DXA scans of pig feet accurately predict bone ash content

Abstract – W151

Dual-energy X-ray absorptiometry (DXA) offers a rapid method to predict bone ash content of humans, animals, and tissues. Earlier work in our laboratory demonstrated that the GE Lunar Prodigy instrument (software version 10.10.030) in selected scan modes, accurately predicted bone ash content of pigs from 1 to 60 kg. The current experiment was designed to assess the accuracy of DXA scans of pig feet as a rapid screening method to evaluate qualitative responses by pigs to dietary treatments affecting mineral status. The front foot was selected as an easily accessible sample to collect from a slaughter plant. The front foot included all bone distal of the carpals. Ten pig feet were aligned parallel to the DXA bed and placed in various orientations to determine which position allowed the most accurate prediction of bone ash content. Orientations included 1) direction of hoof, hoof either scanned first or calf bones first, 2) dewclaw orientation, dewclaws facing up or down. Another variable included variation in background material, either 2.5 cm or 5 cm thick rice bags, and the position of rice bags, either both beneath the foot or one below and one above the foot. Following scans all bones within each foot were dissected, dried at 100°C for 24 h, and ashed at 750°C for 12 h. Total bone ash content from each foot was compared by regression analysis with bone mineral content (BMC) from DXA scans within each orientation and type of background material. Selection of the regression models to most accurately predict bone ash content from DXA scans were based on the model with a coefficient closest to 1.0. The model selected (ash = -0.403 + 0.988*BMC, R²= 0.979) was based on scans with the hoof scanned first, dewclaws down, and two rice bags beneath the foot. The model with the lowest coefficient (ash = 11.6 + 0.717*BMC, R²= 0.836) was based on scans with hoofs scanned last, dewclaws up and one rice bag. In conclusion, DXA scans of pig feet can accurately predict bone ash content of the foot, but foot orientation and background material are important variables.

Methods

The front foot was selected for ease of collection and low market value. Bones from 10 entire feet were dissected and ashed to establish amounts of bone mineral (dissected ash).

DXA Scans

Pig feet were scanned with GE Lunar Prodigy instrument in orientations shown below.

Thickness of background

Rice is used as a source of carbon to mimic soft tissue in DXA scans. The number (1 or 2) of rice bags were varied to determine if background thickness contributed to variable results due to scan orientation. Rice bags provided either 2.5 or 5 cm thickness beneath the foot.

Aashing Method

After scans all bones were dissected from each foot and ashed at 750°C for 12 hours.

Statistical Methods

Regression analysis were used to compare DXA BMC data from each orientation and background thickness with the dissected ash values.

Results

Foot Orientation

Results – Background Thickness

- Dissected Ash, g

Results – Foot Orientation

Conclusions

GE Lunar DXA accurately predicted BMC of pig feet and offers a rapid screening method to assess responses to dietary P variables. Scans of feet with the hoof north, dew claws facing down and 5 cm thick background produced the most accurate prediction of bone ash.

Objectives

Evaluate the accuracy of DXA scans of pig feet as a rapid screening method to assess responses of pigs to dietary P while not compromising animal performance.

Introduction

Concerns for environmental P pollution have pressured swine producers to reduce dietary P while not compromising animal performance. Adequacy of dietary P is often based on assessment of bone strength and/or ash. Quantitative assessments involving bone mechanical tests or dissection and ash measurements are expensive. New dual-energy X-ray absorptiometry (DXA) instruments allow scans that accurately predict bone mineral content (BMC) of whole animals. A rapid screening method is needed to assess relative P contributions from feed ingredients.

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