

# Keel bone damage in laying hens: effects of aviary design, soft perches and genetic selection of bone strength

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## Key words

Keel bone damage, laying hens, aviary system, bone strength

## Aim of the study

The aims of the project were to identify potential causes of keel bone damage in laying hens and develop novel approaches to reduce the high prevalence of keel bone damage in laying hens housed in aviary systems.

## Material and methods

The project consisted of three experiments investigating the effects of (i) soft vs. standard metal perches, (ii) additional perches, platforms or ramps vs. a standard aviary design and (iii) genetic selection of high and low bone strength vs. LSL hybrids on keel bone damage in aviary systems under conditions comparable to commercial production. In all three experiments, keel bone status was assessed repeatedly by palpation as well as by dissection at the end of the experiments. In the second experiment, video observations were conducted to assess successful movements as well as falls, including occurrence of collisions, cause of fall, and height of fall. In the third experiment, external egg and body parameters were assessed and compared between the three different genetic lines.

## Results and significance

Analyses of experiment (i) revealed that the proportion of keel bones with fractures and deviations was reduced by soft perch material, thereby providing evidence for the effectiveness of soft perches in reducing keel bone damage under commercial conditions. Behavioural analyses of experiment (ii) revealed that platforms and ramps facilitated successful movements between tiers compared to the standard aviary design, thereby reducing the number of falls and collisions as well as the proportion of fractures. Analyses of the third experiment revealed that greater bone mineral density (high bone strength line) was associated with a reduced incidence of fractures, poorer egg quality (i.e. thinner egg shells, reduced breaking strength) and a higher wing loading index compared with the standard LSL line. Taken together, these findings indicate that targeted modifications of aviary design (soft perch material, structures facilitating vertical movements between tiers), as well as inclusion of bone traits associated with improved bone strength in commercial selection procedures, are promising measures to reduce keel bone damage in laying hens under commercial conditions.

## Publications, posters and presentations

Stratmann, A.; Fröhlich, E.K.F.; Gebhardt-Henrich, S.G.; Harlander-Matauschek, A.; Würbel, H.; Toscano, M.J.

Modification of aviary design reduces incidence of falls, collisions and keel bone damage in laying hens.

Applied Animal Behaviour Science, *in press*.

Stratmann, A. et al Soft perches in an aviary reduce keel bone damage in laying hens. PlosOne, *under revision*.

Stratmann, A. et al Selection for bone strength affects prevalence of keel bone damage and egg parameters in laying hens. *In preparation for Poultry Science*.

Stratmann, A. (2014) ISAE Congress, Vitoria-Gasteiz (poster; student poster award); (2014) EPC, Stavanger (oral presentation); (2012, 2013) Int. Tagung Angewandte Ethologie, Freiburg (oral presentation); (2013) IEC, Newcastle (poster)

**Project 2.11.05**

**Project duration** June 2011 – July 2014