

Keel bone condition in laying hens: a histological evaluation of macroscopically assessed keel bones

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The aim of the present study was to conduct a histological analysis of macroscopically assessed keel bones of four different layer strains kept in furnished cages, small group systems (both allowing more activities due to the provision of perches) and an aviary system. Housing systems fully conformed to the EU legislative standards. In the laying months 3, 6, 9 and 12 of two experimental trials, keel bones were macroscopically evaluated according to a commonly used scale (1: severe, 2: moderate, 3: slight, 4: no deformity) and keel bone samples were chosen for histological analysis according to their macroscopic assessment (162 in total). In 97.9 % of grade 4 keel bones, no histological deviations were found. In 100 % (grade 1) and 80 % (grade 2) of keel bones, the predominant histological finding was the incidence of fracture callus material (FCM) and new bone (woven bone), suggesting a traumatic origin. A clear dislocation of cortical bone fragments was still visible in 37.5 % of grade 2 and 26.7 % of grade 1 keel bones. Histological analysis of grade 3 keel bones showed FCM in 50.9 % of samples, whereas in 40.7 % only s-shaped deformities were detected without evidence of a preceding bone fracture. These deformities were related to extended pressure most likely due to perching activities in systems with perches rather than to short-duration trauma. 8.4 % of grade 3 keel bones reflected the incidence of periosteal ectostosis appearing as a thin layer alongside the cortical bone without evidence of FCM. These bone formations were seen as a reaction of bone tissue to provide structural support and also triggered by external, mechanical forces. The results of histological analysis showed that keel bone deviations of grade 1 and 2 were mainly attributed to traumatic origin and therefore associated with pain experience in layers, whereas keels bones assessed with grade 3 manifested either FCM as a result of trauma or adaptational deformities without any evidence of bone fracture, which were most likely not associated with pain. Therefore, histological analysis was found to be a mandatory tool when evaluating grade 3 keel bones with respect to layers' welfare. Furthermore, this analysis corroborates the findings that the incorporation of perches in laying hen husbandry systems strongly impacts keel bone condition. Russell, W.M.S. and Burch, R.L. (1959). *The Principles of Humane Experimental Technique*. Methuen, London.

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