



First approach: Validation of a scoring system to assess pododermatitis in Pekin ducks

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Background



Footpad dermatitis (FPD)

- Important welfare issue in poultry livestock production
- Welfare assessment tool

Heitmann et al., 2018; De Jong et al., 2014;
Haslam et al., 2007



Visual scoring systems: Assessment of FPD in poultry

- on farm
- during *post-mortem* inspection at the abattoir

Allain et al., 2009; Bilgili et al., 2009; Hocking et al., 2008;
Ekstrand et al., 1997; Martland et al., 1984

Visual scoring: Impact of subjective effects of observers

- Perception
- Interpretation

Meagher, 2009

Poor reliability of data collected by visual scoring

Mayne et al., 2007

Objectification of visual scoring systems - operationalise animal welfare

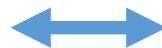
Aim of the study

Validation: Visual five-point scoring system

Objectify the classification of severe lesions in Pekin duck feet

Reliable linkage?

Parameters of visually detectable lesions



Existence of ulcerations



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Materials and methods

Experimental setup



Visual scoring (five-point scoring system)

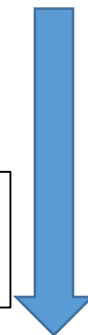
- N= 100 Pekin duck feet collected an abattoir
- 2 flocks of Cherry Valley Pekin ducks
- 41 days of age



Calculation of

- Size of metatarsal footpad (pixel)
- Size of lesion (pixel)
- Respective percentage of lesion (%)

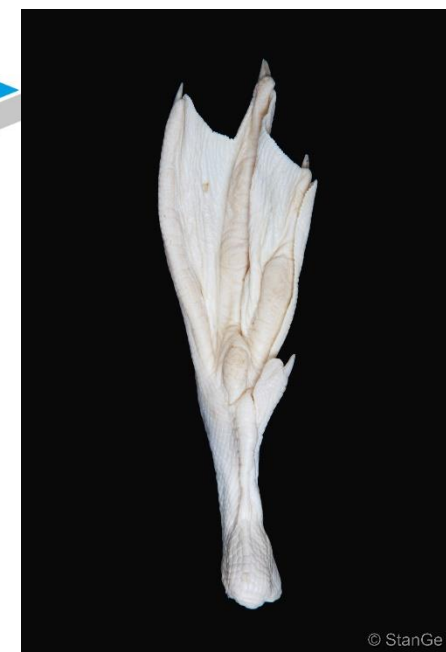
Digital images
of feet



Reference method for
visual scoring

Histopathological examination of metatarsal footpads

- No lesions
- Ulceration
- Granulation tissue
- Any other kind of pododermatitis



Visual scoring system of footpads



Modified according to Hocking *et al.* (2008)

Body region	Score	Attribute of scores
Footpad condition	0	No alterations
	1	Slight hyperkeratosis on either < 50% of the footpad <u>or</u> toepads
	2	Severe hyperkeratosis/ parakeratosis on either > 50% of foot pad <u>or</u> > 50% of the toepads
	3	Superficial pododermatitis on > 50% of the footpad and the whole toepads
	4	Severe ulcerative pododermatitis on the whole foot- and toepads

Measurement of metatarsal footpad (pixel) on the basis of images



N= 100 feet

ImageJ Software 1.51j8 (National Institutes of Health, USA)
3 repeated measurements per foot

Collected data

- Size of metatarsal footpad (pixel)
- Size of lesion (pixel)
- Respective percentage of lesions (%)

Measurement of size of metatarsal footpad
(area surrounded by the green line) and size of
lesion (area surrounded by the red line) per foot
using ImageJ Software 1.51j8

Histopathological examination of metatarsal footpads - reference method for visual scoring



System of histopathological classification (Department of Pathology of University of Veterinary Medicine Hannover, Foundation, Germany, 2018)

Body region	Score	Attribute of scores	Histopathological characteristics
Metatarsal footpad	0	No lesions	No lesions detectable
	1	Ulceration	Focal loss of epidermis with penetration of basement membrane, infiltration of inflammatory cells and accumulation of debris at the surface
	2	Granulation tissue	Directed proliferation of blood vessels and connective tissue
	3	Any other kind of pododermatitis	Perivascular pododermatitis, e.g. mainly lymphocytic or purulent perivascular pododermatitis

Statistical analysis

Data was tested for normal distribution using UNIVARIATE procedure

Descriptive comparison:

- Results of histopathological examinations and visual scoring of feet
- Measured parameters “size of metatarsal footpad”, “size of lesion” and “respective percentage of lesion” presented per visual score levels

Exact Wilcoxon two-sample test (level of significance: 0.05)

- Significant differences per visual score level and parameters were calculated

Correlation coefficients:

- Point biserial correlation
(biserial macro, SAS Institute Inc.)
- Fisher’s exact test



Relations between

- **measured parameters** (size of metatarsal footpad, size of lesion and respective percentage of lesion = **metric**)
- **histopathological parameters**
(ulceration; perivascular pododermatitis = **nominal**),



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Results

Parameter	Score	Mean ± SD	Median	Min	Max	Range
Size of metatarsal footpad (pixel)	0	1659 ± 404 ^a	1547	1098	2529	1431
	1	2038 ± 319 ^{bd}	2037	1521	2664	1143
	2	2251 ± 325 ^{cd}	2262	1665	2873	1208
	3	2395 ± 394 ^d	2352	1816	3192	1376
	4	2851 ± 386 ^e	2924	2108	3616	1508
	Total		2239 ± 538	2225	1098	3616
Size of lesion (pixel)	0	0.00 ± 0.00 ^a	0.00	0.00	0.00	0.00
	1	18.7 ± 18.3 ^b	19.0	0.00	69.0	69.0
	2	83.3 ± 64.3 ^c	63.0	10.0	219	209
	3	489 ± 381 ^d	351	134	1574	1440
	4	952 ± 319 ^e	944	297	1539	1242
	Total		308 ± 431	69.7	0.00	1574
Respective percentage of lesions (%)	0	0.00 ± 0.00 ^a	0.00	0.00	0.00	0.00
	1	1.00 ± 1.07 ^b	0.76	0.58	3.84	3.26
	2	3.70 ± 2.94 ^c	2.83	0.56	12.5	11.9
	3	19.9 ± 13.4 ^d	15.1	5.48	49.8	44.3
	4	33.6 ± 11.1 ^e	31.9	9.49	60.0	50.4
	Total		11.6 ± 0.15	3.37	0.00	59.3

a, b, c, d, e: Different letters in the same column indicate significant differences (p<0.05; Exact Wilcoxon two-sample test)

Results of visual vs. histopathological scoring

Histopathological alterations in visually classified feet (visual score 0-4, N = 100; n = 20 feet per visual score level).

Combinations of several histopathological findings occurred in affected feet.

Histopathological score	Visual score					Total
	0	1	2	3	4	
Score 0 (no lesions)	11	2	0	0	0	13
Score 1 (ulceration)	0	11	18	18	20	67
Score 2 (granulation tissue)	0	1	1	2	0	4
Score 3 (perivascular pododermatitis)	9	14	11	10	3	47

Visual scoring system:

47 feet histopathologically classified as severe lesions could not be detected by the visual scoring system.

➔ Ulcerations not detected in actual prevalence

Correlation coefficients

Correlation coefficients (point biserial correlation; Fisher's exact test) of measured parameters (metric, nominal; N = 100 feet)

	Size of footpad	Size of lesion	Respective percentage of lesion (%)
Perivascular pododermatitis	-0.17 p=0.0975	-0.26 p=0.0687	-0.24 p=0.0839
Ulceration	0.47 p<0.0001	0.43 p<0.0001	0.46 p<0.0001

Moderate correlations:

- Size of lesion and ulceration
- Respective percentage of lesion and ulceration



No reliable linkage between the **visual scoring system** and **histopathological classification**



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Conclusions

Aim of the Study

- Objectification: Classification of severe lesions in Pekin duck feet

Visual five-point scoring system

- not appropriate to detect severe ulcerative footpad dermatitis in actual prevalence

Investigated visual parameters

- not suitable for a reliable visual assessment of severe lesions

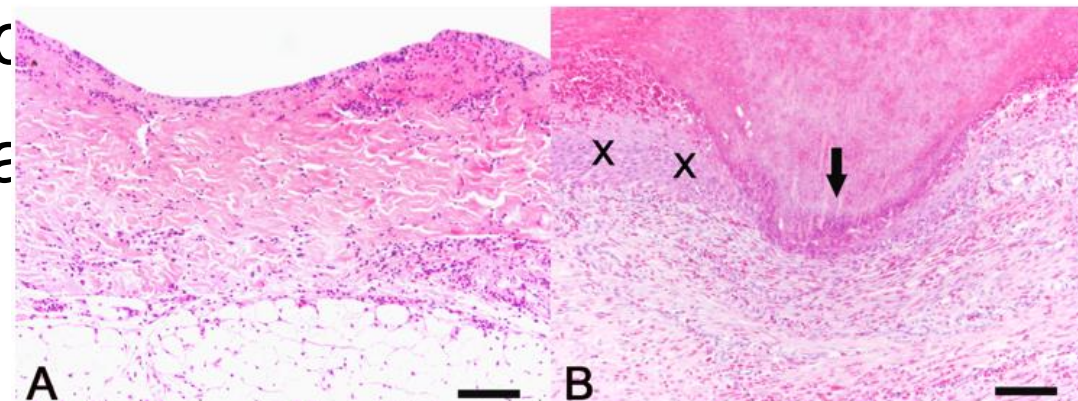
Modification of visual scoring system according to findings



Reliable indicator for a

Unfeasible due to experimental design:

Evaluation of painfulness of lesions



Acknowledgements

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Thank you for your attention!

