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EVALUATION OF BODY COMPOSITION USING UREA DILUTION AND SLAUGHTER TECHNIQUE OF GROWING PRIANGAN SHEEP

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ABSTRACT

This study aimed to evaluate the measurement in vivo body composition using urea space (US) and slaughter technique (ST) method. Correlation were described between urea space, total body water, fat and protein in growing Priangan sheep and also results from US and ST were compared. Six growing Priangan sheep were fed with commercial concentrate and grazed on the pasture during a half day. Prior to and the last day of the experiment, body composition was measured by the urea space technique and after that animals were slaughtered and analyzed for water, fat and protein contents. Results showed that there were no significance difference of body water, fat and protein as percentage of empty body weight (EBW) on both US and ST. The data of US and ST were 68.64 and 65.87 for body water; 9.78 and 9.85 for body fat; 16.87 and 16.53 for body protein, respectively. Body fat using US was underestimate of 0.7%, while body water and protein were overestimate 4.02 and 2.01%, respectively. The correlation between US and body compositions as percentage of EBW were developed as following the equations :

Water = 16.519 + 1.0465 US, with r = 0.95
Fat = 23.837 - 0.2965 US, with r = - 0.98
Protein = 6.714 + 0.2082 US, with r = 0.96

The correlation between body water and body fat and protein using ST method, as percentage of EBW were :

Fat = 27.68 - 0.270 body water, with r = - 0.96
Protein = 4.42 + 0.184 body water, with r = 0.91

It was concluded that US was a good method and can be applied for estimating body composition of growing Priangan sheep using a certain factors.

Key words : Urea space, Slaughter technique, Body composition, Priangan sheep

INTRODUCTION

The relations of total body water, fat and protein have been previously examined in living sheep and goats (Panaretto, 1963). Tritiated water space, antipyrine and N-acetyl-4-aminoantipyrine space are methods which were already studied to relate with body composition in ruminants (Panaretto and Till, 1963), and following by the evaluation of urea dilution as technique for estimating body composition of beef steers in vivo (Rule *et al.*, 1986). Urea was shown to be a suitable substance to use as a tracer for estimating body composition because it is inexpensive and the technical requirements of plasma urea N analysis are minimal. Urea space was found to be similar with deuterium oxide as a tracer for body water determination in humans (San Pietro and Rittenberg, 1953). Accurate calculation of the quantities of water, fat and protein in the bodies of living domestic animals could be used as a non destructive procedure to assess changes in experimental animals.

Information on body compositions in living indigenous animals in Indonesia are very few. According to that information, this study was conducted to relate the in vivo body compositions of living growing

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Priangan sheep with urea space method and made some correction factors.

MATERIAL AND METHODS

Six male growing Priangan sheep (av. 20 kg LW) were used in this experiment. Animals were fed with 500 $g.d^{-1}$ of commercial concentrate (GR-1, PT Indo feed, Bogor), and native grass during grazing on the pasture, whereas water was served *ad libitum*. Concentrate contained of (87.5 % DM) 17.40 $MJ.kg^{-1}$ GE and 18% crude protein, as a DM basis, while native grass (54.80 % DM) contained 14 $MJ.kg^{-1}$ GE and 12.60 % crude protein.

Prior to and the last week of the experimental period, each sheep was injected with 130 mg $urea.kg^{-1}$ MBS in solution of 200 $g.L^{-1}$ of sterile saline through a jugular vein over a one minute period, time was recorded at the start and end of injection. The jugular vein was flushed with 3 ml of heparinized saline after urea injection. The actual quantity of urea injected was determined gravimetrically by weighing syringes before and after injection. Blood samples were obtained before injection and 12 minutes after mean injection time. Plasma was prepared by centrifugation of blood at 5000 x g for 10 minutes in order to analyze urea-N by Indophenol urease-N method. Urea space was calculated from the dose of urea N injection divided by the change in plasma urea-N before and after 12 minutes injection, following the equation as described by Bartle, *et al.*, (1983), while body protein and fat (BP and BF) as mentioned by Panaretto and Till (1963), and body water (BW) following the equation of Rule *et al.*, (1986). All parameters as percentage in empty body weight (%EBW) :

$$US(\%) = \frac{[\text{dose of urea-N(mg) injected}]}{\text{change in plasma urea-N(mg/100ml)X10 X LW}}$$

$$BW\ (\%) = 59.1 + 0.22\ X\ US\ (\%) - 0.04\ LW$$

$$BP\ (kg) = 0.265\ X\ BW\ (L) - 0.47$$

$$BF\ (\%) = 98.0 - 1.32\ X\ BW\ (\%)$$

Empty body weight means body weight which excludes only the contents of the alimentary canals (fasting around 24 hours), for slaughter animals, it was obtained immediately after slaughter without weight of the gastrointestinal contents. All sheep were slaughtered and resulted carcass and non-carcass components to analyze chemical compositions. Sample from each group (carcass and non-carcass) mixed in order to have homogenized subsamples. Five g subsamples were dried at 60°C for 24 h to determine dry matter. Fat content was determined by extraction with petroleum ether for 48 h in a soxhlet apparatus, while protein was determined by Kjeldahl method (AOAC, 1975).

Validation was carried out in a separate experiment on 6 animals by comparing in vivo results with ST analysis data on the same sheep. Data from US was related to body water, fat and protein from the slaughter technique, in order to make linear regressions for those parameters. Another equations were also developed, based on body water to relate with body fat and protein using slaughter method.

The significance differences between mean parameters were analyzed using t-test (Steel and Torrie, 1986), and the computer program Minitab/SPSS release 6.1 (1988) was used for linear regression procedures.

RESULTS AND DISCUSSION

The results of body compositions of growing Priangan sheep, both using US and ST, are presented in table 1. There was no significance difference in body water using US, according to equation Rule *et al.*, (1986) and ST methods, and also in BF and BP, according to equations Panaretto and Till (1963). In predicting body water, 95 % of the US was around ± 0.04 X US (% EBW) would include body water measured by desiccation in these sheep. Similarly, 95 % of values for body protein calculated from US (% EBW) was around ± 0.02 X US, and 95 % of values calculated for body fat was ± 0.007 X US (% EBW). Urea space overestimated to the body water and protein around 4 and 2 %,

respectively, but underestimated around 0.7 % for body fat measurement. Urea space yielded an accurate and unbiased estimate of total body water, fat and protein of growing Priangan sheep. Empty body water estimated according to Rule *et al.*, (1986), resulted in underestimation by 4.2 % using Etawah crossbred goats (Arta *et al.*, 1998). This study was no significance difference with experiment previously using merino crossbred, for body water and protein of sheep (%EBW), which values were 64.16 and 17.54 %, respectively, (Panaretto, 1963). Body fat on that kind of sheep was quit different (14.21 %) with growing Priangan sheep (9.78 %). The wide range and low of body fat in growing Priangan sheep suggested that this kind of sheep tended to have low fat content. This result supported the fact that male Priangan sheep were reared for fighting.

The relations between the US and body water, fat and protein in six growing Priangan sheep are illustrated in figures 1. The regression coefficients could be shown to differ for any of the relationships illustrated in those figures with P<.01. The US was related to body water, fat and protein (%EBW) with the coefficient correlation (r) 0,95; -0.98 and 0.96, respectively. The negative value of coefficient correlation in equation US to BF means the higher of US, the decreasing of BF (% EBW). The relationship between US and BW, both expressed as % EBW, was found the prediction of BW will lie in the interval $Y_1 \pm$ 2.96 % (2 X SE) for 99% of US measurements, where Y_1 was the BW content as % EBW, predicted from regression. The standard error of a predicted BW content was ± 1.48 % EBW. Similarly, the relationship between the US to BF and BP were calculated to get the prediction of BF and BP. Body fat will lie in the interval $Y_2 \pm 0.68$ % for 99 % of US measurements, with the standard error of a predicted BF content was ± 0.34 % EBW. Body protein will lie in the interval Y_3 ± 0.07 % for 99 % of US measurements, with the standard error of a predicted BP content was ± 0.35 % EBW.

According to the slaughter technique method which was done in this experiment, body fat and protein of growing Priangan sheep could be calculated from the body water (% EBW) using equations which are illustrated in figures 2. The coefficient correlation from those linear regression developed, were -0.96 and 0.91 for fat and protein, respectively.

The relationship between BW and BF, both expressed as % EBW, found the prediction of BF will lie in the interval $Y_4 \pm$ 0.94 % for 99% of BW measurements, where Y_4 was the BF content as predicted from regression with standard error of a predicted BF content was ± 0.47 % EBW. Regression of BW on BP found the prediction of BP will lie in the interval $Y_5 \pm$ 1.02 % for 99 % of BW measurements, with standard error of a

Table 1. Body compositions of growing Priangan sheep (%EBW)

Parameters	Mean	SD
Urea space:		
- US	47.16	5.26
- BW	68.64	1.28
- BF	9.78	1.50
- BP	16.87	1.30
Slaughter technique:		
- BW	65.87	5.67
- BF	9.85	1.59
- BP	16.53	1.14

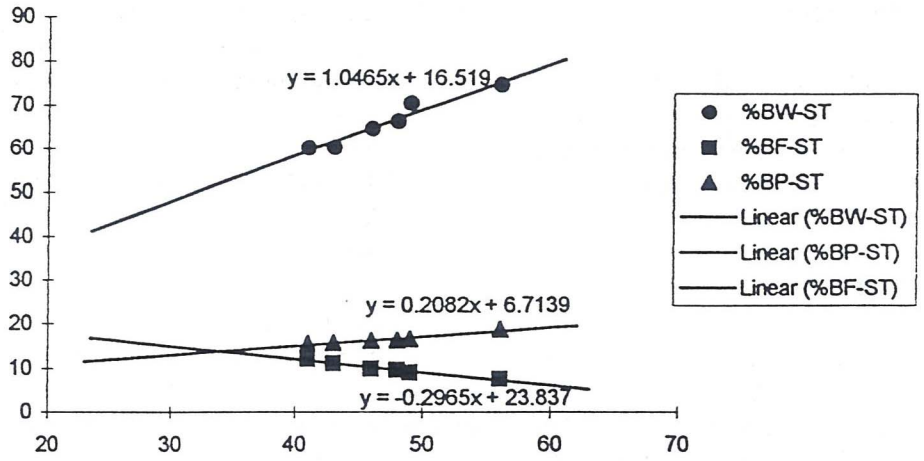

Figure 1. The regression between US (X) with BW (Y_1), BF (Y_2) and BP (Y_3) as % EBW in growing Priangan sheep

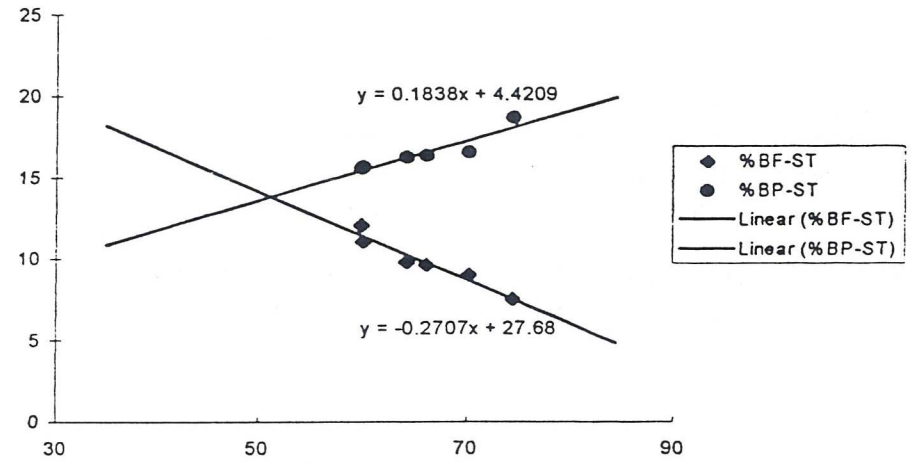

Figure 2. The regression between BW (X) and BF (Y_4), BP (Y_5) using ST method in growing Priangan sheep.

predicted BP content was ± 0.51 % EBW.

The relation between water and protein in empty bodies of these sheep were therefore not surprising as mentions in figure 2. The reasons for this relation are beginning to emerge. Water has been postulated to be intimately involved in the stabilization of protein configuration and the results supported this hypothesis at the tissue level (Klotz, 1962). Panaretto *et al.*, (1963) reported that the most close of relationship between the total BW and crude protein were presented in liter (BW) and kg (BP). However, the relationship between the total BW and CP as expressed as % LW, was very poor with r = 0.38. In this experiment, all parameters of the regression were presented in % EBW, which had the best equations between parameters.

CONCLUSION

The results indicated that the urea dilution (urea space technique) can be use as an estimator of body composition of growing Priangan sheep using correction factors.

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