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# The Effect of Feeding Different Roughage : Concentrate Ratios on the Performance of Growing Merino Lambs

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NINTEEN Merino lambs averaging 19.4 kg weight were used. The experiment lasted for 175 days as a first period and prolonged for 231 days in the second period. The animals were fed rations contain ng 50:50, 40:60 and 30:70 roughage to concentrate ratios to supply their daily starch equivalent requirements. The results showed that increasing concentrates in the diet increased digestion coeffecient of crude protein, ether extract and NFE. The daily gain was increased with the increase in concentrates; feed efficiency was also increased. On the other hand, the dressing percentage on either fasting body weight or empty body weight basis was not affected when concentrate ratio weight was increased from 50 to 60%.

The use of 70% concentrates caused an increase in dressing percentage. The best values for the efficiency of protein utilization were obtained when using 70% concentrate, while the best values for the efficiency of energy utilization were obtained when using 60% concentrate in the diet.

It is generally accepted that three factors are responsible for the better utilization of the diet; the amount of feed intake, the physical state of the diet and the chemical composition of the diet (Weir *et al.*, 1959; Reynolds and Lendahl, 1960 and Vaz Portugal, 1972).

The ingestion of increased concentrates in animal diets, seems to improve the daily gains of lambs (Calotoiu *et al.*, 1973; Jordan and Tichich, 1974 and Younis *et al.* 1976). It was also found by El Ashry *et al.* (1976) that increasing concentrates in the diet improved significantly growth rates and non-significantly the feed efficiency of lambs. These results raised a question about the optimum ratio of roughage to concentrates to be used economically and the significance of such ratios with the carcass analysis and the efficiency of protein and energy utilization.

## Material and Methods

Ninteen weaned male merino lambs of almost the same average live body weight (19.42 kg) were used. During a standerdizing period of 2 weeks, the lambs were fed a standerd ration. All lambs were shorn, fasted overnight, weighted and the initial sample group of 3 lambs were slaughtered. The remaining lambs were randomly alloted into three groups. Every group was given the daily starch equivalent requirement by consuming one of three rations

formulated to supply 50, 60 and 70% of the energy rquirements form concentrates and the rest from roughages. The energy and protein allowances of the three rations were those recommended by Tommi (1963).

The rations used consisted of Egyptian clover (*Trifolium alexandrinumh*) and wheat straw as roughage sources. The concentrate mixtures consisted of 50% undecorticated cotton seed cake, 25% corn,12% wheat bran, 8% rice bran, 4% molasses,1% salt and mineral mixture plus yellow corn. The average chemical analysis of feedstuffs used are given in Table 1. Feed was offered

TABLE 1. **Chemical composition (%) of feedstuff.**

| Feedstuff | Moisture | Ash | CP | EE | CF | NFE |
|---|---|---|---|---|---|---|
| Concentrate mixture . . . . . | 8.07 | 7.10 | 18.47 | 6.55 | 13.48 | 45.40 |
| Yellow maize . . . . . | 12.73 | 1.47 | 10.19 | 4.26 | 3.32 | 80.76 |
| Berseem hay (2*nd* cut) . . . . . | 11.25 | 14.08 | 10.55 | 2.73 | 40.31 | 32.33 |
| Wheat straw . . . . . | 6.09 | 12.84 | 1.78 | 0.45 | 41.51 | 43.42 |

once daily and the residues if any were removed and weighed weekly. Salt blocks and water were available at all time. The intakes were adjusted according to the increase in body weight to meet the required allowances and the shrunk live body weight were recorded weekly. The nutritive value of the three rations used expressed as total digestible nutrients (TDN) and digestible protein (DP) was determined by carrying out digestibility trials of three weeks duration, two weeks for adaptation and one week for colllection. Feeds and feces were analysed for crude fibre, ether extract, crude protein, moisture and nitrogen free extract according to A.O.A.C. methods (1965). The gross calorific value of feed intake was calculated using the factors 5·65 Kcal/g for protein, 9·4 Kcal/g for fat, 4·15 Kcal /g for fibre and carbohydrates (Blaxter, 1966). The digestable calorific value were obtained by multimplying the calculated calorific value of each constitutent of feed intake by its digestion coefficient. The metabolizable energy for differnent treatments were calculated accozding to Blaxter (1966). The comparative slaughter method was used to estimate the gains or losses of the body components during growth and fattening. Beside the initially slaughtered group, a medium group was slaughtered after 175 days and a final group was slaughtered after the end of the feeding experiment (231 days). The lambs were shorn, fasted over night and slaughtered by severance of the blood vessels. The content of the digestive tract were then removed and their weight were subtracted from the preslaughtered live weight to give the empty body weight (EBW). The following measurements were taken:

*a*. The weight of head, legs, skin and warm carcass.

*b*. The weight of rumen, small and large intestine (cempty and full).

*c*. Lung and trachea and liver in absolute and relative to fasting body weight.

The ribs number 9, 10 and 11 were taken from each lamb and weighed then stored in a sealed polyethylen bags at -10° for chemical analysis according to A.O.A.C. (1969).

TABLE 2. **Mean (SD) chemical composition, digestion coefficients value of feeds used for Merino sheep receiving treatments varying in roughage to concentrate ratio.**

| Item | Ttreatments (R : C ratio) | | |
|---|---|---|---|
| | I (50 : 50) | II (40 : 60) | III (30 : 70) |
| Chemical composition, % | | | |
| CP | 13.87 ± 0.08 | 14.78 ± 0.36 | 14.65±0.60 |
| EE | 4.59 ± 0.05 | 5.02 ± 0.17 | 4.95 ± 0.32 |
| CF | 23.31 ± 0.43 | 20.71 ± 1.12 | 21.41 ± 0.64 |
| NFE | 49.00 ± 0.42 | 50.90 ± 0.87 | 50.17 ± 45 |
| Digestion coefficients, % | | | |
| CP | 61.79 ± 2.85 | 65.13 ± 1.83 | 72.88 ± 0.79 |
| EE | 62.12 ± 3.20 | 74.61 ± 5.77 | 77.57 ± 1.05 |
| CF | 49.86 ± 0.08 | 40.42 ± 6.53 | 47.88 ± 5.91 |
| NFE | 74.23 ± 4.77 | 77.50 ± 1.88 | 81.78 ± 0.48 |
| Nutritive value (1), % | | | |
| TDN | 62.97 ± 2.86 | 65.91 ± 0.73 | 70.66 ± 0.01 |
| DP | 8.57 ± 0.34 | 09.62 ± 0.04 | 10.67 ± 32 |

(1) Determined in a digestibility trial.

## Results and Discussion

*Digestibility and nutritive value*

The data in Table 2 % the average chemical composition, digestion coefficients and nutritive value of the three rations used. The ration containing the ratio of 40:60 roughage to concentate gave the higher values of crude protein percentage, ether extract and nitrogen free extract. However, the crude fiber values were the lowest. The digestion coeficients of crude

protein, ether extract and nitroge free extract were higher for the ration nub-emr III while the crude fiber digestion coefficient gave the higher value in ration. I. The differences among treatments were not significant ($P > 0.05$) for the digestion coefficients of crude fiber, ether extract and nitrogen free extract, while the crude protein values differed significant ($P < 0.05$) among the three treatments. The nutuitive value of the three treatment expressed as total digestible nutritients and digestible protein differed significantly ($P < 0.05$).

TABLE 3. **Mean live weight gains (±SD) and feed efficiency of Merion sheep receiving treatments varying in roughage to concentrate ratio.**

| Item | Treatments (R:C ratio) | | |
|---|---|---|---|
| | (50:50)[I] | (40:60)[II] | (300:7)[III] |
| Initial body weight (kg) | | | |
| Through 175 days[a] | 20.25 | 20.20 | 21.00 |
| Trough 231 days[b] | 20.17 | 19.00 | 21.00 |
| Final body weight (kg) | | | |
| Through 175 days | 38.92 | 43.50 | 44.10 |
| Through 231 days | 47.33 | 50.50 | 49.83 |
| Total gain (kg) | | | |
| Through 175 days | 18.67 | 23.30 | 23.10 |
| Through 231 days | 27.16 | 31.50 | 28.83 |
| A. daily intake of DM (kg) | | | |
| Through 175 days | 1.1039 | 1.1814 | 1.2031 |
| Through 231 days | 1.2080 | 1.2877 | 1.3272 |
| D G(kg) | | | |
| Through 175 days | 0.1000±0.09 | 0.1234±0.02 | 0.1285±0.01 |
| Through 231 days | 0.1291±0.01 | 0.1385±0.01 | 0.1248±0.01 |
| Feed efficiency-[c] | | | |
| Through 175 days | 0.0906 | 0.1044 | 0.1063 |
| Through 231 days | 0.1069 | 0.1075 | 0.0940 |

*a*: Average of 6 and 5 animals in treatment I, IIand III, respectively.

*b*: Average of 3,2,3 animals in treatment I, II and III, respectively.

*c*: kg. gain/kg DM intake.

*Live weight gain and feed efficiency*

As shown in Table 3, the initial body weight for the three treatments were almost similar ($I^{st}$ whole period of the experiment.) Increased concentrate ratios resulted in an increase of the final body weight. In the first period animals fed 70% concentrates gave the highest body weight while animals fed 60% concentrate, through the whole period of 231 days, gave the highest body

weight. The feed intake on dry matter basis was markedly increased by increasing the concentrate ratio in Merino sheep rations during the whole course of the experiment. The average daily gain values during the first period (175 days of the three treatments were significantly different ($P < 0.05$), while the differences among treatments during the whole period (231 days) were not significant ($P > 0.05$).

TABLE 4. Carcass characteristics of Merino sheep receiving treatments varying in raughage. to concentrate ratio.

| Item | Initial (1) slaughter | Treatments (R:C ratio) | | | | | |
|---|---|---|---|---|---|---|---|
| | | I (50 : 50) | | II (40:60) | | III (30:70) | |
| | | Medium(2) | Final(3) Slaughter | Medium | Final Slaughter | Medinm | Final Slaughter |
| Fasting body weight, kg | 21.50 | 36.67 | 50.00 | 40.67 | 51.00 | 44.50 | 48.67 |
| Warm carcass weight, kg | 8.03 | 18.00 | 24.00 | 19.67 | 24.00 | 22.50 | 23.67 |
| Empty body weight, kg | 19.143 | 33.433 | 44.713 | 36.980 | 46.825 | 4.157 | 43.413 |
| Dressing percentage, % | 40.87 | 52.48 | 51.79 | 51.96 | 50.69 | 54.01 | 52.57 |
| Relative to FBW . . . | 45.87 | 57.49 | 57.93 | 57.09 | 55.21 | 59.85 | 58.94 |
| Relative to EBW . . . | | | | | | | |
| Edible offals (4), % . . | 2.98 | — | 3.43 | — | 4.23 | — | 3.93 |
| Rumen . . . . . | 2.31 | — | 1.66 | — | 1.41 | — | 1.78 |
| Small intestine . . . . | 4.81 | — | 2.52 | — | 2.32 | — | 2.02 |
| Large intestine . . . . | 0.47 | 0.48 | 0.63 | 0.45 | 0.65 | 0.41 | 0.66 |
| Heart . . . . . | 1.48 | 1.63 | 1.60 | 1.68 | 1.57 | 1.69 | 1.70 |
| Liver . . . . . | 1.51 | 1.54 | 1.51 | 1.40 | 1.48 | 1.40 | 1.58 |
| Lung + trachia . . . . | | | | | | | |

(1) Average of 3 animals.
(2) Avergae of 3,3 or 2 animals in treatments i, II and III, respectively.
(3) Average of 3, 2 or 3 animlls in treatments 1, II and III, respectively.
(4) Relativ to fasting body weight.

*Carass characteristics*

The results given in Table 4 show that the initial salughter group was constant for the different treatments adopted. The dressing percentage relative to Fasting Body Weight (FBW) or Empty weight (EBW) in either medium slaughter group or final slaughter group was supeior in the treatment received 70 % 70% concentrates, however, the lowest value was that of treatment 11 (60% concentrate). The differences among treatments were singificantly different ($P<0.05$).

The figures given in Table 4 for edible offals relative to FBW show that the rumen weight in treatment 11(60%) concentrates ) was markedly higher than the other two treatments in final slaughter group. The lowest rumen weight was obtained in treatment 1 (50% concentrates).

These results suggest that dressing percentage of Merino sheep. decreased slightly by increasing the concentrate percentage from 50 to 60%. Then feeding as much as 70% concentrates caused a remarkable increase in the dressing percentage. The value given for this treatment exceeds the value given for both treatments 1 and 11. The explanation for this may be attributed to the high digestible energy intake which resulted in deposition of fat. However, Godey (1972) revealed that intensive feeding of a balanced *ad libitum* feedstuff actually allows for nearly a doubling of the lambs carcass weight in about two months time. Similar results were found by Dark and Fontenot (1966) who pointed out, that increasing roughage percentage in the ration of lambs resulted in a significant decrease in dressing percentage.

*Chemical composition of carcass*

Table 5 shown amount of drymatter (DM), crude protin (CP) ether extract (EE) and energy deposited in bodies of Merino sheep fed different roughage to concentrate ratios during the *lst*, *2nd* and whole period of the experiment.

The amounts deposited/kg empty body weight (EBW) gain as DM, CP, EE and energy during the *lst*, *2nd* and whole period of the experiment, were calculated by the amount deposited on fasting body weight (FBW) basis, divided by the EBW gain during lst, *2nd* and whole period of the experiment, to take care of the differences among treatments, which may be attributed to the filling of the gastrointestinal tracts.

EBW gains are calculated by subtracting the initial EBW from the medium EBW; substracting the medium EBW from the final EBW or substracting the initial EBW or substracting the initial EBW from the final EBW for *lst*, *2nd* and whole period, respectively.

Results given in Table 5 show that, DM deposited/kg EBW gain for the three treatments *lst*, *2nd* and whole period) were almost the same with the exception that DM deposited/kg EBW gain was slightly low in treatment 1 (50% concentrates). In case of the *2nd* period, DM deposited/kg EBW gain was higher in treatment 11 (60% concentrates) followed by treatment 1 (50% concentrates).

CP deposited/kg EBW gain values for the three treatments during *lst*, *2nd* and whole period were 0.1609, 0.1345 and 0·1285; 0.2784, 0.2295 and 0·6081 and 0·2127, 0·1683 and 0·1928 for treatments 1,11 & 111, respectively.

TABLE 6. Efficiency of protein and energy utilization of Merino sheep receiving treatments varying in roughage to concentrate ratio.

| Item | Treatments (R/C) ratio) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | I (50:50) | | | II (40:60) | | | III (30:70) | | |
| | 1st period | 2nd period | Whole period | 1st period | 2nd period | Whole period | 1st period | 2nd period | Whole period |
| DE intake/d, MCal | 2.90 | 4.05 | 3.17 | 3.24 | 4.44 | 3.53 | 3.43 | 5.19 | 3.86 |
| DE intake/d/kg EBW gain, Kcal | 203 | 359 | 124 | 182 | 249 | 128 | 163 | 1595 | 158.9 |
| ME intake/d, Mcal | 2.38 | 3.32 | 2.60 | 2.66 | 3.64 | 2.90 | 2.81 | 4.26 | 3.16 |
| ME intake/d/kg EBW gain, Kcal | 166 | 294 | 102 | 149 | 204 | 105 | 134 | 1308 | 130 |
| Protein intake Mcal/d | 0.75 | 1.02 | 0.81 | 0.87 | 1.16 | 0.94 | 0.93 | 1.29 | 1.02 |
| Protein intake Kcal /d protin kg EBW gain | 52.2 | 90.5 | 31.7 | 48.6 | 117.8 | 33.9 | 44.4 | 297.4 | 42.0 |
| Protein retained kg/ kg EBW gain | 0.16 | 0.28 | 0.21 | 0.14 | 0.23 | 0.17 | 0.13 | 0.61 | 0.19 |
| Protein retained MGI kg EBW gain | 0.90 | 1.55 | 1.19 | 0.75 | 1.28 | 0.94 | 0.72 | 3.39 | 1.07 |
| Protein retained Kcal /d/ kg EBW gain | 5.12 | 27.7 | 5.1 | 4.3 | 22.8 | 4.1 | 4.1 | 60.5 | 19.2 |
| Energy retained/kg EBWgain | 3.68 | 2.40 | 3.11 | 5.08 | 2.35 | 4.11 | 4.94 | 2.47 | 4.61 |
| Energy retained/d/ kg EBW gain, Kcal | 21.02 | 42.78 | 13.48 | 29.03 | 42.00 | 17.80 | 28.23 | 44.07 | 19.95 |
| Efficiency of protein utilization%of protein intake (Kcal) | 9.82 | | 16.19 | 8.80 | | 11.98 | 9.21 | | 45.62 |
| Efficiency of energy utilization% | | | | | | | | | |
| of DE | 10.37 | | 10.87 | 15.97 | | 13.95 | 17.30 | | 12.55 |
| of ME | 12.65 | | 13.26 | 19.47 | | 17.01 | 21.10 | | 15.31 |

The energy deposited/kg EBW gain values for different treatments during *lst* and 2nd period were almost similar, with the exception that the energy deposited/kg, EBW gain was low in Treatment I (*lst* period). In case of the whole period of the experiment,energy deposited/kg EBW gain was more in Treatment 111 (70% concentrates) followed by Treatment 11 (60% concentrates) and Treatment 1 (50% concentrates) was the lowest values.

It can be concluded that, the amount of energy deposited per kg. EBW gain increased as the proportion of the concentrates increased in the rations. But during the lst period lambs fed 60 or 70% concentrates in their ration were equal in respect to energy deposited/kg EBW gain.

*Efficency of energy and protein utilization*

The intake of digestible energy (DE) and metabolizable energy (ME) were divided by empty body weight gain for different treament to obtain the efiiciency of protein utilization expressed as percentage of protein intake during the *Ist* and 2nd period of the experiment. As shown in Table 6 it is obvious that the efficiency of protein utilization increased as the level of concentrates increased in the ration from 60 to 70%. Robinson and Forbes (1970) came to the same conclusion while the efficiency of energy increased as the III rough-age: concentrate ratio decreased in ration (*Ist* period) a result which is similar to that obained by Searle and Gorhan (1972). But during the whole period, the optimum ratio of roughage to concentrate ratio for Merido sheep is 40:60.

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# تأثير التغذية على علائق تحتوى على نسب مختلفة من المواد الخشنة والمركزة على أداء الأغنام المرينو

عبد الفتاح محمد الصيرفى ، حاتم محمد على ، حمدى محمد خطاب ، محمد عبد المنعم العشرى وسوسن منصور أحمد

كلية الزراعة ـ جامعة عين شمس والمركز القومى للبحوث

استخدم فى هذه التجربة ١٩ حولى مارينو بمتوسط وزن ١٩ر٤٢ كجم • واستمرت التجربة لمدة ١٧٥ يوما كفترة أولى ثم امتدت حتى ٢٣١ يوما كفترة ثانية •

غذيت الحملان على علائق تحتوى على النسب الآتية من المواد الخشنة الى المواد المركزة : ٥٠ : ٥٠ ، ٤٠ : ٦٠ ، ٣٠ : ٧٠ والتى تمد الحيوانات باحتياجاتها اليومية من معادل النشا •

وقد أوضحت النتائج أن زيادة نسبة المواد المركزة أدى الى زيادة معاملات هضم كل من البروتين الخام ومستخلص الايثر ومستخلص المواد الخالية من الآزوت • كما أدى زيادة المواد المركزة أيضا الى زيادة معدل النمو اليومى وكذلك كفاءة التحويل الغذائى •

ومن جهة أخرى فان نسبة التصافى سواء المحسوبة على أساس الوزن الصافى أو الوزن الفارغ قد انخفضت بزيادة نسبة المواد المركزة من ٥٠ الى ٦٠٪ • أما استخدام المواد المركزة بنسبة ٧٠٪ قد أدى الى زيادة نسبة التصافى •

وكانت أحسن نتائج بالنسبة لكفاءة الاستفادة من البروتين هى عند استخدام نسبة ٧٠٪ من المواد المركزة بينما أحسن نتائج بالنسبة لكفاءة الاستفادة من الطاقة كانت عند استخدام ٦٠٪ من المواد المركزة •