NITROGEN UTILIZATION BY PREGNANT YANKASA SHEEP

By

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SUMMARY

Series of Nitrogen — balance trials were conducted during the last 6 weeks of gestation using nine adult Yankasa ewes aged about 2½ years. The animals were fed a basal *Digitaria smutsii* hay diet supplemented with compounded concentrate ration red at three levels of crude protein, viz 8.4, 15.6 and 19.1%. The estimated metabolizable energy concentration in the rations averaged 3.2 MJ/kg DM.

Mean daily liveweight gains during the last third of pregnancy which were 125.7, 165.7 and 214.3g for the three treatment groups respectively were significantly ($P < 0.05$) afffected by the level of crude protein fed.

Nitrogen retained increased with dietary crude protein levels. There was a curvilinear relationship between N-intake and N-balance per unit of metabolic weight.

The results showed that Yankasa ewes required 1.5g DCP/day/$W^{0.75}_{kg}$ for maintenance and 7.48g DCP/day/$W_{kg}^{0.75}$ for pregnancy.

INTRODUCTION

There is usually an increase in body heat production in pregnant ewe particularly during the last third of pregnancy. This increase is accompanied by a reduction in urinary nitrogen output and consequently an increase in protein deposition (Robinson and Forbes; 1967). Little variation in nitrogen (N) retained during the first 90 days of pregnancy has been observed (Robinson, Fraser, Corse and Gill, 1970). These workers also reported that as from the 90th day, N-retention showed wide discernible variations in response to varying protein intakes. The accepted norm of feeding sheep is that the crude protein content of the diet during early pregnancy need not be more than 10% just as for non-pregnant ewe.

Information relating to the nutrient requirement for various production functions of the indigenous sheep in the literature is very scanty. Adu (1975) estimated the maintenance energy requirement for growth, pregnancy and lactation to be 100, 150, 175 kcal. ME/$Wkg^{0.75}$ respectively for the West African dwarf sheep. Adegbola, Adeleye and Yoila (1978) estimated maintenance energy requirement for non-pregnant, non-lactating West African dwarf sheep to be 125.12 kcal. ME/$Wkg^{0.75}$. Similar attempts to assess the protein requirements of the indigenous sheep have not received much attention. This paper therefore reports some aspects of protein utilization by pregnant Yankasa ewes with a view to estimating crude protein requirements for pregnancy.

MATERIALS AND METHODS

Nine pregnant Yankasa ewes, aged about 2½ years and weighing between 35 and 40kg by the 3rd month of pregnancy were used in a series of N-balance trials as from the 90th day of pregnancy to parturition. The ewes balanced for weight were alloted randomly into three treatment groups. The ewes were kept in individual metabolism cages designed to facilitate separate collection of urine and faeces. The ewes were fed a basal diet of *Digitaria smutsii* hay supplemented with compounded concentrate ration at three levels of crude protein namely 8.4, 15.6 and 19.1% designated treatment groups A, B and C respectively. The dietary composition of the concentrate supplements are

TABLE 1.

Composition of the ration

	Ration Groups			
	A	B	C	
Crude protein level, %	8.4	15.6	19.1	
Ingredients, %				
Maize	94.64	81.51	68.36	
Groundnut cake	4.86	17.99	31.14	
Common salt	0.50	0.50	0.50	
Bone meal, g/kg feed	20.00	20.00	20.00	
Chemical Composition, %				*Hay*
Dry matter	94.20	93.70	94.60	93.40
Crude protein	8.40	15.60	19.10	5.90
Estimated ME concentration, MJ/kg DM	3.16	3.17	3.17	2.55

shown in Table 1. Each ewe received 0.5kg of hay plus 1kg of supplementary concentrate ration at a particular level of crude protein per day. In addition, the ewes had free access to salt licks and fresh, clean water daily.

The first two weeks was the preliminary period designed to allow the animals adjust to the feeds. Thereafter, daily feed intake was measured. Faeces and urine were collected each morning just before feeding. The faeces were weighed and dried to constant weight in a forced — drought oven at 70°C for 48 hours. Dried samples for 7 days were bulked, milled and kept in air-tight containers. Similarly, daily urine output was measured and 10% of the daily output was taken. The daily aliquots for 7 days were bulked. Samples were stored in a deep freezer at — 5°C until required for chemical analysis. The milled samples of feeds, faeces and bulked urine were analysed for nitrogen according to A.O.A.C. (1970) methods.

RESULTS

Mean values of nutrient intakes and digestibility coefficients are presented in Table 2. Dry matter intake was highest in treatment B (86g/Wkg$^{0.75}$) and lowest in treatment A (63g/Wkg$^{0.75}$). Daily nitrogen intake was significantly ($P<0.05$) higher for ewes on treatments B and C than those on treatment A. The differences in N-intake between the ewes on treatments B and C were not significant. The digestion coefficients for N followed the same trend as dry matter and nitrogen intakes. Although the values for nitrogen digestibility coefficients increased with increase in protein level, the treatment effects were not significant.

Data on liveweight gain and reproductive performance of the ewes are shown in Table 3. The mean daily liveweight gains during the experimental period were 125.7, 165.7 and 214.3g for ewes on treatments A,B and C, respectively. The differences observed in the weight gains between the groups were highly significant ($P < 0.01$). Liveweight gain was 40.4 and 22.7% higher on treatment C than the values obtained for ewes on treatments A and B respectively. Similarly, the net ewe body weight loss at parturition was 3.4 and 2.47kg less on treatment C relative to the corresponding values for treatments A and B, respectively.

Table 4 shows data on N-balance and the efficiency of N-utilization. N-retained increased linearly with increase in crude protein levels. The relationship between N-intake and N-retained was curvilinear (Figure 1). The multiple regression equa-

TABLE 2.
Mean nutrient intakes and digestibility coefficients.

	Treatment A	B	Groups C
Daily nutrient intake, g/Wkg$^{0.75}$			
Dry matter	68 ± 0.30[a]	86 ± 1.60	83 ± 1.20
Nitrogen	0.8 ± 0.07	1.8 ± 0.67	1.6 ± 0.48
Apparently digested nitrogen	*0.50 ± 0.04*	*1.22 ± 0.15*	*1.12 ± 0.03*
Digestibility coefficients, %			
Dry matter	73.1 ± 2.10	76.3 ± 1.30	74.6 ±0.60
Organic matter	61.8 ± 0.70	67.8 ± 1.00	69.7 ± 1.60
Nitrogen	71.5 ± 1.46	73.0 ± 2.19	71.9 ±1.05

[a]Mean plus standard deviation.

TABLE 3.
Ewe Performance Data.

	Treatment A	B	*Groups* C
Initial liveweight, kg	37.0±2.18	36.5±2.02	36.5±1.78
Metabolic weight, Wkg$^{0.75}$	11.9±2.14	11.8±1.73	11.8±1.96
Ewe liveweight gain, g	125.7±0.87	165.7±2.36	214.3±10.14
Lambing percentage	133.3	100.0	100.0
Lamb birth weight, kg	2.96±0.21	3.06±0.27	2.84±0.14
Ewe weight loss at parturition + +, kg	6.68±1.73	6.78±1.96	7.45±2.31
Ewe body weight change + + + kg	-3.56+1.07	-2.63±0.49	-0.16±0.01

+ Based on single lambs

+ + Based on weight difference weight closest to lambing and weight after lambing (maximum 14 hours).

+ + + Based on weight difference between weight at 15th week of pregnancy (beginning of trial) and weight after lambing.

TABLE 4.
N-Balance Data and Efficiency of N-Utilization.

	Treatment A	B	Groups C
N-intake, g/day	9.55 ± 1.09	21.24 ± 2.38	18.88 ± 1.64
Urinary nitrogen, g/day	3.04 ± 0.94	8.50 ± 1.96	4.07 ± 1.03
Faecal nitrogen, g/day	2.94 ± 0.42	6.11 ± 1.71	4.39 ± 1.08
Retained nitrogen, g/day	0.30 ± 0.02	0.56 ± 0.03	0.88 ± 0.07
Nitrogen intake retained, + %	66.80 ± 3.51	66.43 ± 2.98	70.48 ± 4.09

tion is given by $Y = 0.55 + 1.52x - 0.42x^2$ ($R = 0.73$, $SE = 0.14$). The multiple regression coefficient (R) was highly significant ($P < 0.01$). The efficiency of N-utilization was estimated from the percentage of apparently digested N-intake that was retained. The efficiency of N-utilization was highest in ewes on treatment C (70.6%) and lowest in ewes on treatment B (66.4%).

When the derivatives of N-retained with respect to N-intake are equated to zero, the maximum value of N-retained occured at N-intake of 1.8g/$Wkg^{0.75}$/-day. Also, the intercept on the intake axis in the quadratic equation relating N-retained to N-intake showed that 0.24g N or 1.5g DCP/$Wkg^{0.75}$/day was required for maintenance during the last 6 weeks of pregnancy.

DISCUSSION

Various approaches have been used in estimating energy and protein requirements during the last 2 months of pregnancy in sheep. These approaches have used different criteria namely lamb birth weight and ewe body weight changes (Langlands, Corbett and Mcdonald, 1963) and balance studies (Robinson and Forbes, 1967; Robinson, Scot and Fraser, 1973; Guada, Robinson, and Fraser, 1975) to assess the adequacy or otherwise of particular nutritional regimes. These approaches have their limitations. For example, birth weights will give little indication of adequacy of nutrition because no matter the nutritional status, foetal growth will be sustained at the expense of depletion of maternal body reserves. Also the relatively short periods of observation in balance studies is a limitation in extrapolating results to generalised situations.

In considering the nutrition of pregnant animals, changes in both energy and protein metabolism during pregnancy is important (Robinson and Forbes, 1967; Guada *et al*, 1975). This study recognises the interacting effect of energy (crude fibre) on N-utilization. In the present study, energy supply and hence crude fibre intake has been standardised as far as possible between diets by keeping the energy concentration, roughage to concentrate ratio and the level of feeding uniform.

The mean daily liveweight gains obtained in the study showed that the ewes were adequately nourished. Also, since the ewes were in positive N-retention throughout the study, it would be justified to assume that a daily DCP intake of 7.48g/$Wkg^{0.75}$ was adequate for pregnancy in the Yankasa ewe. The maintenance requirement for pregnancy obtained from this study also seemed adequate. The value, (1.5g DCP/day/$Wkg^{0.75}$ was similar to the value of 1.53 to 2.18g DCP/day/$Wkg.^{0.75}$ recommended as maintenance requirement for goats by Devendra and Burns (1970), but higher than 1.24g DCP/day/Wkg$^{0.75}$ reported for West African dwarf goats aged 2½ years and weighing from 24 to 32kg during pregnancy and lactation by Akinsoyinu, Mba and Olubajo (1975). There was no considerable variation in the efficiency of N-utilization in the present study. It would therefore seem conclusive that the DCP estimates of 1.5 and 7.48g/day/Wkg$^{0.75}$ for maintenance and pregnancy respectively reported in this study are adequate for the Yankasa ewe. The results are also useful additions to the paucity of information on the concepts of protein utilization particularly for tropical animals during pregnancy and provide some guide to the minimum crude protein allowance in the nutrition of the indigenous sheep.

ACKNOWLEDGEMENTS

The authors wish to thank Mr. S.A. Bello of the Department of Animal Husbandry and Biochemistry of NAPRI for his assistance in laboratory analysis. The permission of the Director of NAPRI to publish this work is gratefully acknowledged.

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