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INFLUENCE OF PHYSICAL ACTIVITY ON TIBIAL BONE MATERIAL PROPERTIES IN LAYING HENS

A. B. Rodriguez-Navarro[1*], H.M. McCormack[2], R.H. Fleming[2], P. Alvarez-Lloret[3], J. Romero-Pastor[1], N. Dominguez-Gasca[1], Tanya Prozorov[4], I. C. Dunn[2].

[1]*Departamento de Mineralogía y Petrologia, Universidad de Granada, 18002 Granada, Spain.*

[2]*The Roslin Institute, University of Edinburgh, EH25 9PS, Scotland, UK.*

[3]*Departamento de Geología, Universidad de Oviedo, 33005 Oviedo, Spain.*

[4]*Ames Laboratory. Iowa State University, Ames, IA 50100, USA.*

**Corresponding author: anava@ugr.es*

Abstract

Laying hens develop a type of osteoporosis that arises from a loss of structural bone, resulting in high incidence of fractures. In this study, a comparison of bone material properties was made for lines of hens created by divergent selection to have high and low bone strength and housed in either individual cages, with restricted mobility, or in an aviary system, with opportunity for increased mobility. Improvement of bone biomechanics in the high line hens and in aviary housing was mainly due to increased bone mass, thicker cortical bone and more medullary bone. However, bone material properties such as cortical and medullary bone mineral composition and crystallinity as well as collagen maturity did not differ between lines. However, bone material properties of birds from the different type of housing were markedly different. The cortical bone in aviary birds had a lower degree of mineralization and bone mineral was less mature and less organized than in caged birds. These differences can be explained by increased bone turnover rates due to the higher physical activity of aviary birds that stimulates bone formation and bone remodeling. Multivariate statistical analyses shows that both cortical and medullary bone contribute to breaking strengthThe cortical thickness was the single most important contributor while its degree of mineralization and porosity had a smaller contribution. Bone properties had poorer correlations with mechanical properties in