Relative availability of phosphorus in feed phosphates by growing pigs

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The relative bioavailability of P in five feed phosphates was determined using growing pigs. The five P-sources were dicalcium phosphate (DCP), monocalcium phosphate with 70% purity (MCP70), monocalcium phosphate with 85% purity (MCP85), monocalcium phosphate with 100% purity (MCP100), and monosodium phosphate (MSP). A basal diet (0.10% P) was formulated. Ten additional diets were formulated by adding 0.07 or 0.14% P from each of the five feed phosphates to the basal diet. Forty four growing pigs (initial BW 16.8 ± 4.3 kg) were randomly allotted to the 11 experimental diets. Pigs were housed individually and fed on an ad libitum basis throughout the 28-d experimental period. At the conclusion of the experiment, all pigs were euthanized and five bones (i. e., the tibia, and both sets of third and fourth metacarpals) were harvested and the bone breaking strength was determined in the metacarpals. The relative bioavailability of P in each of the five feed phosphates was calculated using slope ratio methodologies based on breaking strength. The bone mineral density (BMD) and bone mineral content (BMC) was measured in different parts of the tibia using two scanning machines (i.e., Dual-energy X-ray Absorptiometry (DXA) and Peripheral Quantitative Computed Tomography (pQCT)). Correlation coefficients from DXA and pQCT data to breaking strength were developed. The availability of P in DCP, MCP70, MCP85, and MCP100 was 49.5, 68.9, 66.3, and 84.9%, respectively, relative to MSP. The slope of the regression line for MSP was steeper ($P < 0.05$) than the slopes for pigs fed DCP, MCP70, or MCP85, but not different from that of pigs fed MCP100. The slope for MCP100 was also steeper than the slope for DCP ($P < 0.05$), but not different from pigs the other sources of P. The correlation between BMD or BMC and the breaking strength was between 0.73 and 0.79, dependent on which part of the tibia was measured, but regardless of which machine was used for the scanning. In conclusion, P in MSP is more available than P in DCP and MCP, but there is no significant difference in P-availability between different sources of MCP. The breaking strength of bones can be predicted with reasonable accuracy using either a DXA or a pQCT scan.

Key words: Phosphorus, Pigs, Relative bioavailability