Comparative studies on bone structure in dairy cows with different feeding conditions

M. Pilmane¹, I. Zitare², A. Jemeljanovs²

¹ Institute of Anatomy and Anthropology, Riga Stradins University, Dzirciema street 16, Riga, LV 1007, Latvia
² Latvia University of Agriculture, Research Institute of Biotechnology and Veterinary Medicine “Sigra”, Sigulda, Institute Street 1, LV 2150

Abstract

The bone belongs to the dynamic tissues and its structure in domestic cows is still not completely understood in correlation to the impact of different food components. The aim of our work was a histomorphometrical and immunohistochemical research on bone morphology and factors influencing it in healthy dairy cows fed with self-produced grain and with rapeseed cakes.

The bone of self-produced grain-fed cows demonstrated statistically significant difference in the number of osteocytes from the bone of rapeseed cakes-fed cows. The rapeseed cakes-fed cows didn’t show any bone cell positive for BMP2/4, while FGFR1 increased significantly in their supportive tissues. The number of bFGF- and apoptosis-containing structures varied in cows of both groups. MMP2 expression showed statistically significant difference between both animals’ groups with domination in bone of cows fed with self-produced grain. Defensin-, osteopontin- and osteocalcin-containing cells showed tendency to increase in bone of cows on rapeseed cakes diet.

Conclusions. The rapeseed-fed cow’s long bones demonstrate significant decrease of osteocytes per mm² and selective increase of FGFR1, suggesting the (compensatory) growth stimulation in supportive tissue.

The statistically significant selective absence of MMP2 with a slight tendency of increase in osteopontin and osteocalcin in rapeseed-fed cow’s long bones indicates the persistence of seemingly still compensated qualitative changes in bone (beginning of disturbances in mineralization, metabolism etc.) proved also by a slight increase of the bone antimicrobial peptide.

Key words: histomorphometry, immunohistochemistry, bone, rapeseed diet, cows

Introduction

Qualitative and quantitative studies of compact bone microstructure of some mammals with an emphasis on finding an adequate identification key were done during the last years (Martiniakova et al. 2006). Zedda et al. (2008) indicated that bone structure of domestic herbivores is still not completely understood.

Bone is a dynamic tissue – the modeling and remodeling of bones are two processes actively going on in a living body throughout life. Particularly, the structure of bone provides it strength, ensures mobility and protection for bone marrow. Balanced bone resorption and bone formation provide the constant bone mass. Remodelling involves the sequential development and replacement of bone at discrete sites by the actions of osteoclasts and osteoblasts that comprise...