

ALLOWANCES OF STARCH AND
PROTEIN FOR FATTENING LAMBS

٩٢٩ Sub - ٢١٤٥٥

By

HUSSEIN SAAD SOLIMAN

B.Sc. Agric. (Animal Production)

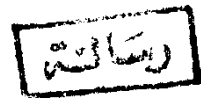
Ain Shams University

THESIS

Submitted in Partial Fulfilment of the
Requirements for the Degree of

MASTER OF SCIENCE

Ain-Shams University
FACULTY OF AGRICULTURE



4755



1971

APPROVAL SHEET

This thesis is approved by:

.....

Dr. Ibrahim M. Elmaghrabi

A. R. Alen Akhade

Date: / /1971.



ACKNOWLEDGEMENT

The writer wishes to express his sincerest gratitude and indebtedness to Dr. O. Shehata Prof. of Animal Nutrition Fac. of Agric. Ain Shams University for his patient supervision of this work and for his valuable suggestions and criticism.

He is also greatly indebted to Dr. M.A. El-Ashry, Lecturer of Animal Nutrition, Fac. of Agric. Ain Shams University for his kind supervision and valuable help.

Thanks are also due to Dr. E. S. Galal for his kind assistance in statistical analysis of the results.

Sincerest thanks are due to all his fellow colleagues and workers in the Dept. of Animal Production for their intimate comradeship and help.

CONTENTS

	Page
INTRODUCTION.....	4
REVIEW OF LITERATURE.....	1
1- Energy requirements of fattening lambs....	1
2- Protein requirements of fattening lambs...	10
3- Energy: protein ratio for fattening lambs	17
4- Effect of energy level on digestibility and N-balance.....	23
5- Effect of protein level on digestibility and N-balance.....	28
6- Effect of protein and energy levels on carcass characteristics.....	34
a- Effect of protein and energy levels on dressing percentage.....	34
b- Effect of protein and energy levels on L-dorsi area and the thickness of fat..	39
7- Effect of protein and energy levels on carcass composition.....	42
a- Effect on carcass lean content.....	42
b- Effect on carcass fatty tissues and bone content.....	46
MATERIALS AND METHODS.....	49
RESULTS	69
1- Gain in body weight and feed efficiency as affected by the different energy and pro- tein levels.....	69
a- The first experimental period(139 days)	69
b- The entire experimental period (236 days).....	79
2- Effect of energy and protein levels on nutrients digestibility and nitrogen balance.....	88
3- Effect of energy and protein levels on carcass characteristics and composition...	95
a- Dressing percentage.....	95
b- Loin eye area and fat thickness.....	104
c- Carcass composition.....	109
DISCUSSION.....	118
SUMMARY AND CONCLUSIONS.....	141
REFERENCES.....	147
ARABIC SUMMARY.	

INTRODUCTION

Population in Egypt are increasing at an alarmingly rapid rate; a fact that makes the increasing rate of production does not commensurate to the requirements of such increasing population.

Shortage of animal protein is of particular importance because of its essentiality in human nutrition and because the individual share in Egypt is still below 13 gm/day.

Meat produced by cattle and sheep represents the major source of animal protein.

Improving the performance of cattle and sheep is more effective than increasing their number particularly when feeding stuffs are not abundant. Recent surveys of livestock in U.S.A, for example, showed a substantial drop in their number while a general increase in production is observed, thus indicating improved performance.

There are about 2 million heads of sheep producing annually about 24.000 tons of lamb's meat. Unfortunately, fattening lambs has not been extensively studied in this country; considerable numbers of lambs are not properly fattened, while others may be overfattend at marketing time.

The main objective of this work is the investigation of the energy and protein requirements of fattening lambs with the hope of improving their performance by proper nutrition.

Different levels of energy and of protein were involved in a factorial design which allows to determine the requirements of energy and protein separately or combined.

This study permits also the determination of the proper nutritive ratio and duration of fattening period where economical gains are achieved.

Digestibility and nitrogen balance trials, feed efficiency and protein utilization, carcass characteristics and composition together with records of body weight changes were all completed.

REVIEW OF LITERATURE

1- Energy Requirements of Fatening Lambs:-

The early work of Rubner and Armsby on basal metabolism established that heat production was proportional to surface area, being of the order of 1000 Cal./M²/day. This could be easily expressed as a function of body weight to the power of two thirds ($W^{\frac{2}{3}}$). More recent analysis of the data on an extended range of animals have increased the exponent to 0.73 (Brody, 1945) and to 0.75 (Kleiber, 1947).

Basal metabolism in sheep follows the concepts laid down by early workers for man and animals. Lines and Pierce (1931) found it to vary from 890 - 1250 Cal./M²/day according to the previous nutritional state of the animals.

Marston (1948) expressed it as $68 W_{kg}^{0.73}$ /day for Merino sheep. Blaxter (1960) considers this formula to be too high for sheep and recommends it to be $56 W_{kg}^{0.75}$. Kleiber (1961) reported that the 0.75 power of body weight in kilograms ($W^{0.75}$) provided a better fitting formula for relating basal metabolism. He expressed the following formula for calculating the basal metabolism:

$$\text{Basal metabolism (k cal.)} = 70 W_{kg}^{0.75}$$

This formula is close to that recommended by Marston (1948). Armsby and Multon (1925) recommended 0.73 Lb. SE (= 0.84 Lb. TDN.) for maintenance requirement of a 100 Lb sheep.

Garrett et al., (1959) studied the comparative energy requirements of sheep and cattle for maintenance and gain. The maintenance requirements for a 100 Lb sheep becomes 1.06 Lb TDN ($0.0335 W_{lb}^{0.75}$) and for gain is $2.47 \times 0.0335 W_{lb}^{0.75}$ or 2.62 Lb Lb TDN per Lb gain at 100 Lb body weight.

Using corriedale and Romney sheep, Coop (1962) expressed the maintenance requirements for a 100 Lb lamb as 0.92 Lb (DOM) digestible organic matter or 0.96 Lb TDN or 0.89 Lb S.E. The author summarized the maintenance requirements of a 100 Lb sheep laid down by different workers in terms of TDN in the following table.

<u>Estimates of maintenance in Lb. TDN per day for a 100 Lb. sheep.</u>		
Basal metabolism	0.61	$70W^{0.75}$ Cal.
Energy equilibrium	0.82-0.98	Henneberg, Kellner
	0.84	Armsby
	0.87	Blaxter & Graham
Pen trails	1.09	Wallace
	1.06	Garret et al.
	1.07	Watson

Mob trails	0.93	Franklin
	1.00	Coop (unpublished)
Recommendations	1.48	U.K (Woodman)
	1.43	U.S.A (N.R.C)
	1.65	Morrison (includes some gain)
Grazing	1.80	Lambourne
	1.90	Greenall

Ghoneim et al., (1960) recommended a level of 310 gm S.E. for a one year old Egyptian sheep.

Abou-Raya et al., (1969a) studied the maintenance requirements of energy for mature Egyptian sheep. They found it to be 17.8 gm S.E. or 29.2 gmTDN for unit metabolic body size ($W_{kg}^{0.75}$) at younger ages of lower weights (18 months old of 37 to 41.2 kg. live weight). They also reported a figure of 15.8 gm S.E. or 24.8 gm TDN per unit metabolic body size for older sheep having higher weights (2.5 years old of 53-56 kg. live weight).

Forbes and Robenson (1969) reported that the estimated maintenance requirements of energy for a 45 kg lamb was 400 gm (0.88 lb) air dry feed on 1.500 Therm(ME)

metabolizable energy. This was not affected by the age of the animal. They also found that the dry organic matter (DOM) required for body weight gain ranged from 1.55 to 1.71 kg per kg live weight gain for the younger and older animals respectively. Moreover they stated that both of these requirements were lower than those obtained by other workers and those suggested by the National Research Council (N.R.C. 1965).

Preston and Burroughs (1958) fed lambs on two energy levels 0.530 or 0.665 Therm ENE (estimated net energy) per pound of ration. It was found that lambs on the high energy level gained higher and were more efficient than those on the low level.

Jones and Hogue, (1960) fed lambs weighing on average 70 Lb on two energy levels 90 and 120% of the minimal level for fattening recommended by Morrison (1957). They found no significant differences in weight gain or feed efficiency among the two energy levels.

Church et al., (1966), studied the energy and protein requirements of growing fattening lambs. Animals were fed two energy levels 1.19 or 1.32

Therm NE/kg feed. It was found that differences in feed conversion were significant, although daily gain was not. In another experiment they fed two energy levels 0.75 or 0.93 Therm NE/kg feed. They also obtained no significant differences in daily gain or feed efficiency among the two energy levels. They concluded that at lower energy levels protein spared energy or vis versa.

Davies, (1966) fed suffolk cross wether lambs on all concentrate diet containing 15% crude protein. Daily dry matter intake ranged from 992 to 1052 gm and gross energy from 4.371 to 4.644 Therm. Differences between diets were not significant in nitrogen balance.

Mansour, (1968), fed lambs on three levels (2.04, 2.61 and 3.18 Therm/day) of M.E in diets providing the same daily intake of digestible protein. It was found that raising the daily intake of ME significantly increased the gain of live weight and efficiency of energy utilization.

Sarican et al., (1968) fed six groups of Black headed mutton lambs weighing 20 kg live weight according to the German standards (2.5% of the animal live weight as SE.)

One group received the standard, another group got the standard and was shorn at 29 kg. Two groups were given 130% of the standard; one of them was shorn. The fifth group received 70% of the standard and the last one got the standard and kept in a day time temperature (35°C) and was shorn.

Results obtained at 38 kg live weight revealed that the first group which gained an average 320 gm/day required least SE (2530 gm) per kg gain. The highest SE level resulted in higher daily gain (+13gm) but more feed were eaten per unit gain. The lowest SE level gave the least weight gain but was next to the first group in efficiency of feed conversion.

Allen (1969) fed lambs on all concentrate diet containing 2.45, 2.65 or 2.85 Therm of ME/kg fresh weight and three levels of protein 12, 16 and 20% crude protein. He found that higher energy level increased gain and feed efficiency but not significantly.

Feeding Romney x Swaledale lambs starting from 16 to 40 kg. live body weight, Andrews et al., (1969) found no significant difference in average daily gain when ME of the ration was decreased from 2.9 to 2.5 Therm/kg DM, feed efficiency was variable.

Three levels of feed intake were investigated by Andrews and Ørskov (1970) using 16-40 kg live weight lambs; the highest level (H) determined by the equation $Y = 4.25 - 0.03 W$, (where Y = the dry matter intake as a percent of live weight (kg/day) and w = live weight kg).

The medium level equals to 85% of the highest level and the low level represent 70% of the highest level.

It was evident that growth rate responded linearly to the increase in feeding level.

In U.A.R., Ghoneim (1967) recommended the following daily intakes of S.E and digestible protein for fattening the local breeds of lambs. The author reported that these recommendations ensure satisfactory gain and finish.

Age in months	S.E. (gm)	D.P (gm)
4	400	60
5	350	70
6	450	75
7	450	75
8	500	85
9	500	85

Age in months	S.E. (gm)	D.P. (gm)
10	550	85
11	600	95
12	600	100

Maynard and Loosli (1964) reviewed the allowances of the National Research Council (N.R.C) 1949 for fattening lambs as follows:

Live weight	Total feed	TDN	DP
Lb	Lb	%	%
50	2.1	57	8.1
70	2.7	63	7.0
90	3.0	66	6.7

Morrison, (1959) set up the following standards for the growing fattening lambs

Weight	Dry matter	TDN	D.P	Net energy
Lb	Lbs	Lbs	Lbs	Therm
50	2.0-2.4	1.4-1.6	0.17-0.19	1.3-1.5
60	2.2-2.6	1.5-1.8	0.17-0.20	1.3-1.6
70	2.6-3.0	1.7-2.1	0.18-0.21	1.5-1.9
80	2.9-3.3	1.9-2.3	0.19-0.22	1.7-2.1
90	3.1-3.6	2.1-2.5	0.20-0.23	1.9-2.3
100	3.3-3.8	2.3-2.8	0.20-0.24	2.1-2.6