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A NOTE ON THE VALIDITY OF USING COMBINATIONS OF PREDICTIVE EQUATIONS FOR ESTIMATING BODY COMPOSITION FROM TRITIATED WATER SPACE

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The value of the tritium method for estimating body composition in sheep has been substantiated abroad and also in South Africa by Hofmeyr, Olivier, Kroon & van Rensburg (1971) and Jacobs (1972). Recently work was done in this laboratory on the growth of Karakul and South African Mutton Merino lambs where it was necessary to estimate body composition at intervals during their growth period (Meissner, Roux & Hofmeyr, 1975).

Twenty five S.A. Mutton Merino lambs and 31 Karakul lambs of both sexes were used in the experiment. The lambs were hand reared on a schedule of cow's milk based on units of maintenance from 2 days of age till 7 weeks. From 3 weeks of age they had free access to a concentrate diet (11,9 MJ ME/kg: 19,2% crude protein) till 34 weeks of age when the animals were slaughtered. Body composition was estimated on weeks 12, 14, 16, 18, 25, and 34 using the tritium method.

Tritiated water space was determined as follows: Food and water were removed for 24 hours. At the end of the fast period a pre-injection blood sample was collected from each lamb before about 400µ C of tritiated water was injected per *vena jugularis.* Six and a half hours later blood (the post-injection sample) was collected from the opposite jugular vein. The blood samples were stored at 4°C until analysed. Duplicate samples of the pre-injection and post-injection blood were freeze-distilled. Duplicate samples of 1,0 g of each distillate mixed with 10 ml of scintillation fluid were subsequently counted in a liquid scintillation counter. The apparent tritiated water space (TOH) was calculated from the ratio of tritium injected to the concentration of tritium in blood water after correction for pre-injection activity. No correction was applied for the various losses of tritium during the six and a half hours of mixing in the lamb.

Immediately after the last blood sample (at 34 weeks of age) was collected the animals were shorn, weighed, and slaughtered. After mincing, thoroughly homogenised samples were analysed for DM, N, ether extract and ash using the procedures of Hofmeyr, Kroon, van Rensburg & van der Merwe (1972).

Due to the experimental lay out variation in body mass ranged only between approximately 40 kg to 60 kg at time of slaughter whereas information on body composition was needed from about 20 kg body mass (12 weeks of age). Therefore, it was decided to test the validity of using the data of Hofmeyr *et al.* (1971) in combination with the present data. Their work involved three divergent breeds, the Pedi, the Merino and the S.A. Mutton Merino, five feeding levels of a specific diet, and body mass distribution from 11 kg to 46 kg.

Linear regression equations (Y = a + bx) between TOH space and body protein and percentage TOH space and percentage fat in the body were fitted. Differences in the a and b-values of the two sets of data were tested using covariance analysis. If in two linear regression models, the a's differ significantly from each other but not the b's, it means that the regression lines run parallel to each other. A common slope (b-value) and adjusted a-values can consequently be estimated. If on the other hand the b-values differ significantly no such transformation can be made for obvious reasons.

The relationships between TOH space and respectively body protein and body fat for the two sets of data are illustrated in Table 1. There were no significant differences between the relationships of the Mutton Merinos and those of the Karakuls in the present study. The data of the two breeds were consequently pooled into one regression equation.

It is evident that body protein and fat can be estimated with similar accuracy when using either of the two regression equations between TOH space and body protein.

The F-values of the covariance analyses between the regression equations of the data of Hofmeyr *et al.* (1971) and those of the Karakul and Mutton Merino lambs in the present study are tabulated in Table 2.

Table 1

Linear regression equations between TOH space and body protein and body fat respectively

	Y	r	Sy. x	Reference
TOH and protein	0,218X–0,332	0,977*	0,301	Hofmeyr *et al.* (1971)
(kg)	0,225X+0,836	0,926	0,451	present data
TOH and fat	–0,883X+82,555	–0,932*	1,996	Hofmeyr *et al.* (1971)
(kg)	–1,046X+85,062	–0,881	1,859	present data

* Values differ slightly from the published values because the data of one lamb was discarded.

Table 2

Results of covariance analyses of the regression equations between TOH space and protein and %TOH space and %fat respectively

	F-test for differences in a	F-test for differences in b
TOH and protein (kg)	87,423**	0,144 N.S.
TOH and fat (%)	32,366**	2,139 N.S.

** P < 0,01.

There were substantial differences between the a-values but no significant differences between the b-values. The differences in a-values reflect differences in contents of the alimentary tract which were as expected due to the fact that Hofmeyr *et al.* (1971) did not fast their animals before tritium injections. Common values for b and adjusted a-values for these relationships were subsequently fitted for the two sets of data.

The derived equations and the relationships between determined and predicted protein and fat when using these equations are illustrated in Table 3 and Fig. 1 respectively.

Table 3

Derived linear regression equations between TOH space and body protein and body fat respectively

	Y	Combined r	Combined Sy.x	Reference
TOH and protein (kg)	0,222X–0,404 0,222X+0,915	0,943	0,417	Hofmeyr *et al.* (1971) present data
TOH and Fat (%)	–0,960X+87,904 –0,960X+80,562	–0,899	1,886	Hofmeyr *et al.* (1971) present data

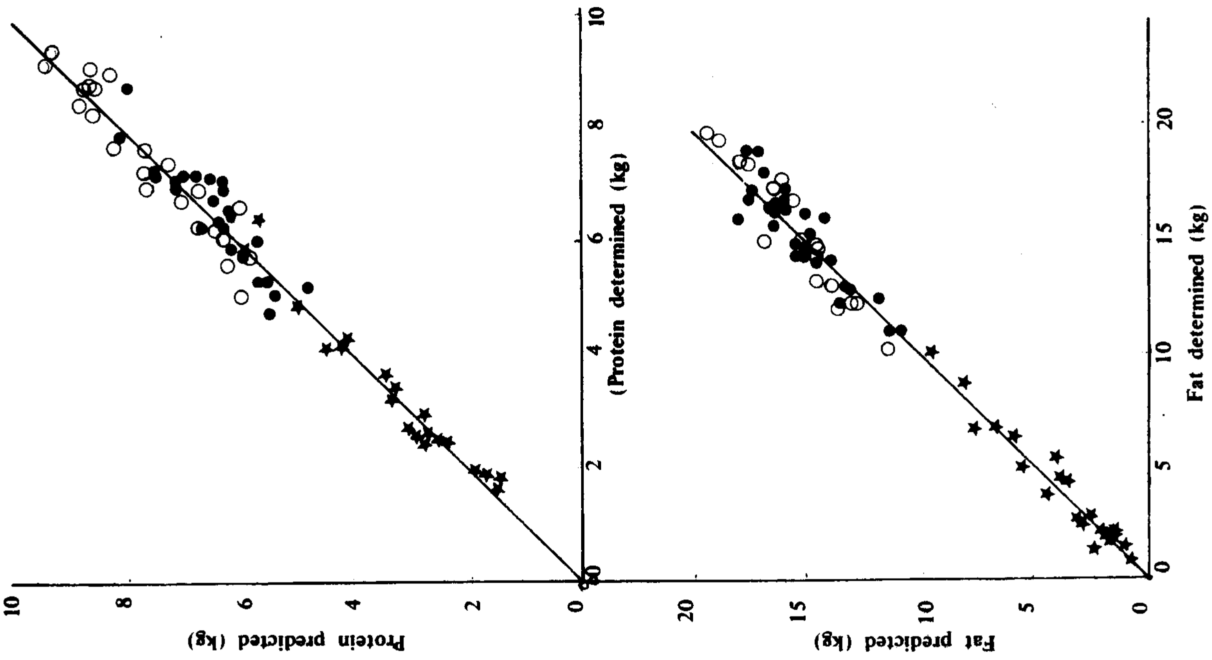

Fig. 1 *The relationship between determined and predicted values for body protein & body fat*

Hofmeyr et al. ★
S.A. Mutton Merino ○
Karakul ●

The adjusted regression equations estimated body protein and body fat with similar accuracy to that of the original set of equations. Therefore, it is suggested that combinations of regression equations relating TOH space and body protein or fat would be justified to use as such.

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