DETERMINATION OF VEAL CARCASS COMPOSITION BY DUAL ENERGY X-RAY ABSORPTIOMETRY (DEXA)

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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. However, the use of DEXA was not effective in determining the fat content of very lean carcasses, derived from young calves.

Key Words – fat, mineral, protein

I. INTRODUCTION

DEXA body's composition and constitution can be accessed in vivo in humans and animals. Although methods such as computed tomography, ultrasound and electrical bioimpedance are available (KAUFFMAN & WARNER, 1993), the ability to estimate quickly and with accuracy the carcass composition remains a challenge for researchers and for the meat industry.

The main objectives of new methodologies are focused to avoid the inaccuracies of the methods and provide a more convenient technique than dissection or chemical analysis. By regression equations, it is possible to validate the DEXA technique for carcass evaluation, since these equations establish relationships between interrelated variables.

II. MATERIALS AND METHODS

The experiment was conducted at Animal Science Department of the Universidade Federal de Viçosa (UFV), Viçosa, Minas Gerais, and 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 male calves were used, aged 45 ± 11 days with average initial weight of 48 ± 7.5 The animals were fed with two different experimental diets from birth to slaughter: 1 - Pure milk; 2 - Milk and concentrate.

The animals were euthanized from administration of Acepromazine (0,013mg / kg) Thiopental (0.125 mg / kg) 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 the process of *rigor mortis*, half carcasses were scanned in a densitometry unit (GE HEALTHCARE LUNAR PRODIGY), using the software enCORE (2010) for small animals to obtain the fat content, lean tissue, bone mineral content and bone mineral density.

After scanning, the carcasses were dissected into bone, muscle and fat to obtain the mass of each component separately; then all components were grind and it was obtained a sample of approximately 100 grams. Immediately after collection, the sample was frozen at -40 ° C and then brought to the lyophilizer. The analysis to obtain DM, MM, total nitrogen and EE were carried out according to the methods described by Detmann et al. (2012). Subsequently, the parameters mentioned above were compared with DEXA and regression equations were

developed to validate the method. Statistical procedures were performed using PROC REG SAS® (SAS 9.4 Inst. Inc., Cary, NC) with the animal being the experimental unit.

III. RESULTS AND DISCUSSION

Only the equations to quantify weight, amount of bone, amount of mineral matter, amount of lean and amount of crude protein were significant (P <0.05). The low correlation between the amount of fat and ether extract may be due to low body fat composition of the animal, since their meat is practically devoid of fat (LUCHIARI FILHO, 2000).

Table 1 – Regression equations and significance levels for veal carcass evaluation using DEXA.

Regression equations	**P value**	**R^2**
Total mass = - 0.04293 + 0.9304 x DEXA total mass	<0.0001	0.9228
%MM = 9.3545+ 14.4117 x BMD	0.1623	0.1854
%BONE = 33.8402 + 1.09604 x BMD	0.9259	0.0009
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 DEXA fat tissue	0.9557	0.0002
kgEE = 0.6307 + 0.1868 x DEXA fat tissue	0.5068	0.0299
kgLEAN = - 0.4489 + 0.0006444 x DEXA lean tissue	<0.0001	0.6986
kgCP = 0.1206 + 0.0001866 x lean tissue	<0.0001	0.7290
%EE = 15.02162 + 0.05837 x %fat on tissue	0.9359	0.0004
%FAT = 0.4919 - 0.02547 x %fat on tissue	0.7588	0.0065
%EE = 15.00022 + 52.9551 x % fat on tissue	0.9445	0.0003
%FAT = 0.4912 - 26.8522 x % fat on tissue	0.7571	0.0066

IV. CONCLUSION

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 veal carcasses.

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REFERENCES

1. KAUFFMAN, R.G. & WARNER, R.D. Evaluating pork carcasses. In: Hollis, G. R., Warner, R. D. ed. **Growth of the pig**. Wallingford, CABI, p.141-166, 1993.

2. LUCHIARI FILHO, A. **Pecuária da Carne Bovina.** São Paulo, 2000, 134p.

3. DETMANN, E.; SOUZA, M.A.; VALADARES FILHO, S.C.; QUEIROZ, A.C.; BERCHIELLI, T.T.; SALIBA, E.O.S.; CABRAL, L.S.; PINA, D. S.; LADEIRA, M. M.; AZEVEDO, J. A. G. **Métodos para análise de alimentos**. Visconde do Rio Branco, Suprema, 2012, 2014p.