ENERGY REQUIREMENTS OF YOUNG EWES FED GUINEA GRASS (*PANICUM MAXIMUM*) FOR MAINTENANCE AND GAIN

By

T.A. ADEGBOLA, A.A. ADELEYE AND J.D. YOILA
*Department of Animal Science,
 University of Nigeria,
 Nsukka*

SUMMARY

Energy requirement for maintenance and weight gain of non-lactating, non-pregnant West African Dwarf ewes were determined by using equation of the form

$$\text{DOMI} = aW^{0.75} + bG \dots\dots\dots(1)$$

where,

DOMI = Digestible Organic matter intake (kg/day).

W = Liveweight of ewe (kg)

G = Liveweight gain of ewe (kg/day)

a = DOMI requirement per kg of $W_{\text{kg}}^{0.75}$

b = DOMI requirement for each kilogram liveweight gain

The regression equation obtained was

$$\text{DOMI} = 0.0385W_{\text{kg}}^{0.75} + 1.54G \dots\dots\dots(2)$$

The values of DOM required per kilogram of $W_{\text{kg}}^{0.75}$ and for each kilogram of liveweight gain, were 0.0385 and 1.54kg respectively.

In terms of Metabolizable energy (ME) equation (2) can be written as follows:

$$\text{ME} = 523.50W_{\text{kg}}^{0.75} + 20940.92G \dots\dots\dots(3)$$

Values of ME required per kilogram of $W_{\text{kg}}^{0.75}$ and each kilogram of liveweight gain were 523.5 and 20940.92 KJ from equation 3.

These results are comparable to those obtained for other breeds of sheep of both temperate and tropical origin.

INTRODUCTION

Livestock of tropical origin are characterised by low growth rate and inefficient utilization of nutrients for maintenance and weight gain (Williamson and Payne, 1965). This has been attributed to genetic, nutritional, manage-

ment and diseases factors. Brinckman (1974) showed that the fattening of sheep on hay and concentrate was uneconomical and concluded that fattening of local sheep may be profitable only on a high quality roughage since the price of concentrates was very high.

Adegbola (1974) obtained values of 0.017kg and 4.5kg as the digestible organic matter requirement by the West African Dwarf sheep for maintaining each kilogram liveweight and for each kilogram liveweight gain, respectively. These values were higher than those obtained for temperate breeds of sheep (Forbes and Robinson, 1969; Coop, 1962; Langlands, Corbett, McDonald and Pullard, 1963) and this shows that weight gain of the West African Dwarf sheep is not as efficient as that of exotic breeds of sheep. This difference may be due to the genetic make-up of the animal as well as environmental and management factors (Williamson and Payne, 1965). With increased urbanization in the future it is expected that the production of sheep and goats will be modernized through better management, feeding and disease control. This will necessitate efficient utilization of available range lands and also pasture development and preservation for dry season feeding. A knowledge of the nutrient requirement of local livestock will be necessary in order to facilitate adequate nutritional planning.

The present work is aimed at determining energy requirement of young ewes fed

ENERGY REQUIREMENTS OF EWES

Guinea grass, for maintenance and growth.

MATERIALS AND METHODS

Animals and Their Management:

Twenty Dwarf ewes, 10–20 months old and with liveweight ranging between 11kg and 16kg were used in the digestibility trial. Each sheep was kept in a metabolism cage, measuring 1.2m long, 0.8m wide and 0.8m high respectively. They were each fed two kilograms of fresh Guinea grass (*Panicum maximum*) once daily at about 8 O'clock in the morning. The left overs were weighed and stored for chemical analysis. Water and salt licks were provided *ad libitum* and the animals were weighed during the first and last three days of the experiment. There was a preliminary periods of two weeks for the animals to adjust to the cage, and a collection period of six weeks. During the collection period, records were kept of feed intake, faeces output, liveweight and liveweight gains.

Faeces Collection:

The faeces were collected once daily at 7 O'clock in the morning and dried in the oven at 80°C for 24 hours. The dried daily faeces for each animal were bulked, milled and stored in sample bottles.

Analytical Procedure:

The AOAC (1970) method was used to determine organic matter, crude protein, ether extracts and ash contents of feed and faeces but crude fibre was determined by the trichloroacetic acid method. Energy content of feed and faeces was determined in an Adiabatic bomb calorimeter.

CALCULATION:

Digestibility of organic matter was calculated as follows:-

OM intake (kg) — Faecal OM (kg) $\times 100$

OM intake (kg)

The equations for determining DOM requirements were obtained by the method of Langlands *et al*, (1963) as follows:-

$$\text{DOMI} = a_1 W_{\text{kg}}^{0.75} + b_1 G \quad \dots\dots\dots(1)$$

$$\text{ME} = a_2 W_{\text{kg}}^{0.75} + b_2 G \quad \dots\dots\dots(2)$$

where,

DOMI = Digestible organic matter intake (kg/day).

ME = Metabolizable energy intake (KJ/day).

G = Liveweight gain of sheep (kg/day).

a_1, a_2 = DOMI or ME required for maintenance per kg of $W_{\text{kg}}^{0.75}$ respectively.

b_1, b_2 = DOMI or ME required for each kilogram of liveweight gain respectively.

The values of 'a' and 'b' were obtained by regression of $\text{DOMI}/W_{\text{kg}}^{0.75}$ (or $\text{ME}/W_{\text{kg}}^{0.75}$) upon $G/W_{\text{kg}}^{0.75}$.

RESULTS

The proximate composition of the forage (*Panicum maximum*) as well as mean nutrient intake and utilization by the sheep are given in Tables 1 and 2.

The following regression equations were obtained using the equation of Langlands *et al* (1963):-

$$\text{DOMI} = 0.0385 W_{\text{kg}}^{0.75} + 1.54 G \quad \dots\dots\dots(3)$$

$$\text{ME} = 523.05 W_{\text{kg}}^{0.75} + 20940.92 G \quad \dots\dots\dots(4)$$

Equation 3 shows that the DOM requirement for maintenance is $0.0385\text{kg}/\text{W}_{\text{kg}}^{0.75}$, 0.0162 kg/kg liveweight or 0.21kg per sheep. The DOM requirement per kg liveweight gain is 1.54kg . In terms of metabolizable energy, (equation 4) requirements were $523.50\text{KJ}/\text{W}_{\text{kg}}^{0.75}/\text{day}$, 216.48 KJ/kg liveweight per day or 2879.18KJ per sheep per day for maintenance and $20,940.92\text{KJ}$ per kg liveweight gain. Thus the DOM require-

ment of a 13kg sheep gaining 25 g/day is 0.253 kg/day or $3,402.70\text{KJ ME}$ per day.

If the basal metabolism of the sheep is taken as $70\text{ kcal}/\text{W}_{\text{kg}}^{0.75}$, (Brody, 1945) or $292.88\text{ KJ}/\text{W}_{\text{kg}}^{0.75}$, then the ME requirement for maintenance of the caged sheep is 1.79 times the basal metabolism. It can also be shown that the sheep were utilizing 85.8% of available ME for maintenance and only 14.2% for weight gain.

TABLE 1

Chemical composition of the forage (*Panicum maximum*) fed to the sheep (on dry matter basis)

Proximate component	Percentage	S.E. ($\pm$)
Crude Protein	7.37	0.06
Crude Fibre	32.07	0.09
Ether extract	1.81	0.09
Ash	8.05	0.19
Nitrogen-free extract	50.70	0.48

TABLE 2

Mean Nutrient Intake And Utilization By West African Dwarf Ewes

	Mean	SE
Dry matter intake, kg/day	$0.49 \pm$	0.02
Dry matter digestibility, %	$70.3 \pm$	1.10
Organic matter intake, kg/day	$0.45 \pm$	0.02
Organic matter digestibility, %	$71.70 \pm$	0.74
Crude protein digestibility, %	$76.84 \pm$	0.94
Crude fibre digestibility, %	$68.06 \pm$	0.99
Ether extracts digestibility, %	$47.86 \pm$	3.03
Digestibility of NFE, %	$72.78 \pm$	0.96
Digestibility of energy, %	$71.11 \pm$	0.68
Digestible energy content of forage MJ/kg	$13.09 \pm$	0.17
Total Digestible Nutrients; %	$66.29 \pm$	0.87
Starch Equivalent, %	$53.56 \pm$	0.59
Mean Liveweight of sheep, kg	$13.30 \pm$	0.52
Metabolic weight of sheep, kg	$6.97 \pm$	0.27
Liveweight gain, g/day	$25.0 \pm$	11.0

ENERGY REQUIREMENTS OF EWES

DISCUSSION

The dry matter intake of sheep used in present report is higher than the value of 5.54% of the metabolic weight, obtained by Olubajo and Oyenuga (1974) but the digestibility of 70.3% is similar to that of Olubajo (1974). Comparison of results of dry matter intake as percentage of body weight with those of Olubajo and Oyenuga (1974), Olubajo, (1974) and Brinckman (1974) showed that intake of dry matter and organic matter tends to decrease with increasing liveweight of animals.

The high consumption observed in this experiment could be attributed to small sheep needing relatively more nutrient for maintenance as a result of relatively higher basal metabolic rate. The value of 'a' is similar to 0.036 obtained by Adegbola (1974), Garrett, Meyer and Lofgreen (1959), Butterworth (1966) and 0.035 obtained by Langland *et al* (1963). This indicates that maintenance requirement of sheep of different breeds, age, liveweight and sex can be assumed to lie between 0.035 and 0.040kg DOM per kilogram metabolic weight or between 470 and 540 MJ ME per kilogram metabolic weight.

The value of 1.54kg DOM required for each kilogram of weight gain obtained for young dwarf ewes in this experiment is much lower than value of 4.5kg obtained for mature dwarf wethers by Adegbola (1974) and values of 1.55 to 1.71, 2.27 and 3.70kg obtained for mature breeds of exotic sheep by Forbes and Robinson (1969), Coop (1962) and Langlands *et al* (1963) respectively. The value of ME required for maintenance is higher than 103.2 kcals (431.71 KJ) per kg $W_{kg}^{0.734}$ obtained by Olatunji, Mba and Olubajo (1976) for West African Dwarf wethers maintained on hay and concentrate. It is, however, lower than values of 138 kcals (577 KJ) obtained by Garrett, Meyer and

Lofgreen (1959) and 140 kcals (585 KJ) recommended by NRC (1968). The ME requirement for each kilogram of weight gain is much lower than the value of 7902.5 kcals (33064 KJ) obtained by Olatunji *et al* (1976). This suggests that young West African Dwarf sheep utilize feeds efficiently but that this efficiency decreased with age and liveweight. This may be because as the animal matures, it begins to deposit fat and the energy cost of fat deposition is about double that of muscle protein deposition.

The observation that the ME requirement for maintenance is about 1.8 times basal metabolism shows that the caged sheep were exhibiting much activity. Most of the available energy absorbed by the sheep is used for maintenance. The value obtained for young ewes (85.8%) is higher than 72.5% obtained by Adegbola (1974). The low growth rate of the sheep may be due to the fact that there was little nutrient for growth after the maintenance requirement has been met.

The significance of this study is two-fold. Firstly, it enable the farmer to plan for effective feeding of his sheep especially during the dry season when the nutritional quality of forages usually declines. Such a farmer could plan to make hay from Guinea grass or other grasses, and a knowledge of the DOM content of the grass as well as the DOM requirement of his sheep will — enable him to know the actual wuantity of forage he needs to harvest for conservation. The second point is that since no young sheep can achieve appreciable weight gain on this forage alone, it would appear necessary to supplement it with concentrates such as groundnut cake and cotton seed cake which will supply not only energy but protein needed for maximum weight gain.

ACKNOWLEDGEMENT

The authors wish to thank the Senate

Research Grants Committee of the University of Nigeria, Nsukka for their financial support of this project.

REFERENCES

- ADEGBOLA, T.A. (1974). Digestion and Utilization of protein in West African Dwarf Sheep. Ph.D. Thesis. University of Ibadan, Ibadan.
- A.O.A.C. (1970). Official method of Analysis Association of Official Analytical Chemists. 11th Ed. Washington, D.C.
- BRINCKMAN, W.L. (1974). The feeding value of five different hays as fed to sheep. Nig. J. Anim. Prod. 1(2); 225—230.
- BRODY, S. (1945). In 'Bioenergetics and Growth' Reinhold Publishing Co. New York.
- BUTTERWORTH, M.H. (1966). A note on the maintenance requirement of adult rams under tropical conditions. Anim. Prod. 8: 155—156.
- COOP, T.E. (1962). The energy requirements of sheep for maintenance and gain. 1. Pen — fed sheep. J. Agric. Sci. (Camb) 58; 179—186.
- FORBES, T.J. and ROBINSON J.J. (1969). A study of energy requirements of weaned lambs. Anim. Prod. 11; 389—397.
- GARRETT W.N., MEYER J.H. and LOFGREEN G.P. (1959). The comparative energy requirements of sheep and cattle for maintenance and gain. J. Anim. Sci. 18; 528—547.
- LANGLANDS, J.P., CORBETT, J.L., MCDONALD, I. and PULLARD T.D. (1963). Estimate of the energy required for maintenance by adult sheep. 2 Housed sheep. Anim. Prod. 5; 1—9.
- N.R.C. (1968). The Nutrient Requirement of Domestic Animals. J. Sheep. National Research Council. Washington D.C.
- OLATUNJI O., MBA A.U., and OLUBAJO F.O. (1976). Dietary effects on utilization of energy by West African Dwarf Sheep. A.A.A.S.A. Journal 3(2) 57—62.
- OLUBAJO, F.O. (1974). Pasture Research at the University of Ibadan. In 'Animal Production in the Tropics' Heinemann Educational Book (Nig.) Ltd., Ibadan.
- OLUBAJO, F.O. and OYENUGA V.A. (1974). The yield intake and animal production of four tropical grass species grown at Ibadan. Nig. J. Anim. Prod. 1(2); 217—224.
- WILLIAMSON, G. and PAYNE, W.J.A. (1965). In 'A Introduction to Animal Husbandry in the Tropics' 2nd Ed. Longmans Green & Co. Ltd London.