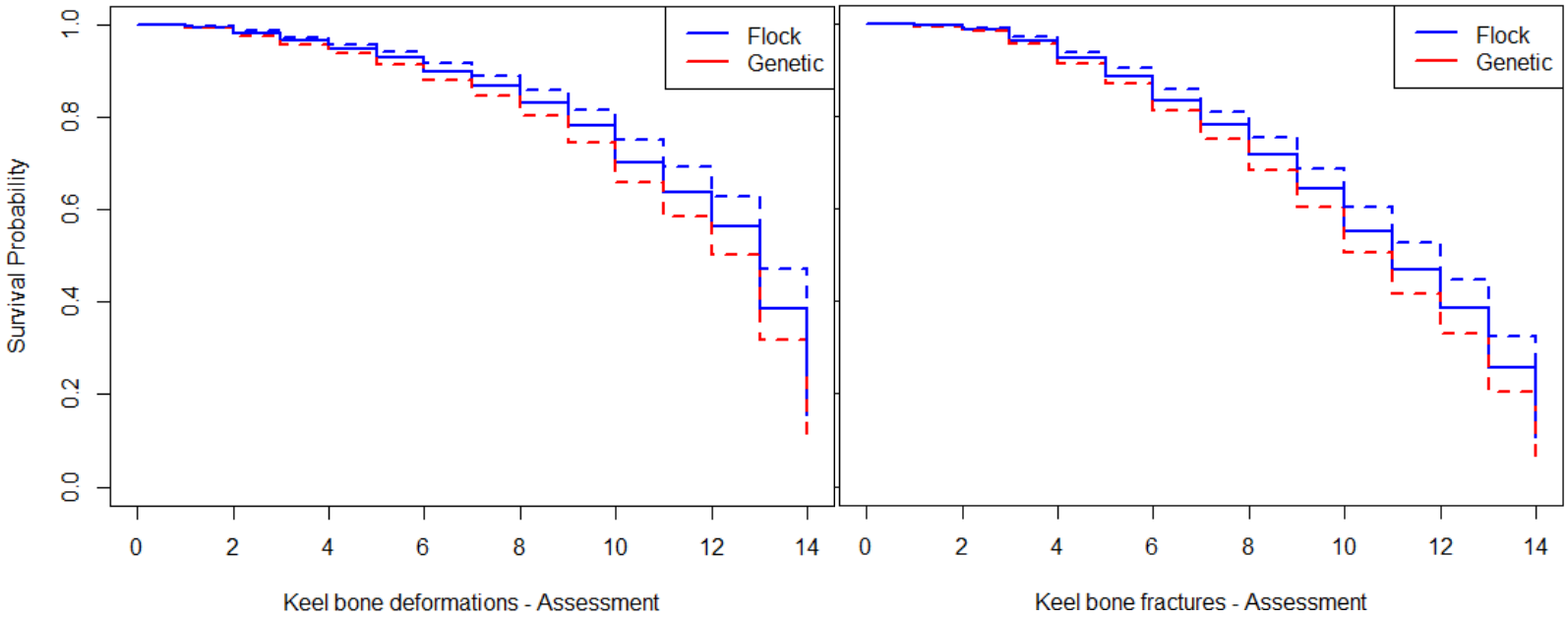
2. The occurrence of keel bone deformations and fractures



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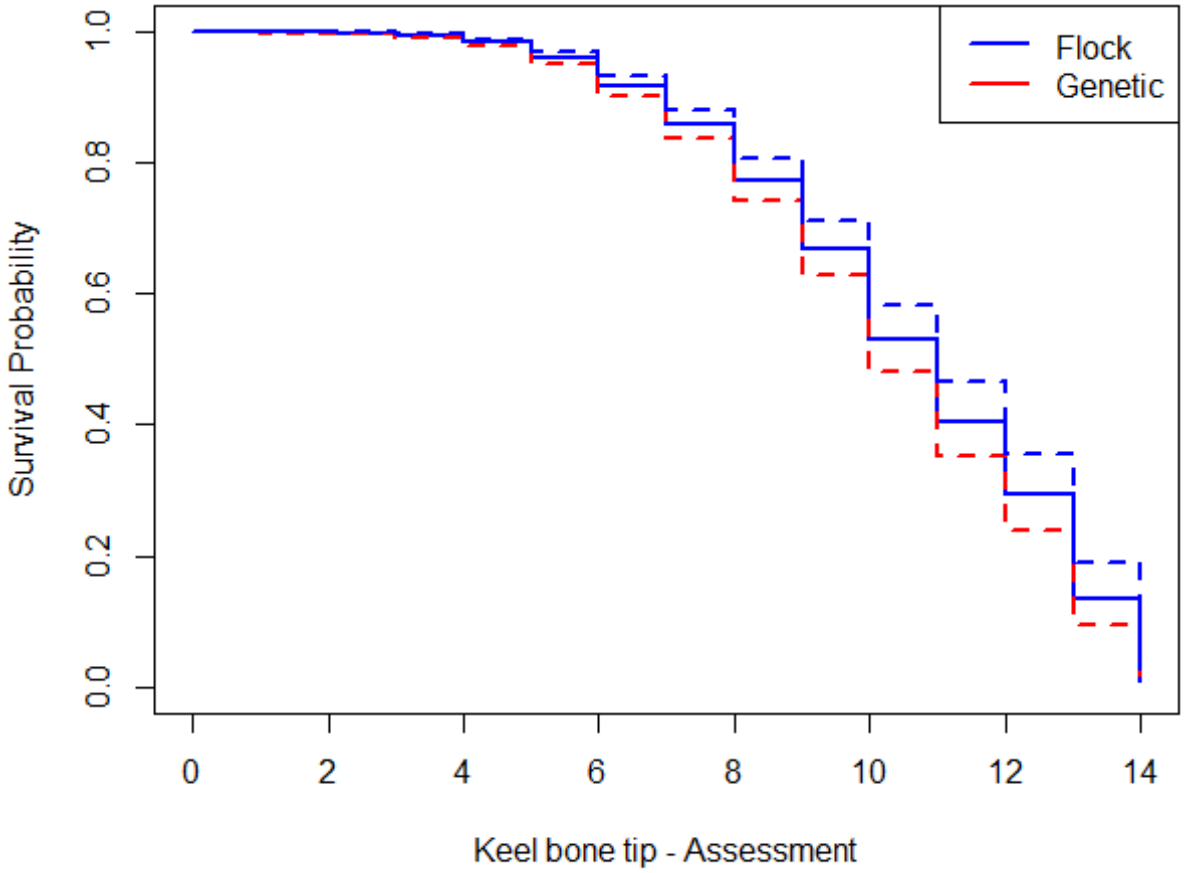
2. The occurrence of tip damage



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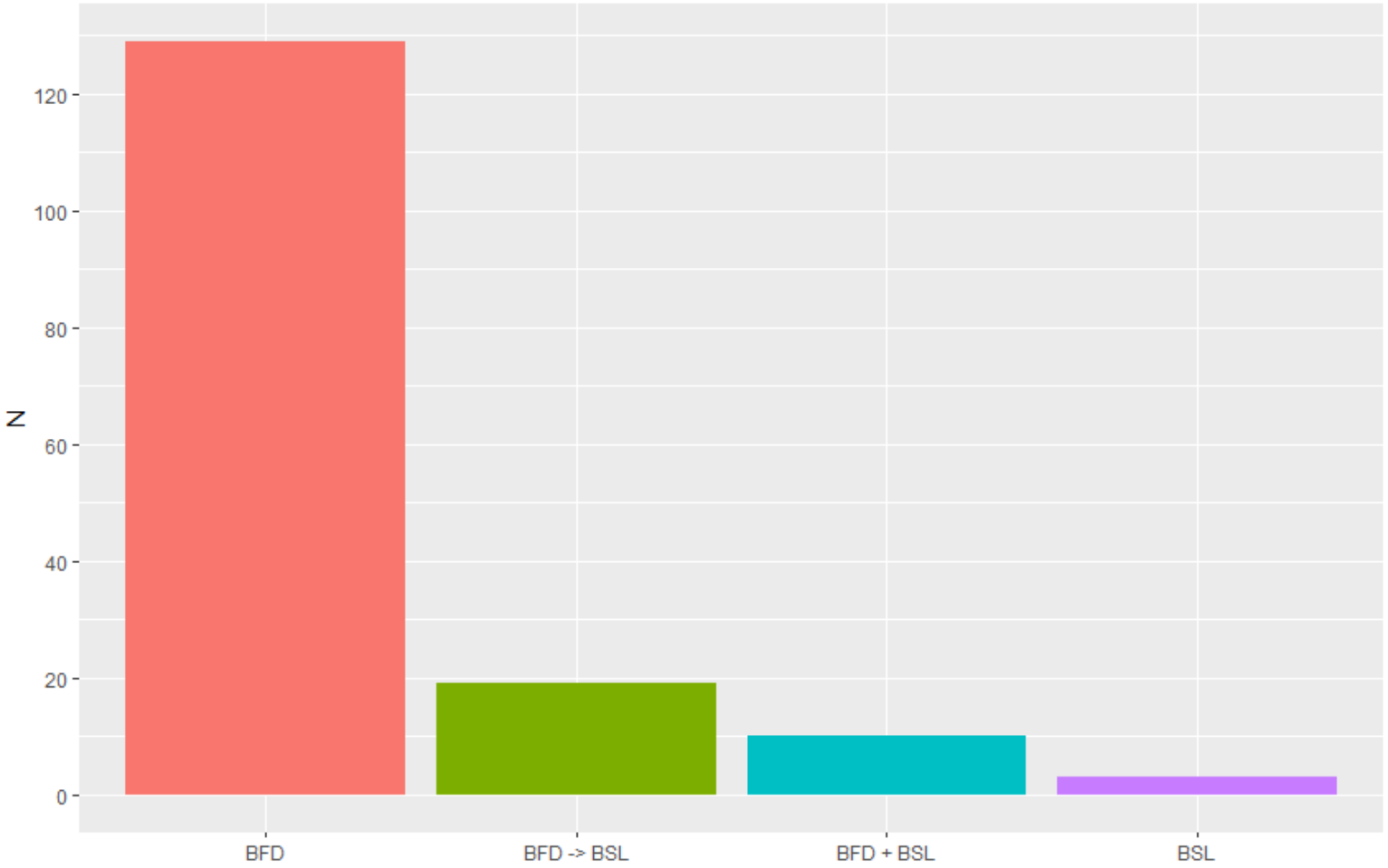
3. Temporal relationship between back feather damage and back skin lesions



BFD = back feather damage, BSL = back skin lesions, „->“ x before y, „+“ xy at the same time

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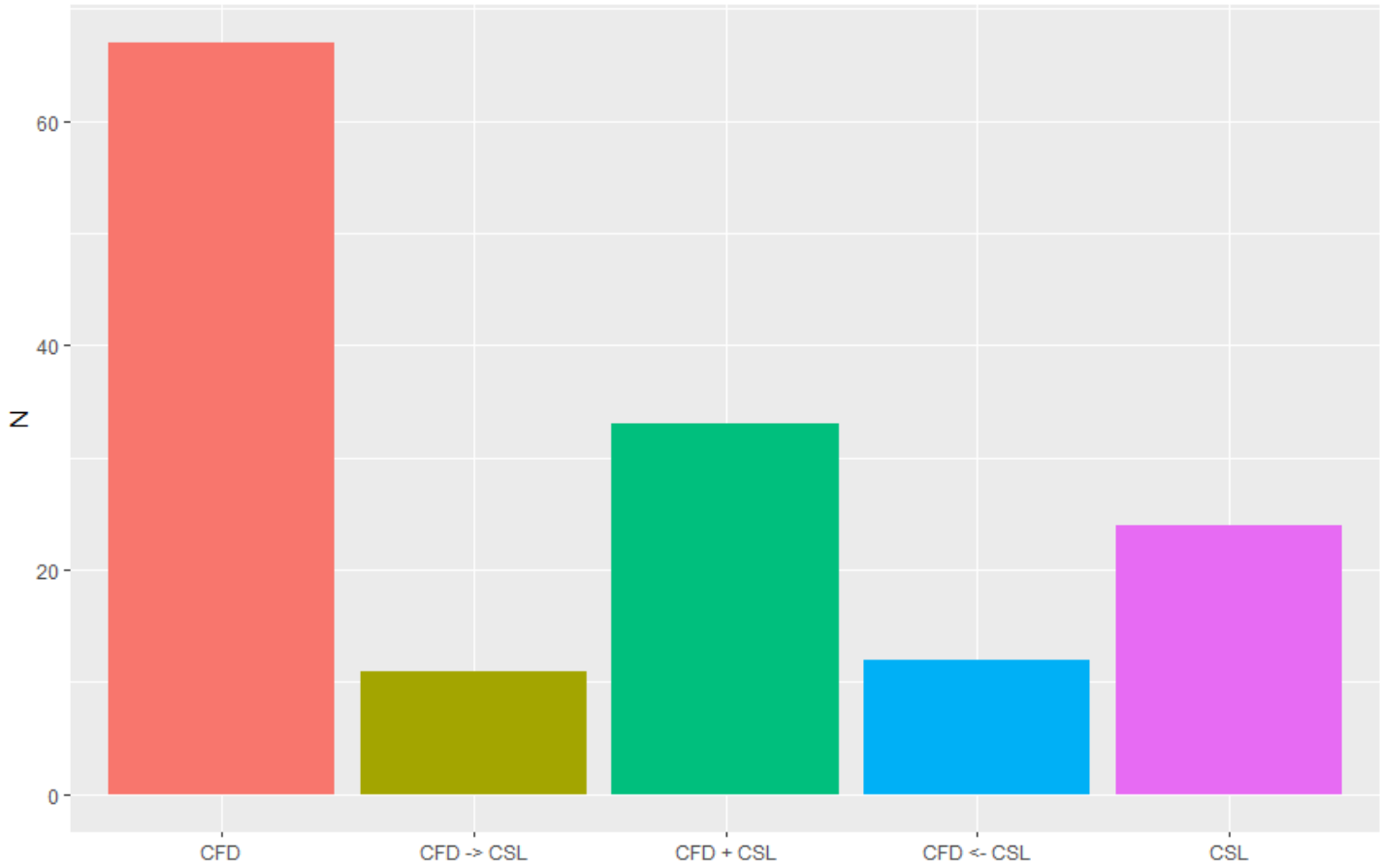
3. Temporal relationship between cloaca feather damage and cloaca skin lesions



CFD = cloaca/belly feather damage, CSL = cloaca/belly skin lesions, „->“ x before y, „+“ xy at the same time,“ <-“ Y before x

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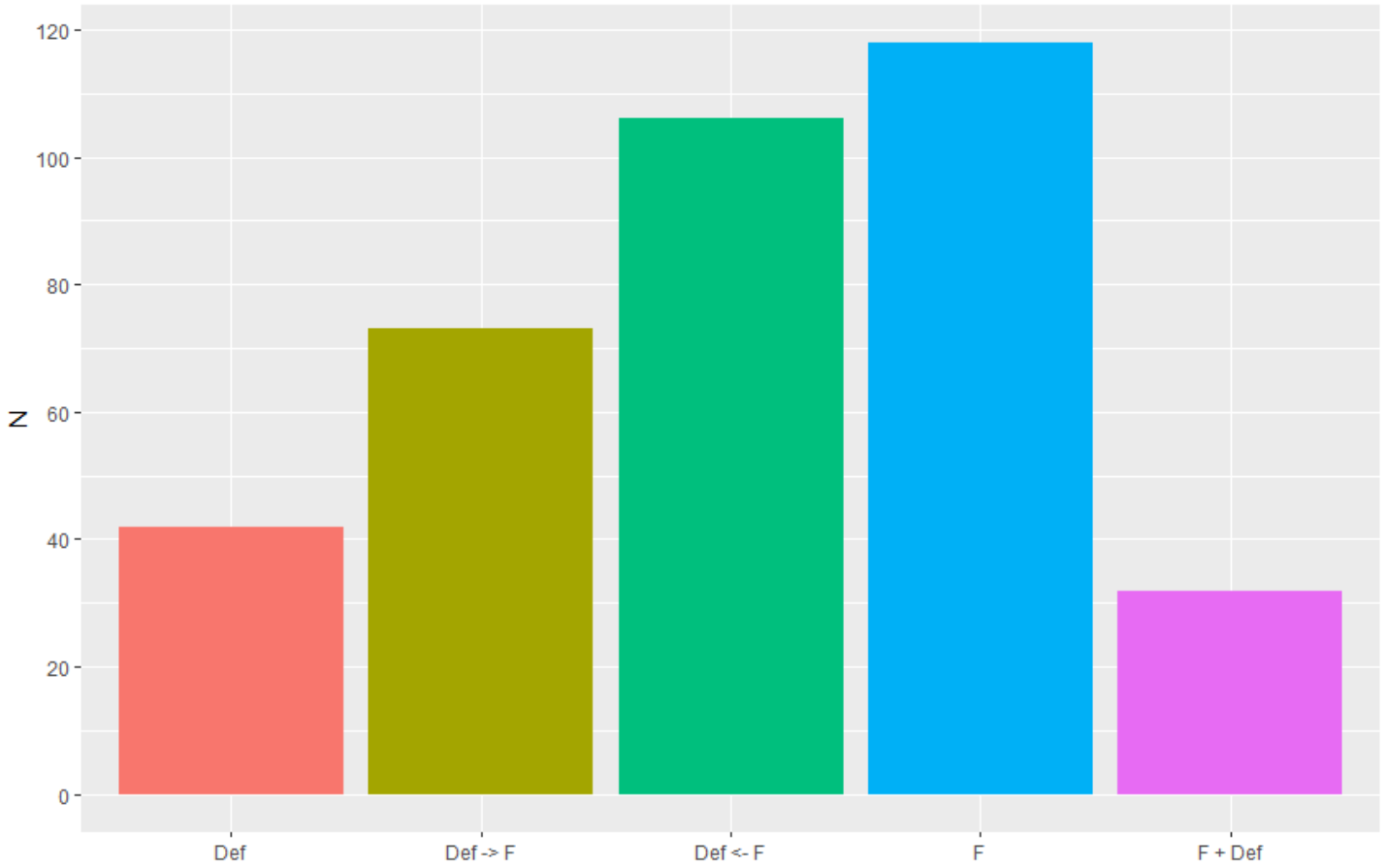
3. Temporal relationship between keel bone deformation and keel bone fractures



Def = keel bone deformation, F = keel bone fractures, „->“ x before y, „<-“ Y before x, „+“ xy at the same time

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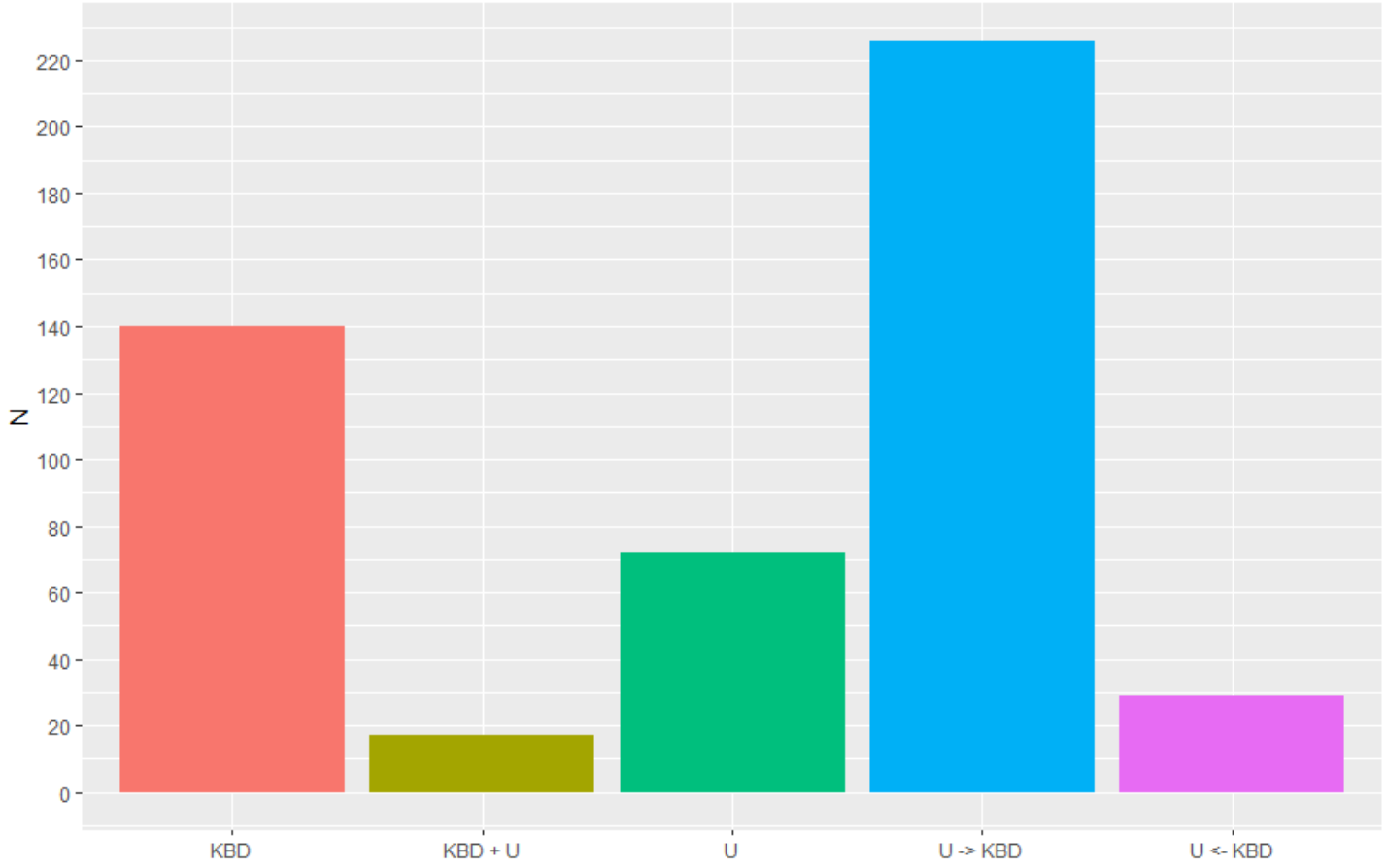
3. Temporal relationship between keel bone damage and underweight



KBD = any kind of keel bone damage, U = underweight , „+“ xy at the same time, „->“ x before y, „<-“ Y before x

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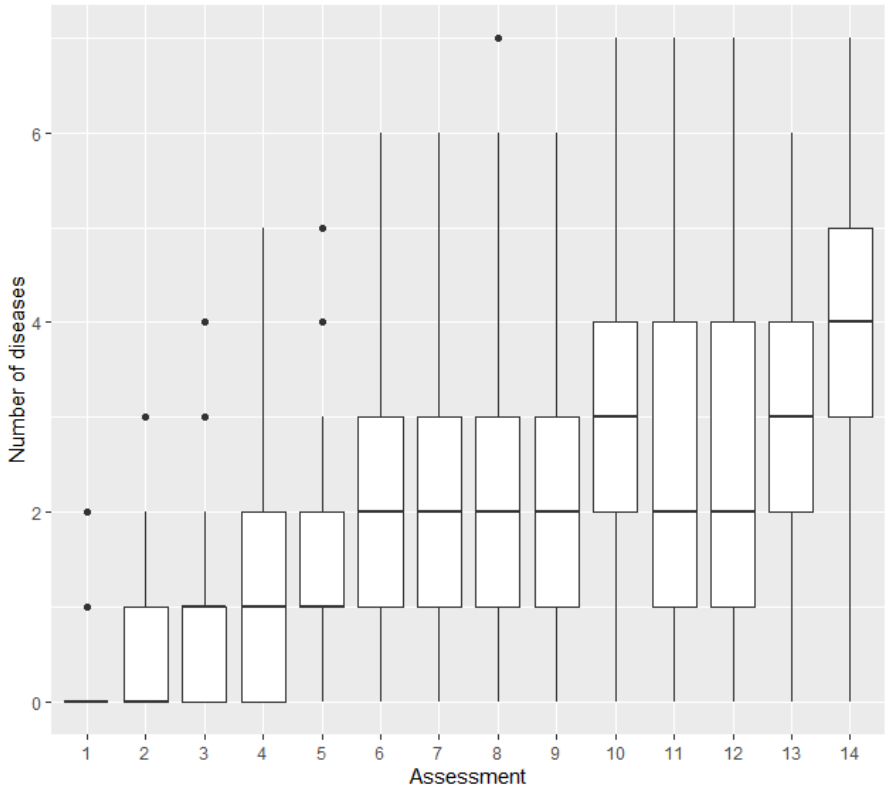
4. Cumulation of diseases

Assessment	% Hens without disease	(N without disease/ N catched)
1	83,93	(423/504)
2	61,06	(243/398)
3	46,06	(193/419)
4	29,90	(122/408)
5	19,21	(73/380)
6	12,00	(49/408)
7	10,68	(39/365)
8	8,16	(27/331)
9	8,36	(29/347)
10	7,14	(25/350)
11	4,76	(13/273)
12	14,45	(25/173)
13	5,95	(10/168)
14	1,64	(1/61)



75% of hens are affected by ≤ 3 diseases

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Summary

Dual purpose breeds are affected by KBD as well

-> bonehealth should be considered as a selection trait

Most diseases started at WoA 31-35

-> special attention during this time

No temporal relationship between plumage damage and skin lesions

-> different causes, lead to different prevention measures

First fractures followed by deformations

-> deformation seem not to be causal for fractures

First underweight followed by KBD

-> nutritinal deficit?

At the end of the laying period there is nearly no hen without a health issue

-> we have to improve welfare also in organic farming systems and also in dual purpose breeds!

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Further questions or ideas:
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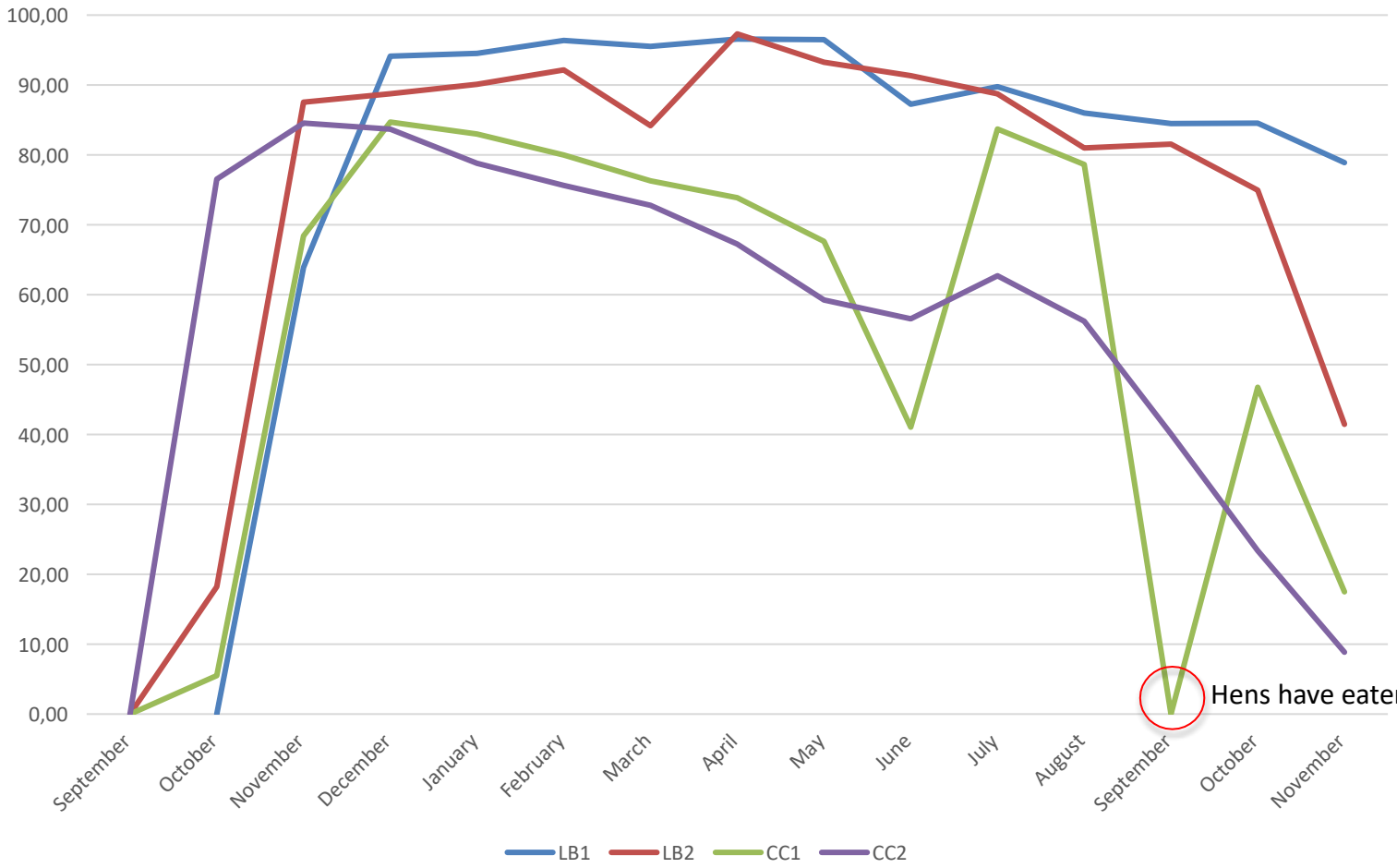
Laying Performance



Hens have eaten the egg-list

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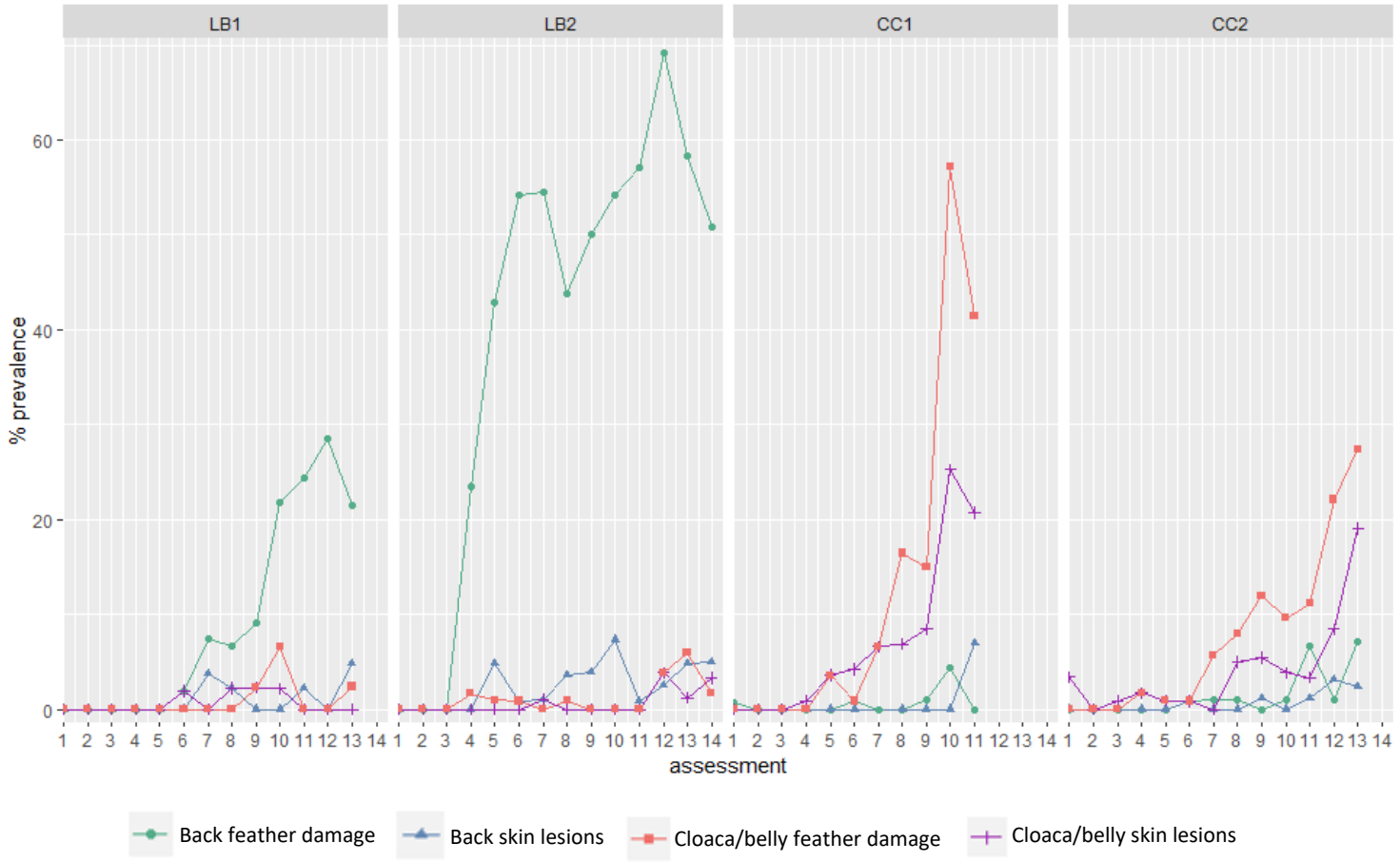
1. Differences between genetics: Plumage and skin damage



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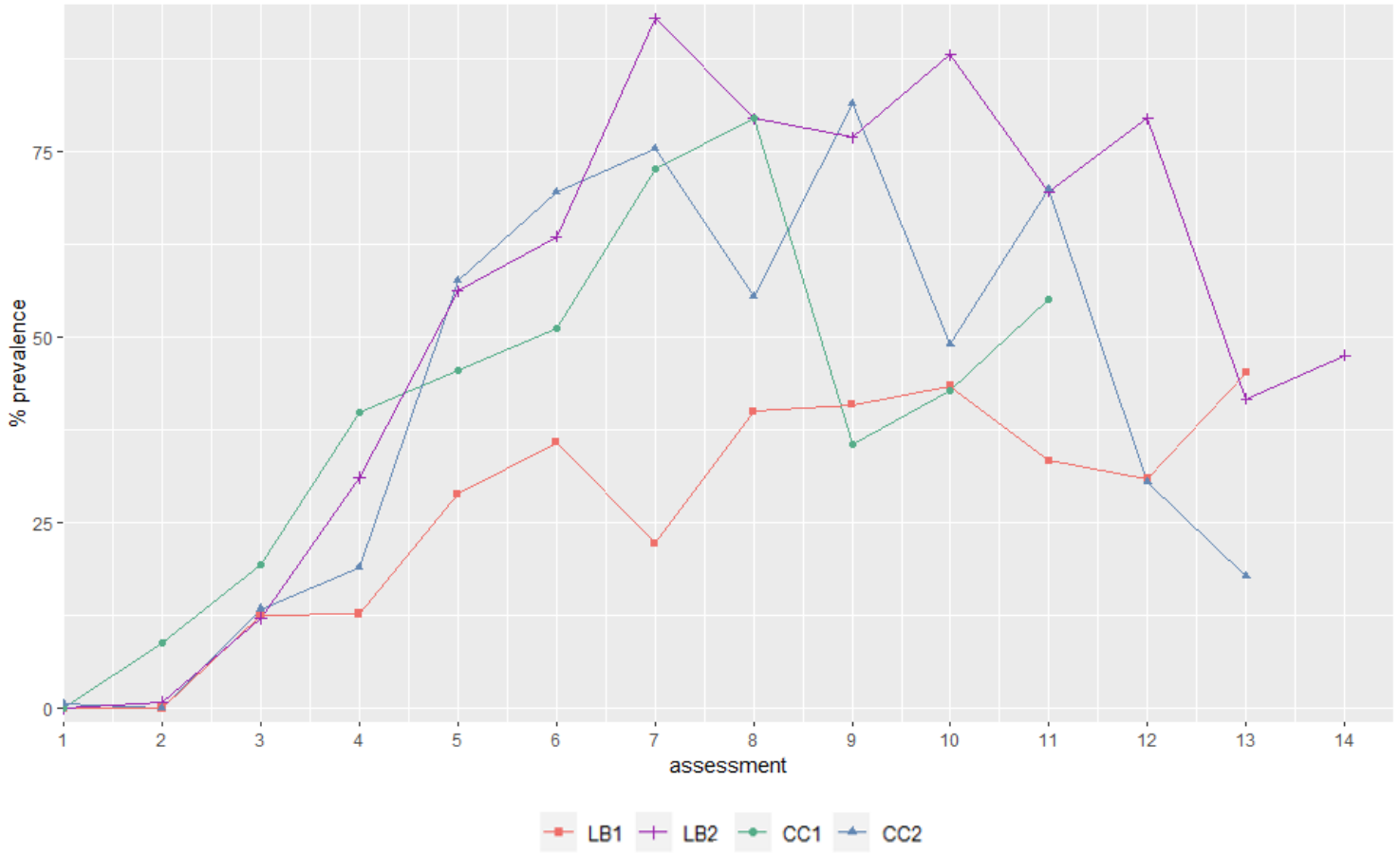
1. Differences between genetics: footpad lesions



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1. Differences between Genetics – GLMM Results

Comb:

- AIC: 4362.1, BIC: 4387.4
- Log-Likelihood: -2177.0
- **LB: Estimate = -2.0107 (p < 0.001)**

Back feather

- AIC: 1651.8, BIC: 1677.2
- Log-Likelihood: -821.9
- **LB: Estimate = 3.3727 (p < 0.001)**

Back lesions:

- AIC: 358.2, BIC: 383.6
- Log-Likelihood: -175.1
- **LB: Estimate = 1.8876 (p < 0.001)**

Cloaca feather:

- AIC: 968.8, BIC: 994.2
- Log-Likelihood: -480.4
- **LB: Estimate = -2.8855 (p < 0.001)**

Cloaca lesions:

- AIC: 752.7, BIC: 778.1
- Log-Likelihood: -372.3
- **LB: Estimate = -2.6918 (p < 0.001)**

Not significant:

Footpad lesion

Deformations

Fractures

Tip

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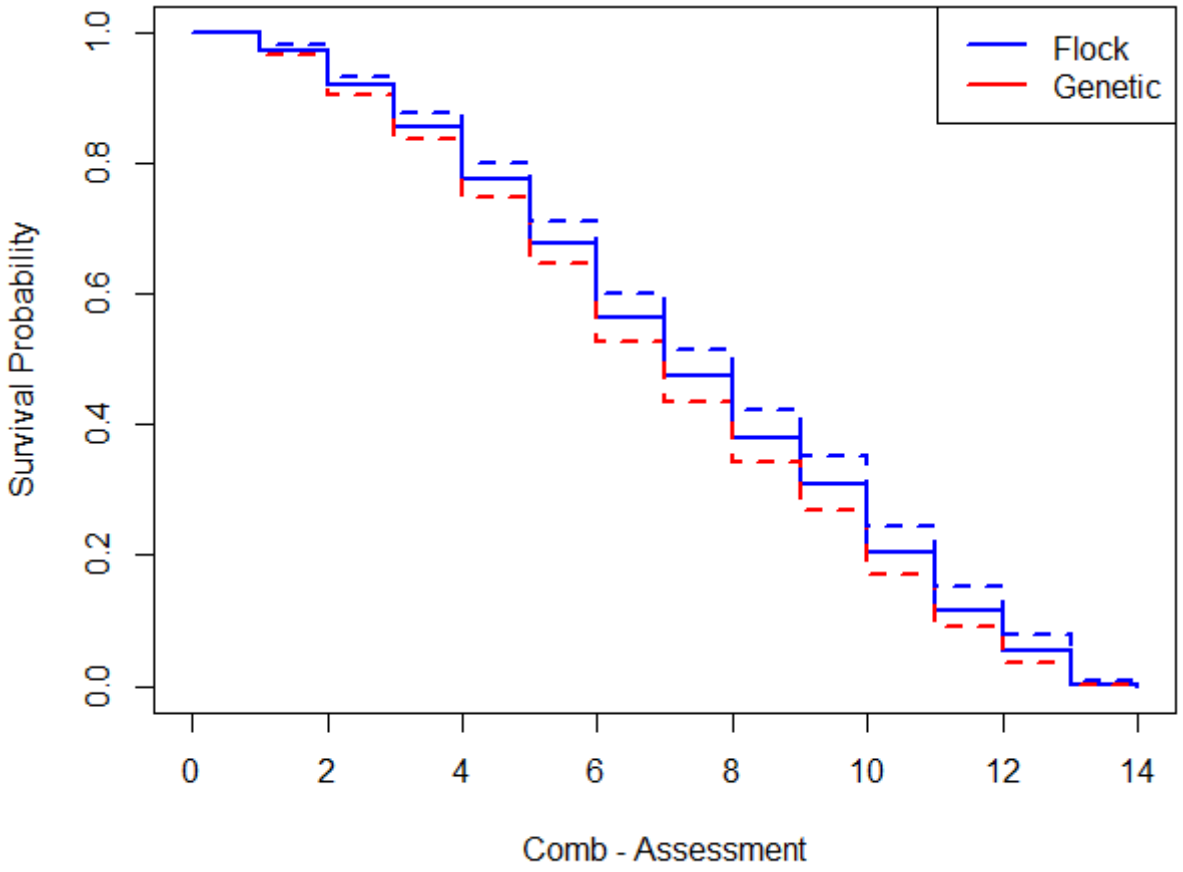
2. The occurrence of comb lesions



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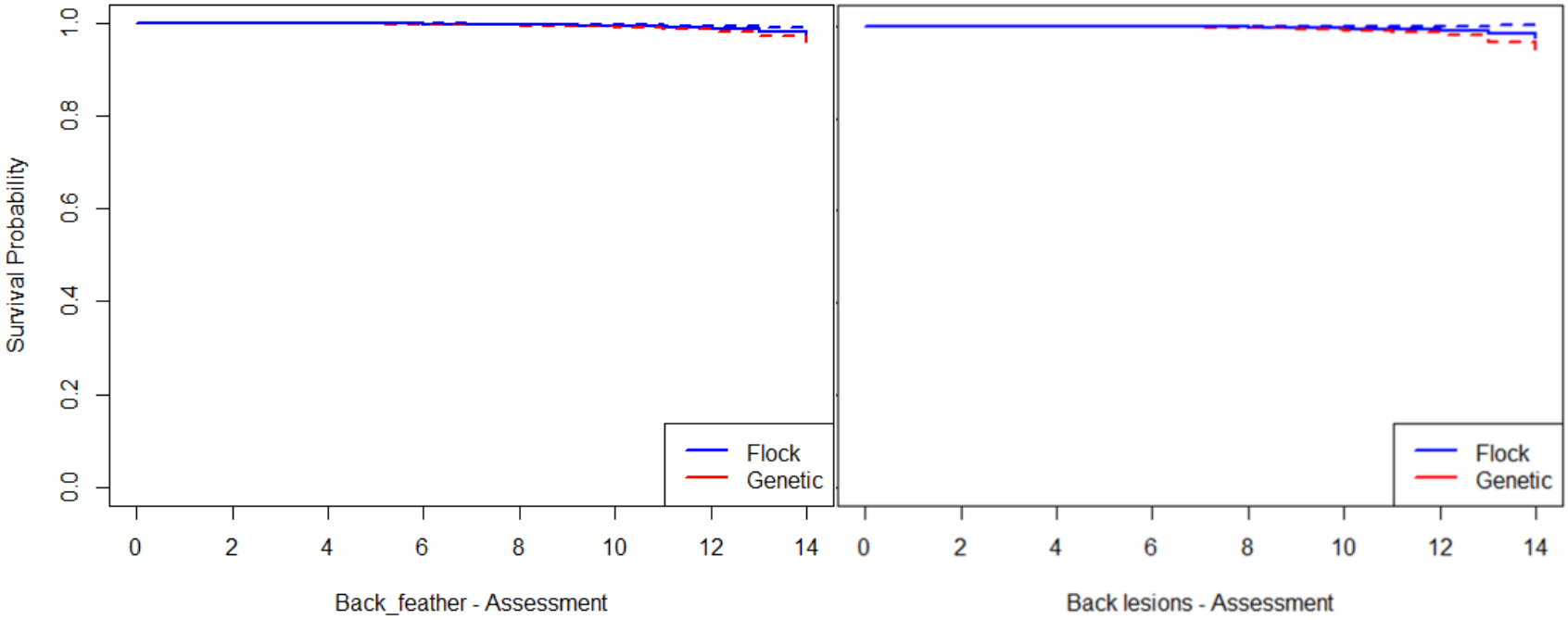
2. The occurrence of back feather damage/skin lesions



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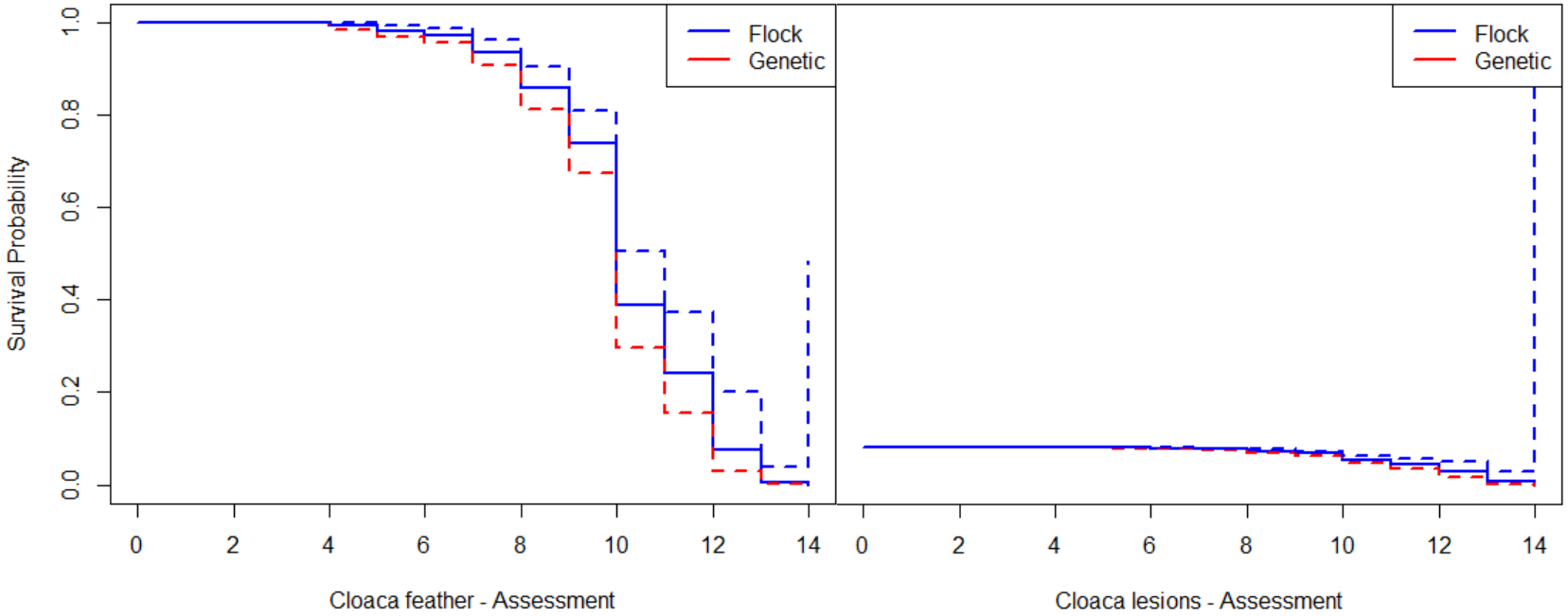
2. The occurrence of cloaca feather damage/skin lesions



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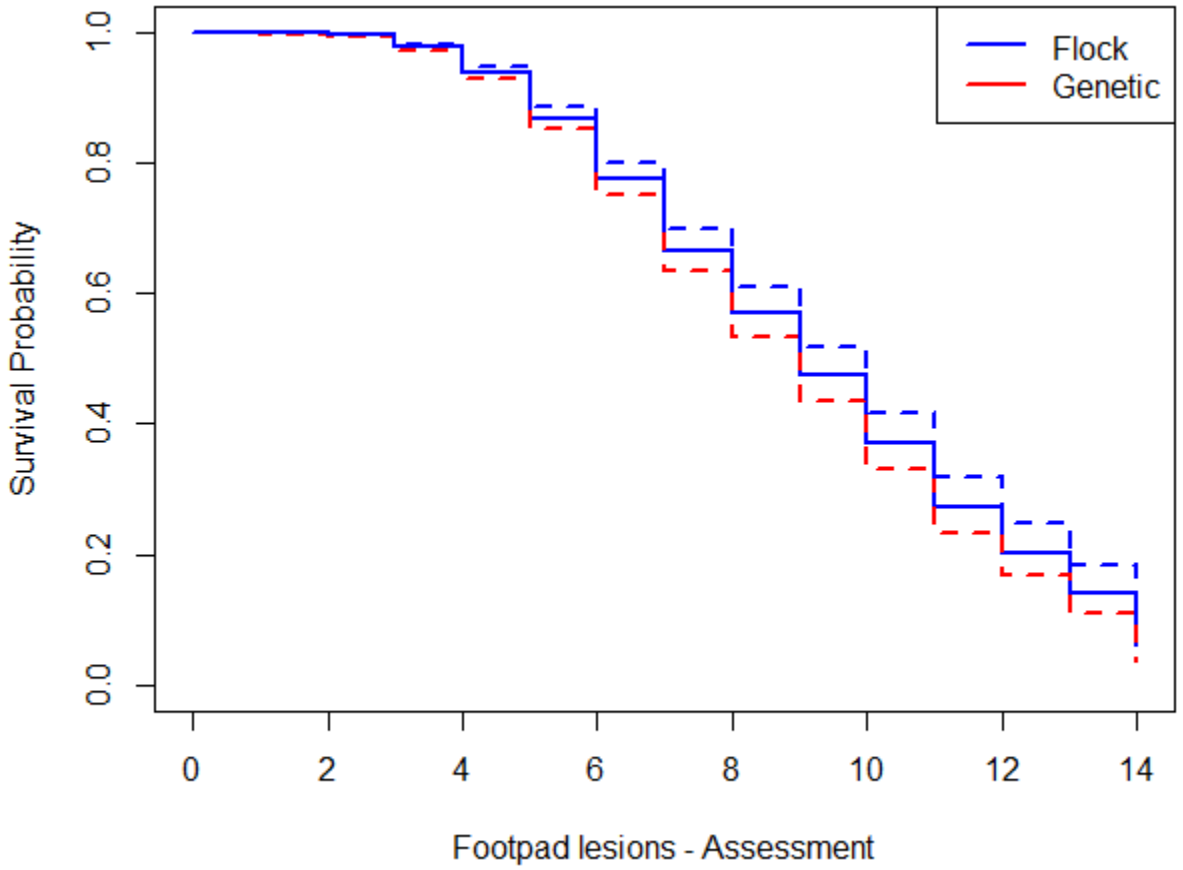
2. The occurrence of Footpad lesions



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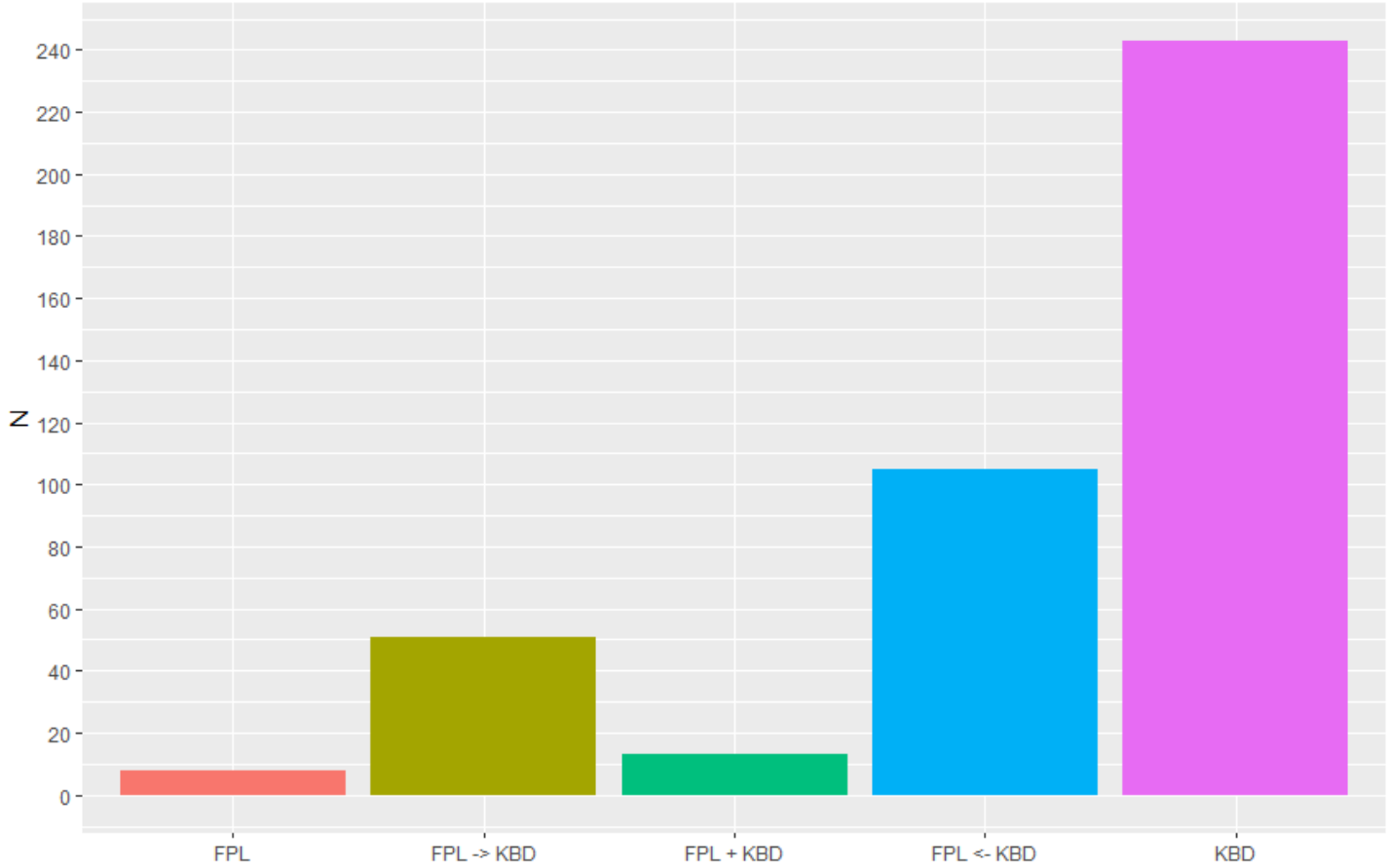
3. Temporal relationship between keel bone damage and footpad lesions



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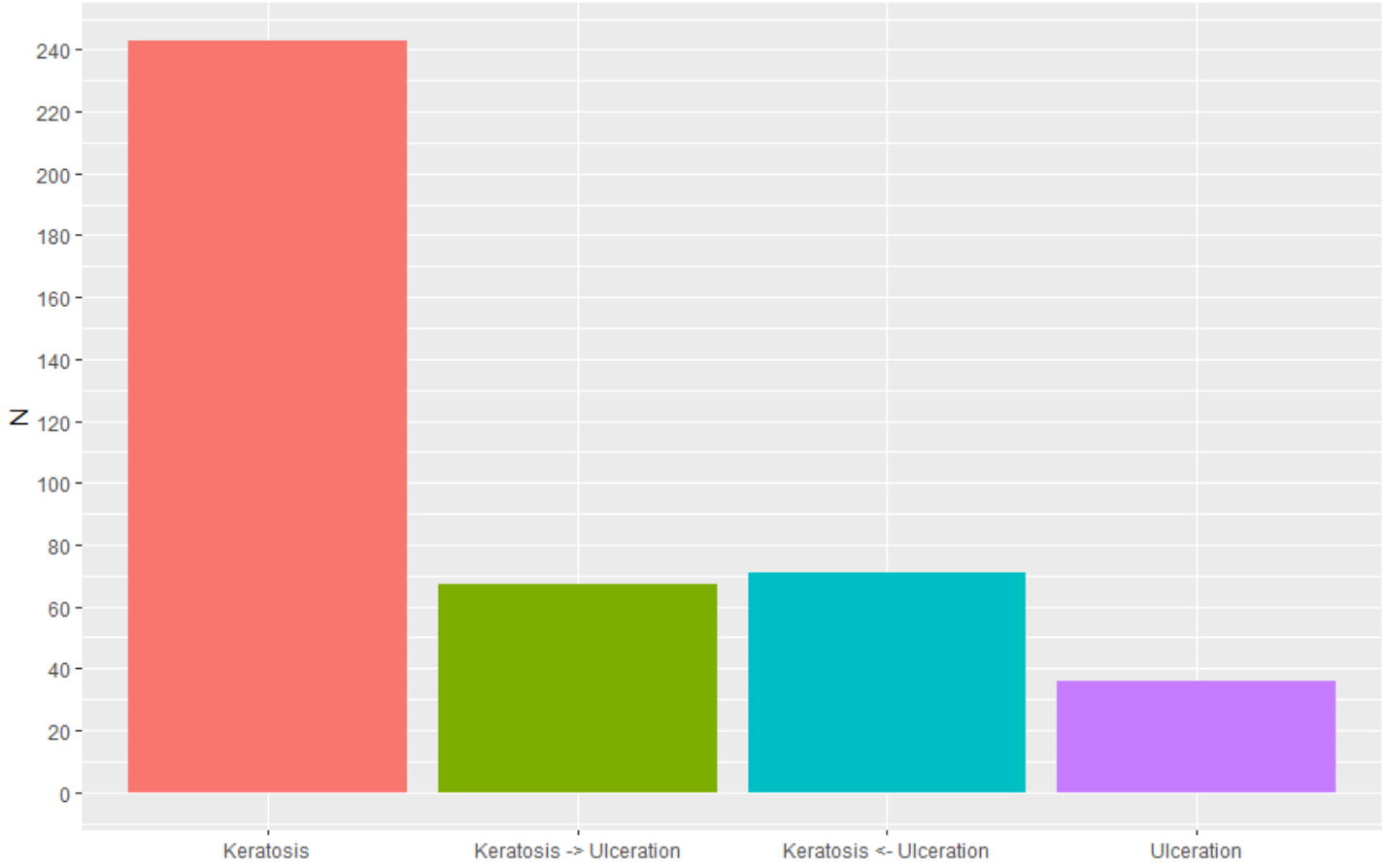
3. Temporal relationship between Hyperkeratosis and Ulceration



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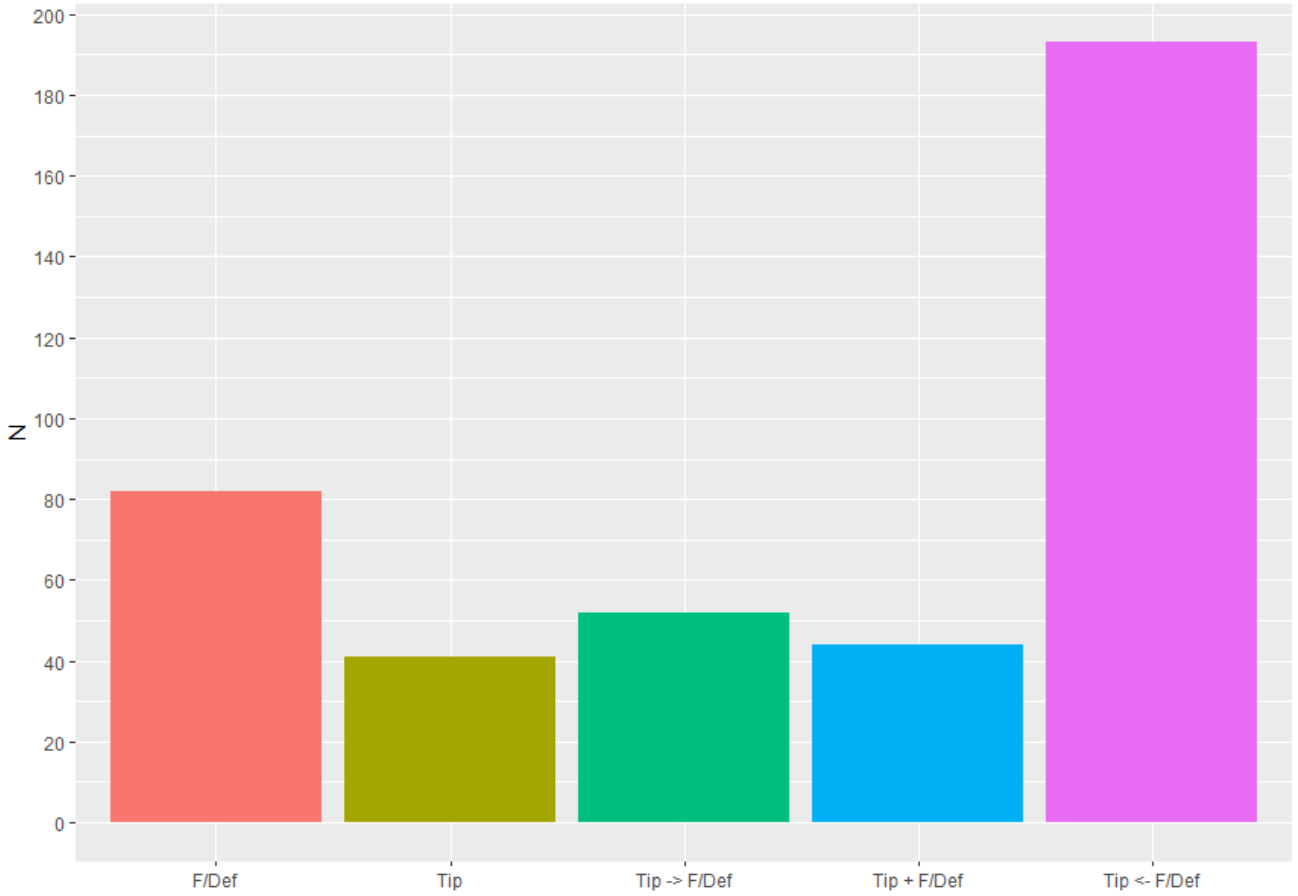
3. Temporal relationship between keel bone deformation/fractures and keel bone tip damage



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