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Body composition of crossbred kids evaluated by Computed Tomography

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ABSTRACT

Sixteen crossbred female kids, (Hungarian Milking Brown×Alpine) F_1 (n=8) and (Hungarian Milking Brown×Boer) F_1 (n=8), were selected from the same farm. The kids were scanned by Computed Tomography to evaluate and compare the body composition of crossbred progenies. The area of fat, muscle and bone tissues were estimated according to the x-ray densities from the 10 mm thick scans. The distance were 20 mm between slices, therefore forty-sixty slices were produced by individual, depending on the longness of vertebral column. The area of tissues were recorded in mm^2 and analysed by GLM using live weight as covariant (LSD-test; $P<0.05$) and partial correlation corrected for body weight. In Alpine crossbreds the average area of fat tissue was 64.6 thousand mm^2, while in Boer progenies it was 71.1 thousand mm^2. The area of muscle tissue in Alpine crossbred kids was 290.4 thousand and 372.0 thousand mm^2 in Boer crossbreds, which difference was significant. The average area of bone tissue was similar in two crossbreds groups. In Alpine F_1 none of the partial correlation among fat, muscle and bone tissues became significant. In Boer F_1 the correlation between muscle and bone tissues was strong and significant. The Boer had stronger and significant effect on body tissue composition comparing to Alpine breed concerning to meat production.
(Keywords: kid, body composition, tissue, computed tomography)

INTRODUCTION

The image creating diagnostic methods (like ultrasonography, x-ray computed tomography, MRI) are wide spread used to estimate the quantity of meat produced by animals. The computed tomography method is based on the x-ray absorption of different tissues. The most important advantage of CT is that the animals can be scanned as frequently as it is necessary.

The veterinarians and animal scientists have used the CT methods in studying almost all animal species (poultry, rabbit, porcine, fish, sheep and bovine) in the University of Kaposvár (Hungary) over the last twenty years.

In goat species, limited information is available concerning the results of „in vivo" methods. *Junkuszew and Ringdorfer* (2005) studied lambs by ultrasonography and CT as well, to estimate the tissue composition and compare the two methods. They found the CT more accurate in prediction, but the ultrasonography was cheaper. *Delfa et al.* (1996, 1998, 1999) studied the relationships between the ultrasound measurements in live adult goats and the measurements of fat thickness and muscle depth taken on carcass. According to *Toldi* (2003) the S/EUROP body conformation of lambs could be predicted

from CT data with medium correctness (r=0.68), while the relationship was strong in the case of fat cover (r=0.87), and the strongest value (r=0.94) was observed in the case of hot carcass weight.

The objective of this study was to evaluate and compare the body composition of Alpine and Boer firstcross kids.

MATERIALS AND METHODS

Sixteen female kids were selected randomly from the same farm. The eight (Hungarian Milking Brown×Alpine) F_1 kids were six months old, while the other eight kids belonging to (Hungarian Milking Brown×Boer) F_1 had 4 months of age.

The animals were starved 12 hours and transported to the Health Sciences Centre of the University of Kaposvár. In the preparation room, the kids were weighted with 0.5 kg accuracy. Two-three kids were parallel placed in an examination hutch and were drug in muscle with 0.3–0.4 mg/body weight Xilazin fifteen minutes before scanning. If necessary further 0.1 mg/body weight drug was injected in, and they were placed in ventral position in the plastic examination trough. The front legs were placed near head while rear legs were locked caudale position. CT scans were performed by Siemens Somatom Expert Plus 4 equipment. In all segments the area of fat, muscle and bone tissue were measured and recorded. Scan pictures series were made by the "Australian method" (*Mezőszentgyörgyi,* 2000) with a 10 mm slice thickness and 20 mm slice distance. The number of pictures (40–60) taken was depended on the longness of vertebral column.

The pictures were evaluated by Medical Image Processing V1.0 software (*Závoda,* 2006). Fat, muscle and bone tissues were recorded in mm^2 by CTPC programme based on the Hounsfield Units (1980) (*Table 1*). Microsoft Excel macros were made to process the data matrix.

Table 1

The Hounsfield Units of body tissues

Type of tissues	Hounsfield Units
fat	from -200 to -20
muscle	from +20 to +200
bone	from +600 to +1000

The individual data received were analysed using SPSS 10.0 software. Means, standard deviations and GLM (Generalized Linear Model) using live weight as a covariant (LSD-test; $P<0.05$) procedure were conducted to compare the two genotypes. The relationships among tissue areas corrected for body weight could be shown using partial correlation.

RESULTS AND DISCUSSION

The average body weight of kids at the time of CT examination were lower in Boer crossbreds (16.9 kg) than in the case of Alpine progenies (17.9), but this difference were not significant (*Table 2*).

In Alpine F_1 the average area of fat tissue was 64.6 thousand mm^2, while in Boer F_1 it was 60.9 thousand mm^2 – the observed difference was not significant. The most

important muscle tissue in Alpine crossbred kids was 290.4 thousand mm^2, while in Boer F_1 kids 302.5 thousands mm^2 were found. The measured 12.9 thousands mm^2 difference in muscle tissue was also not significant. The average area of bone tissue was similar in two crossbreds groups, 53.8 thousand mm^2 in Alpine and 44.6 thousand mm^2 in Boer crossbred kids. The muscle/fat ratio was 25% bigger in Boer F1 kids than in Alpine crossbreds, however the differences were not significant (P=0.158), probably due to the low number of measured kids (*Table 2*).

Table 2

Average (±standard deviation) body weight (kg), average values of fat, muscle and bone tissues (1000 mm^2)

	Body weight	Fat tissue	Muscular tissue	Bone tissue	Muscle/Fat ratio
(HMB×Alpine) F_1	17.88 ±2.42	64.60 ±20.57	290.44 ±42.73[a]	53.77 ±13.18	4.73 0.98
(HMB×Boer) F_1	16.94 ±5.45	60.92 ±39.94	302.53 ±119.78[b]	44.60 ±19.27	5.89 1.98

[a,b] P≤0.05

In Alpine crossbred kids there was low negative correlation between fat and bone tissue. The correlations among fat, muscle and bone tissues were low and none of the correlations became significant. In the case of Boer crossbred kids the correlations were stronger (medium and strong) than in Alpine crossbreds. The correlation between muscle and bone tissue was found strong and significant (*Table 3*).

Table 3

Partial correlation coefficients among different tissue areas (corrected for body weight)

	Fat tissue	Muscle tissue	Bone tissue
Fat tissue		0.37	-0.25
Muscle tissue	*0.67*		0.29
Bone tissue	0.53	0.83*	

* P≤0.05; Values above diagonal are for (HMB×Alpine) F_1 kids; under diagonal for (HMB×Boer) F_1 kids

CONCLUSIONS

However, the Boer crossbred kids were younger than Alpine progenies at the time of examination, and had lower body weight, they had higher area of all measured tissues, particularly the most important muscle tissue. It meant that the Boer goat had stronger and significant effect on body tissue composition comparing to Alpine breed concerning to meat production.

REFERENCES

Delfa, R., Gonzalez, C., Teixeira, A., Vijil, E. (1996). Ultrasonic measurements in live goats. Prediction of weight of carcass joints. 47th Annual Meeting of the EAAP, 273.

Delfa, R., Teixeira, A., Gonzalez, C. (1998). Body weight and ultrasons as predictors of carcass quality and fat partition in adult goats. Revista Portuguesa de Zootecnia. ANOV, 2. 1-16.

Delfa, R., Teixeira, A., Gonzalez, C., Torrano, L., Valderrábano, J. (1999). Use of ultrasounds in Blanca Celtibérica live kids as predictors of carcass composition. Arch. Zootech., 48. 182. 123-134.

Hounsfield GN (1980). Computed medical imaging. Nobel lecture December 8, 1979. J. Computer Assisted Tomography. 4. 665-674.

Junkuszew, A., Ringdorfer, F. (2005). Computer tomography and ultrasound measurement as methods for the prediction of the body composition of lambs. Small Rum. Res., 56. 121-125.

Mezőszentgyörgyi, D. (2000). Study of fat and muscle incorporation in sheep of different genotypes by computer tomography. Doctoral (PhD) dissertation. Kaposvár, Hungary.

Toldi, Gy. (2003). Correlation between S/EUROP qualification and the slaughter value of sheep. Doctoral (PhD) dissertation. Kaposvár, Hungary.

Závoda (2006). MIP (Medical Image Processor). Kaposvár, Hungary.

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