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THE EFFECTS OF DIET, TIMING OF HOUSING AND TIMING OF SLAUGHTER ON THE PERFORMANCE OF *AD LIBITUM* CONCENTRATE FINISHED SCOTTISH BLACKFACE WETHER LAMBS

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INTRODUCTION

Traditional store lamb finishing systems are frequently inflexible and unpredictable. *Ad libitum* concentrate finishing offers the opportunity for more predictability and therefore greater ability to plan and budget than do other less intensive systems. It suffers from the major problem of being high cost. More information is needed on the latitude available in concentrate finishing and the options available of how best to employ the finishing phase, particularly with changes in the financial support system.

The aim of the trial was first to identify the effects of higher quality foods on lamb performance. Secondly, the effects of differing length of time on the diets was investigated and thirdly the timing of finishing and subsequent sale was considered.

MATERIAL AND METHODS

Three hundred and twenty Blackface store lambs were allocated treatments on 16 November, as follows.

Housing treatment: early = lambs withdrawn from grass and housed on 17 November; or late = lambs remaining on grass until housing on 20 January.

Dietary treatment: normal energy/normal protein (NE/NP); high energy/normal protein (HE/NP); normal energy/high protein (NE/HP); high energy/high protein (HE/HP). Analysis involved a 2 × 2 comparison, namely normal *v.* high for both energy and protein where normal protein = 137 g/kg, high protein = 164 g/kg, normal energy = 11 MJ/kg, and high energy = 12 MJ/kg. For each housing treatment, lambs were put into two group pens of 20 lambs per pen, with the 20 heaviest lambs and 20 lightest lambs from each dietary treatment in each pen.

Slaughter treatment: immediate slaughter = if judged to be at slaughter condition (MLC class 3L) then slaughter the next day; delay slaughter = lambs held on food for a further 14 days after being judged as above.

Late-housed lambs were grazed at high stocking rates (*ca.* 10 per ha) on reseeded pasture at heights of 3 to 5 cm. Once housed, lambs were brought to *ad libitum* feeding over a period of 5 days using thrice daily feeding in troughs. Feeding thereafter was *ad libitum* from hoppers. Food intake was recorded on a pen basis. Lambs were handled and assessed for slaughter condition every 2 weeks from housing.

RESULTS

Lamb performance

Results for lamb performance are shown in Table 1. The high level of protein led to a significant reduction in the time to slaughter for all lambs (immediate and delay slaughter combined) ($P < 0{\cdot}05$). Lambs on diets HE/HP were significantly faster to finish than those on diet NE/NP ($P < 0{\cdot}01$). There were also major differences between early and late housed lambs ($P < 0{\cdot}001$).

There was a consistent effect for diet NE/HP to show higher growth rates than other diets. Lambs on HP diets had higher growth rates to slaughter ($P < 0{\cdot}05$), 15 g/day more than NP diets. This was despite low growth rates by the HE/HP diet and indications of an interaction between energy and protein levels ($F = 2{\cdot}89$, $P > 0{\cdot}05$).

Carcass and slaughter results are shown in Table 2. Live weight at slaughter was affected by delayed slaughter ($P < 0{\cdot}001$). None of the dietary treatments had statistically significant effects on live weight at slaughter or on selection for slaughter. There were however significant effects on carcass weights. There was increase in carcass weight with delayed slaughter ($P < 0{\cdot}001$). HE diets had lower carcass weights than NE ($P < 0{\cdot}05$); the NE/HP diet had higher carcass weights than both the HE/NP and the HE/HP diets ($P < 0{\cdot}05$). H diets had higher carcass weights than NP but the difference was non-significant.

Carcass killing-out proportions were significantly

TABLE 1
Lamb performance

	Diet					Energy			Protein			Slaughter			Housing		
	NE/NP	HE/NP	NE/HP	HE/HP	s.e.d.	N	H	s.e.d.	N	H	s.e.d.	Immediate	Delay	s.e.d.	Nov.	Jan.	s.e.d.
Weight at grass (15 Nov.) (kg)	28·2	28·3	28·3	28·6	0·48	28·3	28·4	0·34	28·3	28·4	0·34	28·4	28·3	0·34	28·4	28·2	0·34
Housing weight (kg)																	
Nov. house (16 Nov.)	27·0	27·1	27·1	27·4	0·27	27·2	27·3	0·18	27·1	27·4	0·18	27·2	27·3	0·19	27·1		
Jan house (21 Jan.)	29·6	28·7	29·0	28·6	0·27	29·3	28·7	0·19	29·1	28·8	0·19	29·0	29·0	0·19		29·0	
Weight judged for slaughter (kg)	34·2	33·9	34·4	33·7	0·42	34·3	33·8	0·30	34·0	34·1	0·30	34·2	33·9	0·30	34·7	33·4	0·30***
Slaughter weight (kg)																	
Immediate slaughter	33·9	33·8	34·8	34·3	0·64	34·3	34·0	0·44	33·8	34·5	0·44				34·6	33·8	0·44
Delay slaughter (g/day)	36·7	36·6	36·8	35·7	0·65	36·7	36·2	0·45	36·6	36·2	0·45				36·8	36·1	0·45
Live-weight gain (g/day)																	
To date judged for slaughter	141[a]	152	171[b]	150	12	156	151	8	146	160	8	158	148	8	160	146	8
To actual slaughter	147[a]	160	177[b]	163	10	164	161	7	155	170*	7	158	168	7	158	167	7
Days to slaughter																	
All	46·1[a]	45·3	43·1	42·8[b]	1·67	44·6	44·0	1·17	45·7	42·9*	1·17	38·3	50·6***	1·17	54·5	33·7***	1·17

[a,b] Means with different superscripts are significantly different ($P < 0·05$).

TABLE 2
Carcass effects

	Diet					Energy			Protein			Slaughter			Housing		
	NE/NP	HE/NP	NE/HP	HE/HP	s.e.d.	N	H	s.e.d.	N	H	s.e.d.	Immediate	Delay	s.e.d.	Nov.	Jan.	s.e.d.
Slaughter weight (kg)																	
Immediate slaughter	33·9	33·8	34·8	34·3	0·64	34·3	34·0	0·44	33·8	34·5	0·44				34·6	33·8	0·44
Delay slaughter	36·7	36·6	36·8	35·7	0·65	36·7	36·2	0·45	36·6	36·2	0·45				36·8	36·1	0·46
All	35·3	35·1	35·7	35·0	0·45	35·5	35·1	0·32	35·2	35·4	0·32	34·2	36·5***	0·32	35·7	34·9**	0·32
Carcass weight (kg)																	
Immediate slaughter	14·9	14·6[a]	15·3[b]	14·8	0·30	15·1	14·7	0·21	14·7	15·1	0·21				15·5	14·3***	0·22
Delay slaughter	16·3	16·4	16·7	16·4	0·31	16·5	16·4	0·22	16·4	16·5	0·22				17·2	15·7***	0·22
All	15·6	15·5[a]	16·0[b]	15·5[a]	0·22	15·8	15·5*	0·15	15·5	15·8	0·15	14·9	16·5***	0·15	16·4	14·9***	0·15
Killing out (g/kg)																	
Immediate slaughter	440	431	440	431	5·0	440	431**	3·7	436	436	3·6				449	422***	3·7
Delay slaughter	445[a]	447[a]	453	459[b]	5·1	449	453	3·7	446	456**	3·6				466	434***	3·7
All	442	439	446	444	3·7	444	442	2·6	441	445	2·6	435	451***	2·6	458	428***	2·6
Carcass fat†																	
Immediate slaughter	3·08	3·07	2·94	2·99	0·17	3·00	3·02	0·12	3·07	2·96	0·12				3·27	2·76**	0·12
Delay slaughter	3·57	3·55	3·62	3·70	0·17	3·59	3·62	0·12	3·56	3·65	0·12				4·04	3·13**	0·12
All	3·33	3·30	3·27	3·32	0·12	3·31	3·30	0·09	3·31	3·30	0·09	3·02	3·61**	0·09	3·66	2·94***	0·09
Carcass conformation‡																	
Immediate slaughter	1·84	1·57	1·73	1·65	0·16	1·78	1·61	0·11	1·71	1·69	0·11				2·09	1·31**	0·11
Delay slaughter	1·93	1·71	2·01	1·83	0·16	1·97	1·77	0·11	1·82	1·92	0·11				1·95	1·78	0·11
All	1·89[b]	1·64[a]	1·87[b]	1·73	0·11	1·88	1·69*	0·08	1·76	1·80	0·08	1·70	1·87*	0·08	2·02	1·53***	0·08
Carcass value (£)																	
Immediate slaughter	36·30[a]	35·47[b]	38·09	36·13	1·15	37·23	35·80	0·81	35·87	37·11	0·81				36·21	36·80	0·81
Delay slaughter	39·77	39·47	39·50	37·04	1·15	39·63	38·29	0·81	39·62	38·32	0·81				37·25	40·90***	0·81
All	38·06	37·42[a]	38·78[a]	36·55[b]	0·81	38·43	36·99	0·57	37·74	37·69	0·56	36·51	38·98**	0·56	36·73	38·73***	0·57

[a,b] Means with different superscripts are significantly different ($P < 0·05$).
† Based on MLC scale where fat class 2 = 2, 3L = 3, 3H = 4L = 5).
‡ Based on MLC scores where E = 4, U = 3, R = 2, O = 1, P = 0.

TABLE 3
Food intake (kg) and food conversion ratios (FCR) (kg food per kg live-weight gain)

	Early		Late housing		Trial aggregate	
Diet	Intake	FCR	Intake	FCR	Intake	FCR
NE/NP	1·36	9·51	1·37	8·85	1·37	9·35
HE/NP	1·32	8·35	1·30	7·73	1·30	8·12
NE/HP	1·43	8·12	1·40	7·60	1·40	7·94
HE/HP	1·23	7·88	1·23	7·23	1·23	7·55
Lamb size						
Medium	1·32	8·42	1·29	6·89	1·31	7·65
Large	1·35	8·65	1·34	9·17	1·34	8·91

affected by housing treatment ($P < 0{\cdot}001$) and slaughter treatment ($P < 0{\cdot}001$). There was a significant interaction between energy level and slaughter treatment ($P < 0{\cdot}05$). Within this relationship immediate slaughter HE lambs had lower killing-out proportions. There was a significant increase in killing-out proportions for HP lambs held for delayed slaughter ($P < 0{\cdot}001$). MLC fat classifications were unaffected by dietary treatments as lambs were selected for slaughter on condition score.

MLC conformation classification was increased by delayed slaughter ($P < 0{\cdot}05$). There are no significant correlations between conformation and carcass weight ($r = 0{\cdot}53$, $P < 0{\cdot}001$) and between conformation and fat class ($r = 0{\cdot}23$, $P < 0{\cdot}001$).

Food intake and conversion

Food intake and conversions are shown in Table 3. There was relatively little difference between intakes of large and medium weight lambs. Compared with the NE/NP diet the HE diets appeared to lead consistently to lower intakes. This was most marked in the HE/HP diet. There was no indication whatsoever of any additive effects of protein and energy levels.

All other diets were superior to the NE/NP diet for food conversion. Effects of both energy and protein appeared to be additive.

CONCLUSIONS

1. High quality food led to better food conversion but not necessarily higher food intakes.
2. Live-weight gain was related to both food quality and food intake.
3. High energy diets depressed intakes and at equal MLC fat scores led to lower carcass weights and killing-out proportions.
4. High protein diets had higher growth rates, faster rates of carcass fat change and higher carcass weights.
5. Financial margins were related to growth rate with the NE/HP diet clearly superior. Small lambs had better margins than larger lambs.
6. Delayed slaughter led to higher carcass fat and higher carcass weights. Carcass fat and conformation were significantly correlated. Conformation classes were also higher for delayed slaughter.
7. Late housing led to higher margins due to higher carcass values and lower food costs resulting from less time housed.

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