Determinação da composição da carcaça de bezerros através da absortometria radiológica de dupla energia (DEXA)[1]

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Resumo: Este trabalho foi desenvolvido para avaliar a composição de carcaça por absortometria de raio X de dupla energia (DEXA) em bezerros mestiços (Holandês X Gir). Dezessete bezerros foram usados, com peso médio de 48 ± 7.5 kg e idade média de 45 ± 11 dias. Após o abate as carcaças foram analisadas em um densitômetro DEXA (GE Healthcare Lunar Prodigy) usando software enCORE para pequenos animais para obtenção do conteúdo de gordura, tecido magro, conteúdo mineral do osso e densidade mineral óssea. Posteriormente, as carcaças foram dissecadas para separação de tecido adiposo, muscular e ósseo os quais foram moídos e liofilizados para posteriores análises laboratoriais de matéria seca, matéria mineral, nitrogênio total e extrato etéreo. Os resultados de DEXA para gordura, tecido magro e conteúdo do osso foram comparados àqueles observados por dissecação e análise química, e equações de regressão foram desenvolvidas. A DEXA pode ser usado pra avaliar a quantidade de proteína, minerais, músculo, osso em carcaça de bezerros. Entretanto, o uso da DEXA não foi efetivo na determinação do conteúdo de gordura de carcaças muito magras, derivadas de bezerros jovens.

Palavras–chave: avaliação, gordura, músculo, osso, tecido magro, técnica

Determination of carcass composition of calves by dual energy x-ray absorptiometry (DEXA) [1]

Abstract: This work was developed to evaluate carcass composition by dual energy x-ray absorptiometry (DEXA) in crossbred calves (Holstein x Gyr). Seventeen calves were used, with average weight of 48 ± 7.5 kg and average age of 45 ± 11 days. After the slaughter, carcasses were analyzed in a DEXA unit (GE Healthcare Lunar Prodigy) using enCORE software for small animals to obtain the fat, lean tissue, bone mineral content and bone mineral density. Then, carcasses were dissected into separable muscle, fat and bone tissues which were grounded and freeze dried for further laboratorial analyses of dry matter, mineral matter, total nitrogen and ether extract. DEXA results for fat, lean tissue and bone mineral content were compared to those observed by dissection and chemical analysis, and regression equations were developed. DEXA can be used to assess the amount of protein, minerals, muscle and bone in the calves' carcasses. However, the use of DEXA was not effective in determining the fat content of very lean carcasses, derived from young calves.

Keywords: evaluation, fat, muscle, bone, lean tissue, technique

Introduction

DEXA is the gold-standard method for measuring human body composition. By DEXA, body's composition can be checked in vivo in both, humans and animals, and the whole body can be analyzed for fat content, lean tissue and mineral content (NÜSKE et al., 2007). The ability to estimate quickly and with accuracy the carcass composition remains a challenge for researchers and for the meat industry. The uses of DEXA for monitoring fat deposition in the carcass along the animal development constitute an important non invasive method to increase the knowledge about growth physiology. Nonetheless, DEXA estimates derives from equations developed mainly for humans, and its use to evaluate carcass composition must be investigated. Therefore, the objective of this work was to fit regression equations to determine carcass composition of calves from DEXA measurements.

Material e Methods

The experiment was conducted at Animal Science Department of the Universidade Federal de Viçosa (UFV), Viçosa, Minas Gerais. The experimental protocol was approved by the Ethics Committee on the use of farm animals, CEUAP-UFV, Protocol n ° 27/2013.

Seventeen Holstein x Gyr crossbred male calves were used, aging 45 ± 11 days with average weight of 48 ± 7.5 kg. The animals were fed with two different experimental diets from birth to slaughter: 1 - Pure milk; 2 - Milk and concentrate, in order to cause a variation in the body composition to check the ability of DEXA in predicting carcass composition. After 60 days on feeding, animals were euthanized with administration of Acepromazine (0,013mg / kg of BW), Thiopental (0.125 mg / kg of BW) and Potassium chloride (80 to 120 mL). After slaughter, all left half carcasses were stored in cold chamber for later analysis. The temperature of the chamber decreases 2 ° C every two hours for 12 hours, with an initial chamber temperature of 16 ° C and the final temperature of 4 ° C which was maintained for 24 hours.

After 24 hours from slaughter, half left carcasses were scanned in the DEXA densitometry unit (GE Healthcare Lunar Prodigy), using the software EnCore for small animals (2010), to obtain the fat content, lean tissue content and bone mineral content.

Subsequently, the half carcasses were dissected, separating bone, muscle and fat to obtain the mass of each component separately and then milled in a industrial cutter to obtain a homogenous sample of approximately 100 grams. Immediately after collection, the sample was frozen at -40 ° C and then freeze-dried.

To obtain the chemical composition of carcasses, the freeze-dried samples were ground in a knife mill with 1 mm diameter sieves and the levels of dry matter (DM), mineral matter (MM), crude protein (CP) and ether extract (EE) were carried out according to the methods described by Detmann et al. (2012).

The parameters mentioned above were compared with DEXA measurements and regression equations were developed using the PROC REG procedure of SAS 9.2 (2011).

Results and Discussion

In table 1 the generated equations are shown. Significant regression ($P < 0.05$) were found to estimate carcass weight, bone content, mineral matter content, lean content and crude protein content in the carcass.

The relationship between bone in the carcass and bone mineral density measured by DEXA was not significant ($P > 0.05$, data not shown). However, the relationship between the mineral content measured by DEXA has been correlated to the bone content of the carcass, as well as total mineral mass of carcasses.

Table 1 – Regression equations, significance levels and determination coefficient to estimated carcass composition from DEXA measurements in crossbred calves.

Regression equations	P value	R^2
WEIGHT = - 0.04293 + 0.9304 x DEXA total mass	<0.0001	0.9228
kgBONE = 1.8056 + 0.00403 x BMC	0.0016	0.4965
kgMM = 0.2382 + 0.0006318 x BMC	0.0002	0.6119
kgFAT = 0.06604 - 0.00449 x fat tissue	0.9557	0.0002
kgEE = 0.6307 + 0.1868 x fat tissue	0.5068	0.0299
kgMEAT = - 0.4489 + 0.0006444 x lean tissue	<0.0001	0.6986
kgCP = 0.1206 + 0.0001866 x lean tissue	<0.0001	0.7290

WEIGHT = observed carcass weight, kg; DEXA total mass = carcass weight by DEXA, kgBONE = observed weight of bone, kg; BMC = DEXA bone mineral content, kg ; kgFAT = observed fat mass, kg; fat tissue = DEXA fat tissue mass, kg; kgEE = observed ether extract mass, kg; kgMEAT = observed meat mass, kg; lean tissue = DEXA lean tissue mass, kg; kgCP = observed crude protein mass, kg.

DEXA measurements of lean tissue were significantly correlated to carcass protein and muscle content. Nonetheless, a low correlation between the amount of fat and ether extract in the carcass with fat tissue measurements from DEXA was found. This result may be due to the low body fat content of the calves, since their meat is practically absent of fat (LUCHIARI FILHO, 2000).

Data obtained by X-ray computed tomography has the potential to be used in selection of animals in termination phase for meat quality (MACFARLANE, 2009), but its use in early growing phase might be further

investigated, since the low fat content in this phase might produce prediction errors from the calibration equations used by densitometers .

Conclusions

Dual energy x-ray absorptiometry (DEXA) can be used to evaluate the amount of protein, minerals, muscle and bone in the carcass of calves. However, the use of DEXA was not effective in determining the fat content in lean carcasses, from young calves.

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