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## Swine cortical and cancellous bone: histomorphometric and densitometric characterisation

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### Abstract

Swine bone morphology, composition and remodelling are similar to humans', therefore they are considered good models in bone-related research (Wancket *et al.*, 2015; Rubessa *et al.*, 2017). They have been used for several studies involving bone growth, bone and cartilage fractures and femoral head osteonecrosis. Nevertheless, the literature about pig normal bone features is incomplete (Teo *et al.*, 2005). This work aims to fill the literature gaps on the microarchitecture and Bone Mineral Density (BMD) of swine femoral diaphysis and distal epiphysis and tibial plateau and diaphysis.

Five hind limbs were collected from slaughtered 80-100 kg pigs. Microscopic analysis of cortical and cancellous bone from middle/distal femur and proximal/middle tibia was performed to determine basic histomorphometric parameters at different sites. Dual-energy X-Rays Absorptiometry was also employed to evaluate BMD. ANOVA and correlation between BMD, bone area (BA) and cortical thickness were performed.

Diaphyseal cortical bone was mostly plexiform both in the tibia and the femur; primary/secondary osteons without clear organization were also found. Mean values for bone area, bone perimeter, trabecular width, number and separation and BMD at different anatomical sites were defined. No significant difference was found for these values at different anatomical sites. BMD proved to be positively correlated with cortical thickness ( $r=0,80$ ;  $p<0,01$ ). Despite the small sample size, these results seem homogeneous. They could therefore represent reference values for normal bone parameters in pigs. Applied anatomy and regenerative medicine, in fact, demand very precise information about bone micromorphology, composition and density to provide reliable indication in bone substitutes building. Moreover, since the interpretation of bone abnormalities grounds on mastering normal bone characteristics, the definition of reference parameters is mandatory to avoid misinterpretation and allow comparative evaluation.

The results of this study, although preliminary, may be considered a dependable starting point for the definition of normal bone features in pigs.

## References

Rubessa M., Polkoff K., Bionaz M., Monaco E., Milner D.J., Hollister S.J., Goldwasser M.S., Wheeler M.B., 2017. Use of pig as model for mesenchymal stem cell therapies for bone regeneration. *Animal Biotechnology Mar (7)*,1-13.

Teo, J.C.M., Shi-Hoe, K.M., Keh, J.E.L., Teoh, S.H., 2005. Relationship between CT intensity, micro-architecture and mechanical properties of porcine vertebral cancellous bone. *Clinical Biomechanics 21*, 235-244.

Wancket L.M., 2015. Animal models for evaluation of bone implants and devices: comparative bone structure and common model uses. *Veterinary Pathology 52(5)*, 842-850.