ESTIMATION OF WEIGHT OF TRIMMED FAT IN CARCASSES OF COWS BY FINAL WEIGHT, HALF CARCASS AND ADIPOCYTE DIAMETER

János Tőzsér[1], István Holló[2], Gabriella Holló[1], András Hidas[1] and Endre Szűcs[1]

[1]Szent István University, Faculty of Agricultural and Environmental Sciences, H-2103 Gödöllő, Páter K. u. 1. [2]Kaposvár University, Faculty of Animal Sciences H-7400 Kaposvár, Guba S. u. 40., Hungary

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Background

Several methods of varying costs and accuracy have been investigated with cattle such as body condition scoring, ultrasonic scanning of fat depth, measuring the speed of ultrasound, measuring of fat cell sizes and a technique for the dilution injected deuteriated water. According to *Renand et al.* (1996) the highly positive correlation between adipose cell diameter and fat content (r=0.56) indicates that this characteristic could also be used to further improvement of selection. More recent work that combined image processing parameters (histogram, texture) in multiple regression models showed a good potential for real-time ultrasound technology to predict intramuscular fat *(Wilson et al.*, 1992; *Amin et al.*, 1993; *Izquierdo et al.* 1998). *Cross et al. (1992)* used video image analyser (VIA) for beef grading. Considering the positive results of *Sönnichesn et al.* (1998) VIA seems to be an appropriate instrument for beef classification and prediction of carcass composition. *Thompson* (1991) proposed using computer-aided tomography (CT) to quantify inramuscular fat content in beef. Several prediction equations of the body lipids and muscle are proposed by *Robelin and Agabriel*, (1986) for the use of the animal breeders (e.g.: Holstein cow, Lip%=0.144*DIAM +3.88, where: lip%= total body fat content as a percentage of empty body weight, DIAM= adipose cell diameter, micron). From the point of view of practical application is very important to the breeders that the heritability of adipocyte diameter is relatively high (h^2=0.50)(*Renand et al.*, 1989*)*.

Objective

The aim of this study was to establish prediction equation to estimate the weight of trimmed fat (y), at slaughter based on the final weight (x_1), the weight of hot half carcasses (x_2), and the adipocyte diameter (x_3).

Methods

Hungarian Fleckvieh cows (n=20) were used in this study. The animals were fed corn silage based diets with grass hay and moderate concentrate supplementation free choice. The animals were transported to the slaughterhouse on lorry and after lairage for overnight they were slaughtered. After the slaughter, 1 g subcutaneous fat samples were taken from rump and the adipocyte diameter was measured (*Tőzsér et al.,* 1997). The half carcasses were chilled for 24 h.Right and left half carcasses were then dissected and the weight of lean, bone and fat were taken by complete tissue separation. Statistical analysis was made by principal component analysis using Varimax procedure (*Sváb,* 1979). Factor loadings were calculated from the correlation matrix of variables recorded. Only components with Eigenvalue exceeding 1.0 were estimated. Regression equation for estimation of amount of fat in carcasses was calculated by stepwise multiple regression analysis using of the program package of STATISTICA 4.5.

Results and discussion

Means and standard error of mean for final weight (FW), weight of hot half carcass (WHC), weight of trimmed fat (WTF), adipocyte diameter (ADID) were as follows: 573.0±12.57, 269.0±8.06 and 28,9±3.15 kg; and 72.3±6.84 μ, respectively. Moderate and medium positive relationship (r=0.40, P>0.05) was found between ADID and WHC. A contrary tendency was observed for percentage of lean meat (r= -0.64, P<0.01). We observed a close positive correlations (r=0.83, P<0.001) between ADID and WTF. The correlation was also close (r=0.90, P<0.001) between adipocyte diameter and weight of kidney fat. *Lee at al.,* (1983) published that, the adipose cell size was positively correlated (Hereford young bulls, r=0.70; r=0.62, P<0.01; Charolais young bulls, r=0.63; r=0.60, P<0.01) with percentage carcass fat and total carcass fat mass.

Two factors were determined: (I) factor for carcass and lean meat, (II) factor for fat and adipocyte diameter. In case of factor I, the individual factor loadings (>0,8) involved in WHC, the weight of cold half carcass and the weight of lean meat played predominant roles (the variance of Eigenvalue was 49.8 %). Factor II (the variance of Eigenvalue was 46.1%) determined predominantly the weight of kidney fat, the WTF and the ADID. In this study, 95.9 % of total variance could be accounted for variables involved. These results clearly confirmed that the variables for the deposition of fat and adipose tissue cellularity have to be included into the prediction model.

The results of multiple regression analysis are presented in Table 1-2.

The estimation of weight of trimmed fat (y) from final weight (x_1), and adipose cell diameter (x_3) was very close (R^2=0.82, P<0.001) (Table 1). Using stepwise multiple regression analysis 68 % of total variance with 8.186 residual standard deviation was determined by the adipose cell diameter (x_3) (Table 2).

Conclusions

1. The close positive correlation between adipocyte diameter and weight of trimmed fat confirm that the adipose cell size can be also used to improvement of selection for the in vivo total body fat content prediction.
2. Considering the results of stepwise multiple regression analysis and principal component analysis use of adipocyte morphometry can be recommended to estimate the weight of trimmed fat with other parameters studied.

Table 1 Estimation of weight of trimmed fat (kg) by final weight (kg) and adipocyte diameter (μ)

Dependent variable (y)	Independent variables (x_1 -x_3)	Partial coefficients of correlation (r)	Partial coefficients of regression (b_1 - b_3) step: 0
Weight of trimmed fat (kg)	Final weight (kg), x_1	0.66	0.094**
	Adipocyte diameter (μ),x_3	0.88	0.372***
Regression equations	Intercept	-	-51.699**
	Coefficient of determination (R^2)	-	0.82***
	Residual standard error (r_{sxy})	-	6.329

*=P<0.05; **=P<0.01; ***P<0.001

Table 2 Estimation of weight of trimmed fat (kg) by weight of hot carcass halves (kg) and adipocyte diameter (μ)

Dependent variable (y)	Independent variables (x_1 -x_3)	Partial coefficients of correlation (r)	Partial coefficients of regression (b_1 - b_3) step: 0	Coefficients of correlation (r)	Coefficients of regression (b_1 - b_3) step: 1
Weight of trimmed fat (kg)	Weight of hot carcass halves (kg), x_2	0.58	0.141**	-	-
	Adipocyte diameter (μ),x_3	0.81	0.315***	0.82	0.381***
Regression equations	Intercept	-	-31.744*	-	1.438
	Coefficients of determination (R^2)	-	0.79***	-	0.68***
	Residual standard error (r_{sxy})	-	6.827	-	8.186

*=P<0.05; **=P<0.01; ***P<0.001

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