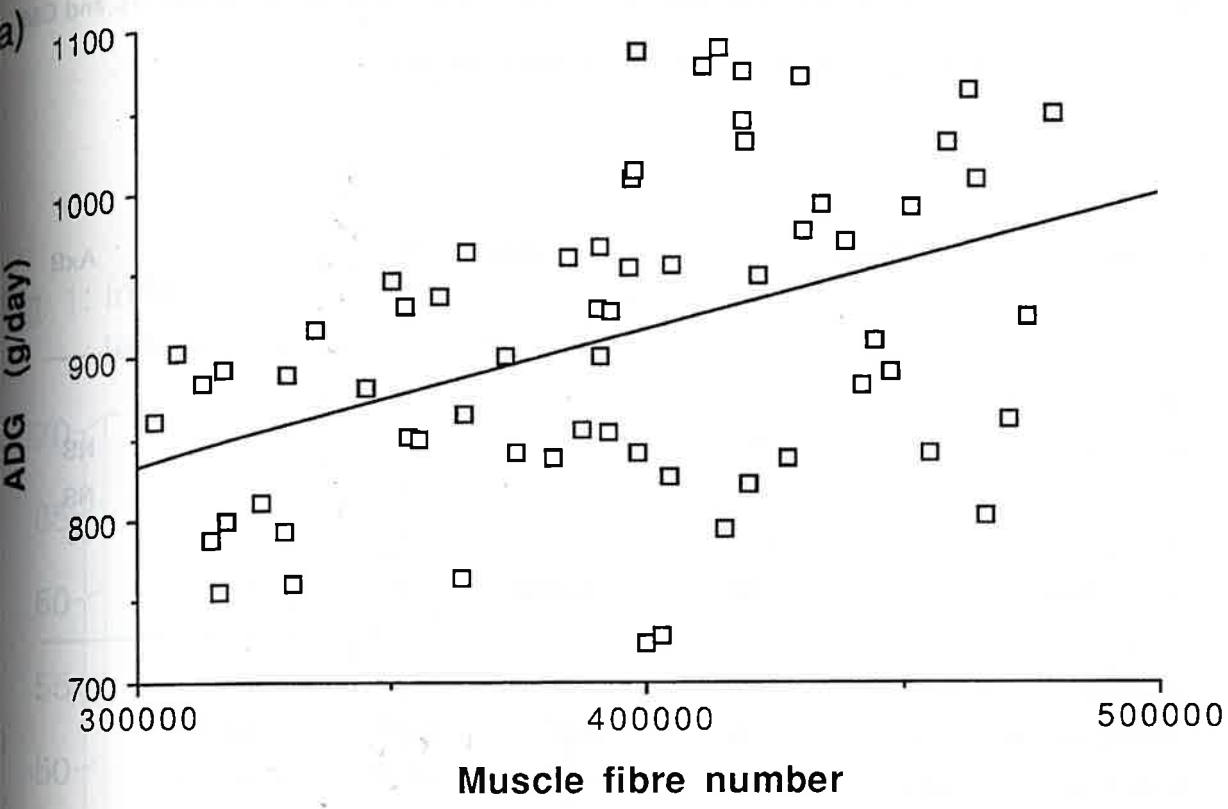

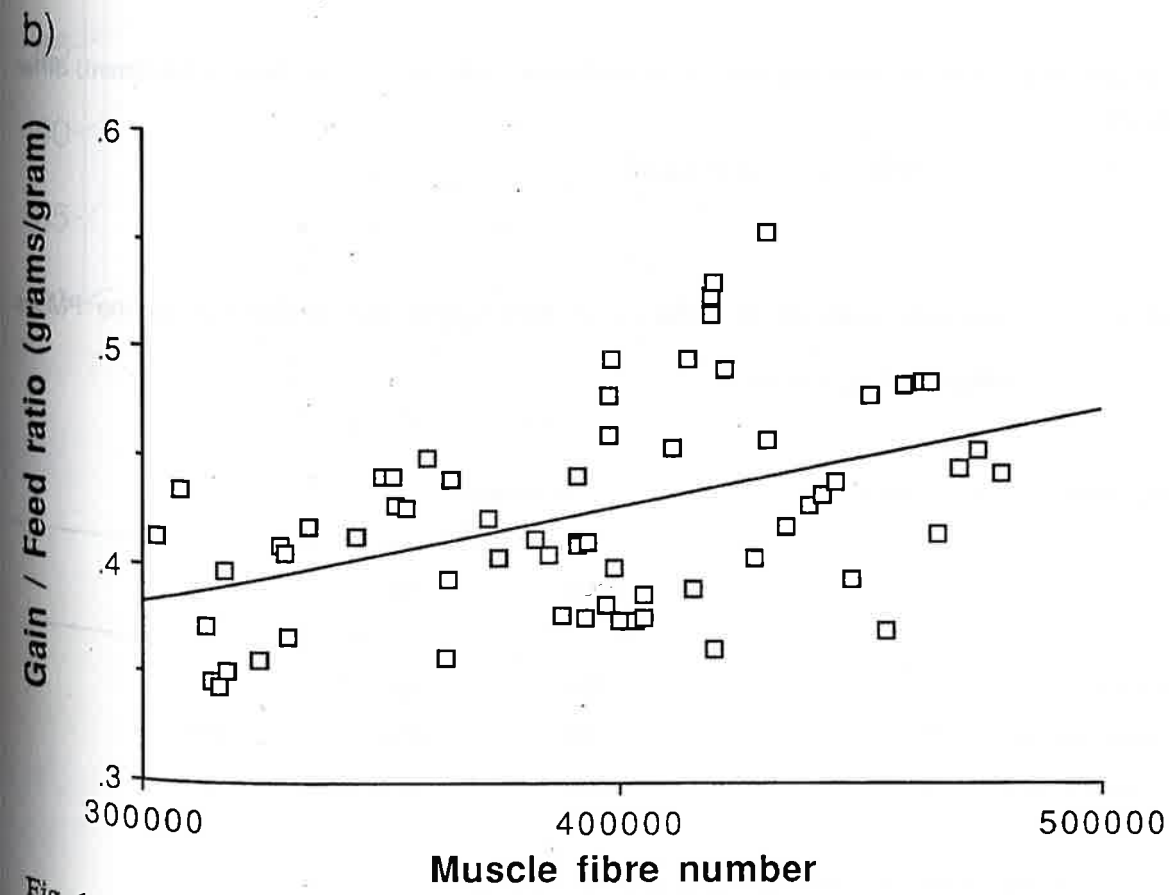

Fig. 1 (a) Average daily gain (ADG) from 25 to 80kg liveweight against total fibre number in the semitendinosus muscle ($r = 0.415$, $P<0.001$); (b) Gain/feed ratio from 25 to 80kg liveweight against total semitendinosus fibre number ($r = 0.419$, $P<0.001$).

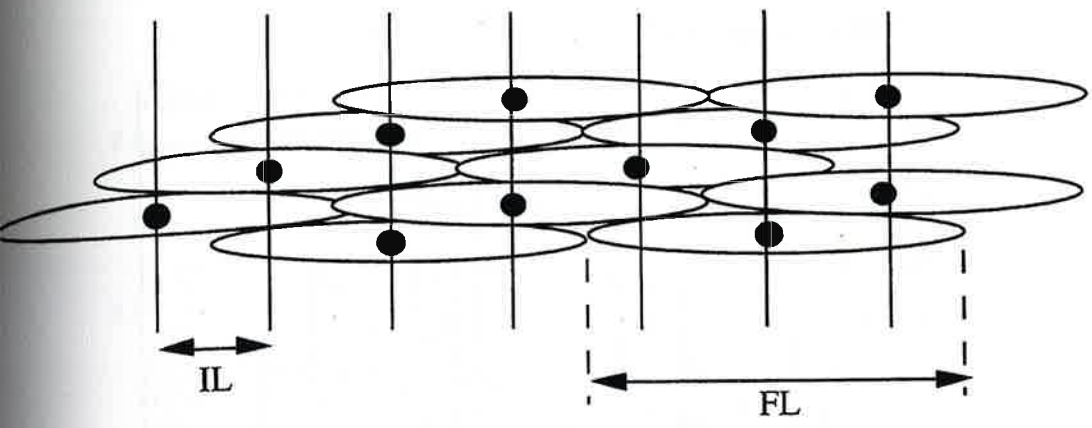

Fig. 1. The staggered overlap arrangement of discontinuous fibres in series fibred muscles. The degree of longitudinal overlap between adjacent fibres (OD) is given by the relationship OD= 1-(IL/FL), where IL is the spacing between motor end plates (black dots) and FL is the fibre length (Trotter, 1993). For bovine sternomandibularis, OD is in the order of 64% (Purslow & Trotter, 1994)

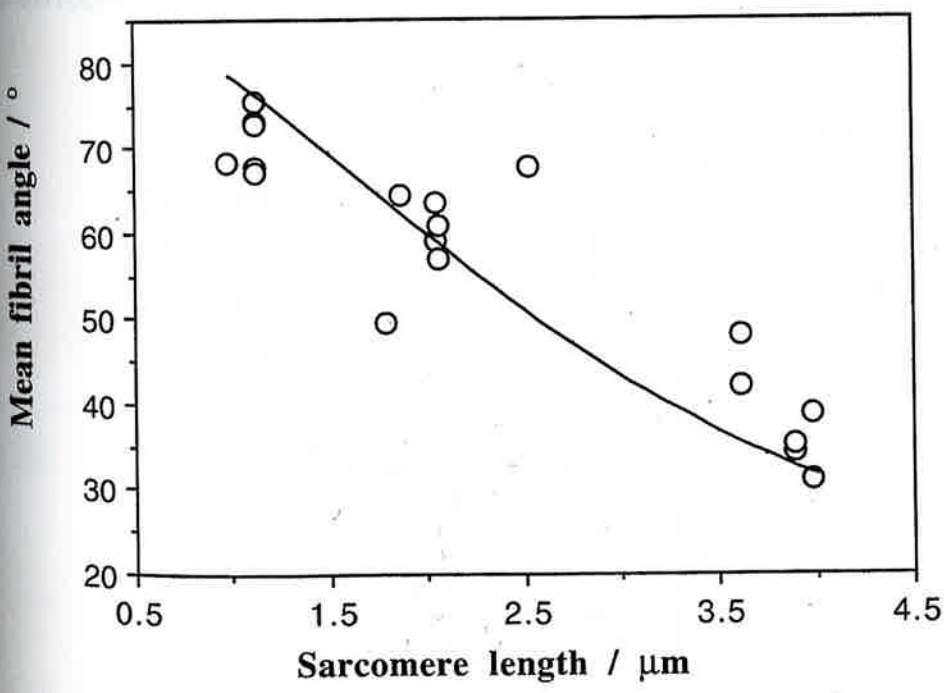

Fig.2. Mean of collagen fibril orientation in endomysium v. muscle sarcomere length. Data points shown are numerically-weighted means from analysed orientation distributions (from Purslow & Trotter, 1994). The line shown is the predicted mean orientation v sarcomere length from the model fitted to perimysial collagen orientation in the same muscle (Purslow, 1989). Adapted from Purslow & Trotter, 1994, with permission.

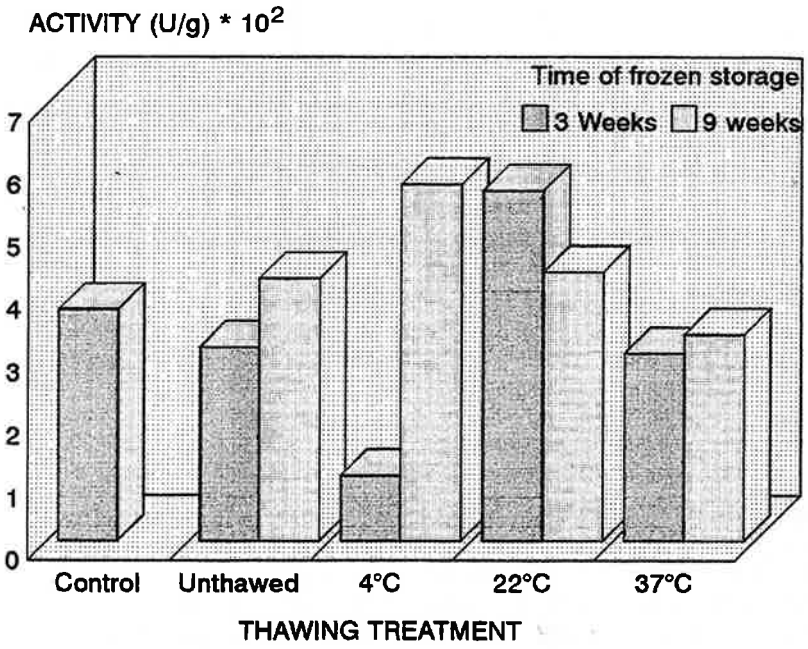

Figure 1. Effect of frozen storage and thawing treatment on Cathepsin D activity.

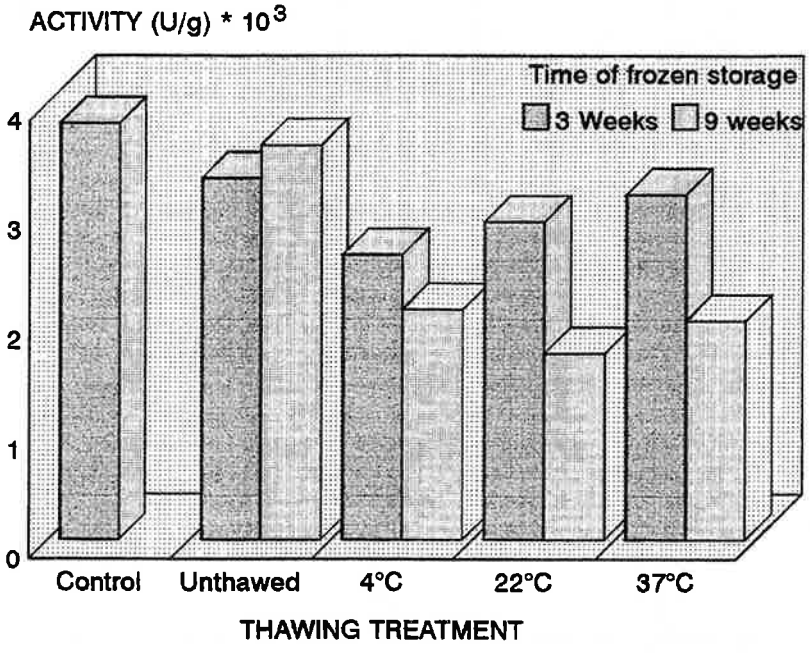

Figure 2. Effect of frozen storage and thawing treatment on Cathepsin H activity.

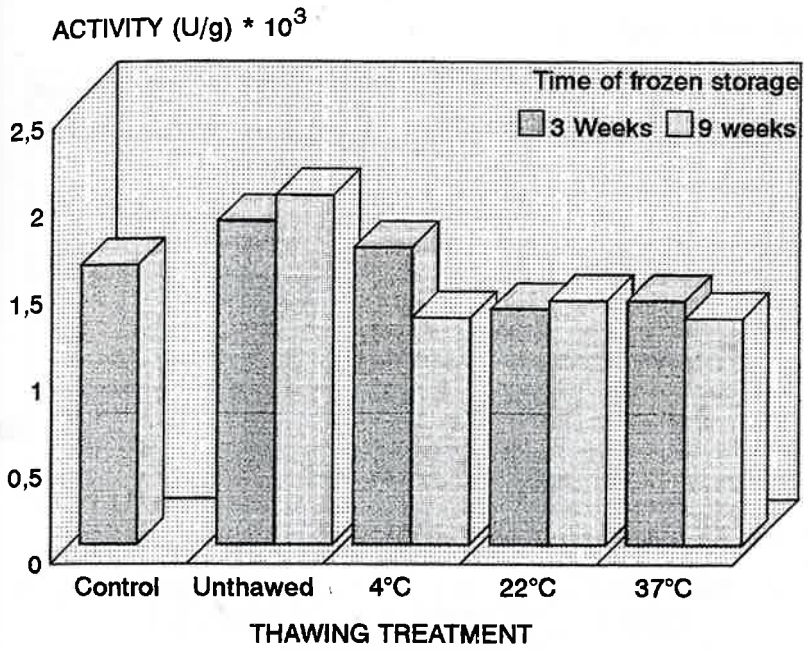

Figure 3. Effect of frozen storage and thawing treatment on Cathepsin B activity.

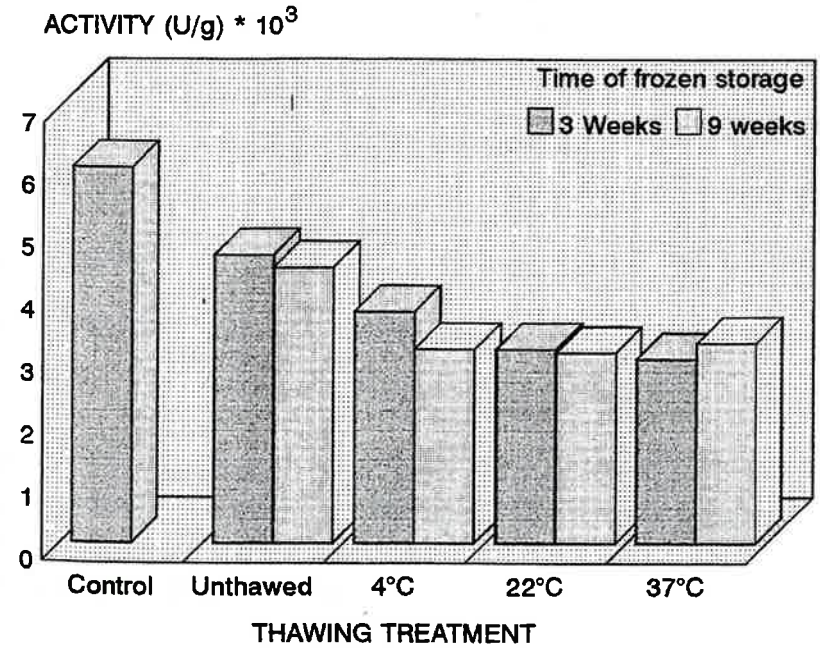

Figure 4. Effect of frozen storage and thawing treatment on Cathepsin B+L activity.

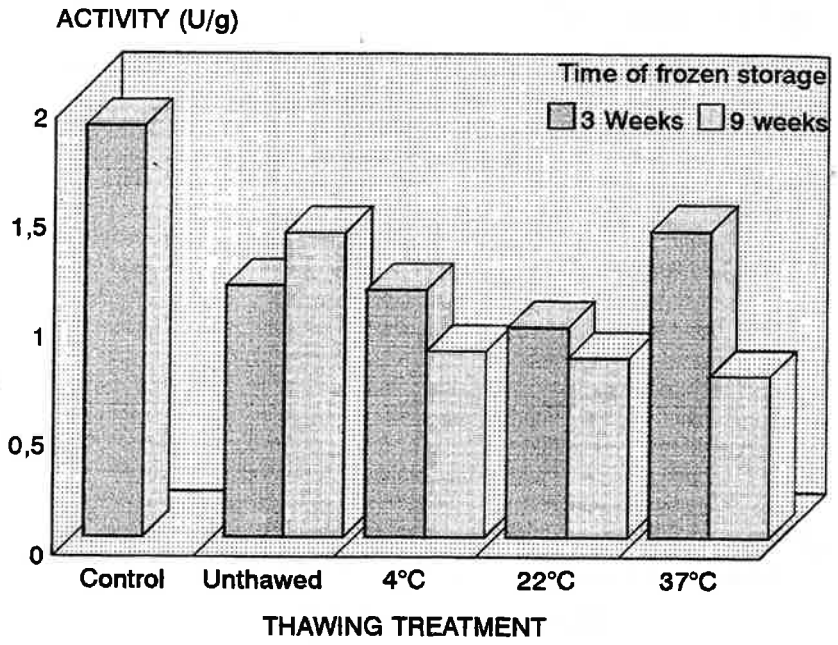

Figure 5. Effect of frozen storage and thawing treatment on alanyl hydrolyzing activity.

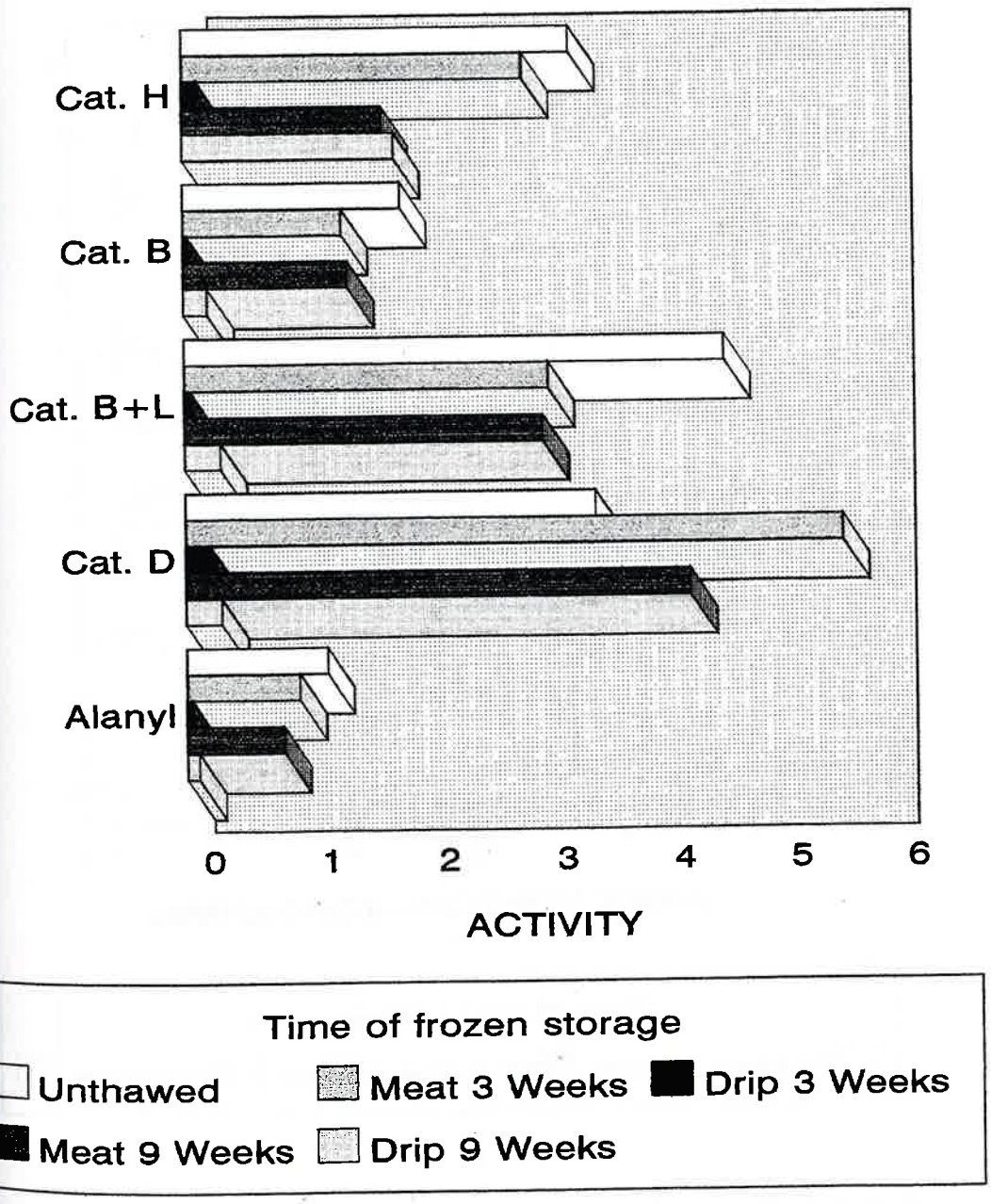

Figure 1. Protease activity in drip loss of frozen pork meat stored for 3 and 9 weeks and thawed at 22°C. Activity of Cathepsin H, B and B+L in U/g * 10^3, Cathepsin D in U/g * 10^2 and Alanyl hydrolyzing activity in U/g.

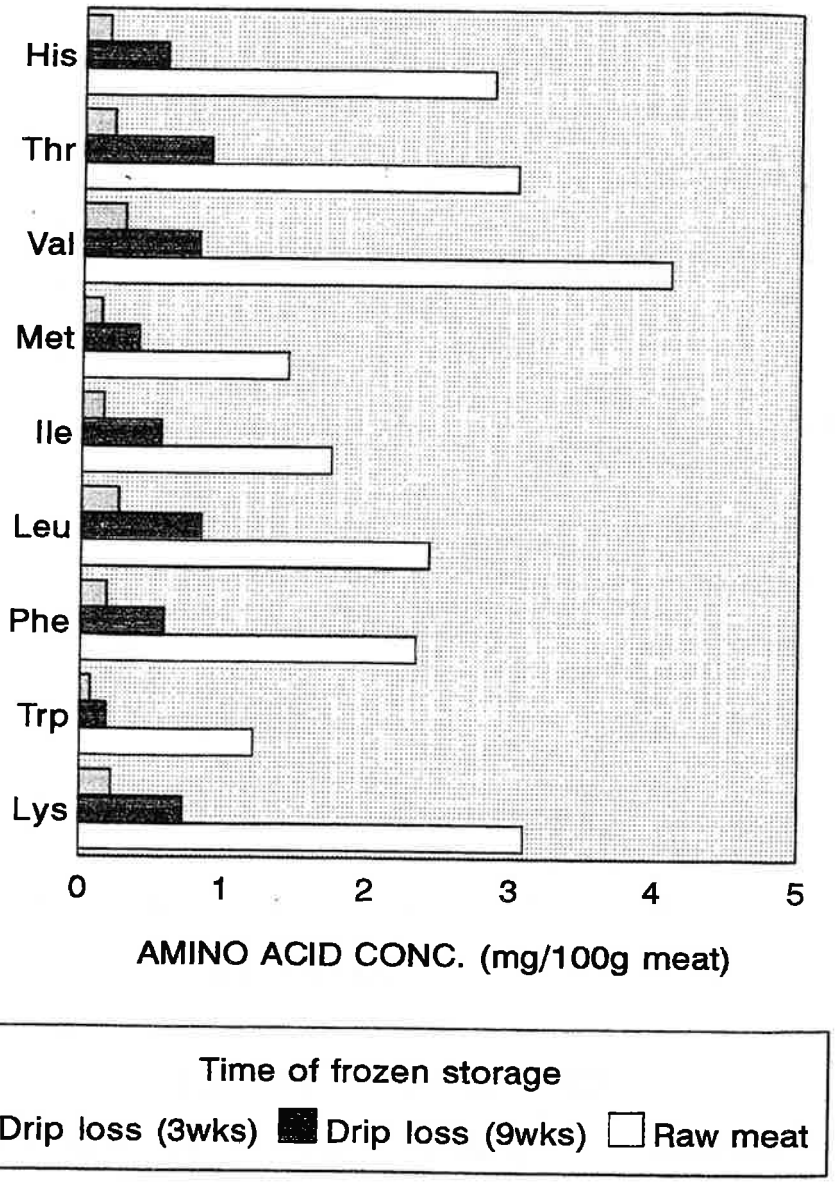

Figure 2. Essential amino acids in drip loss of frozen and thawed pork meat.

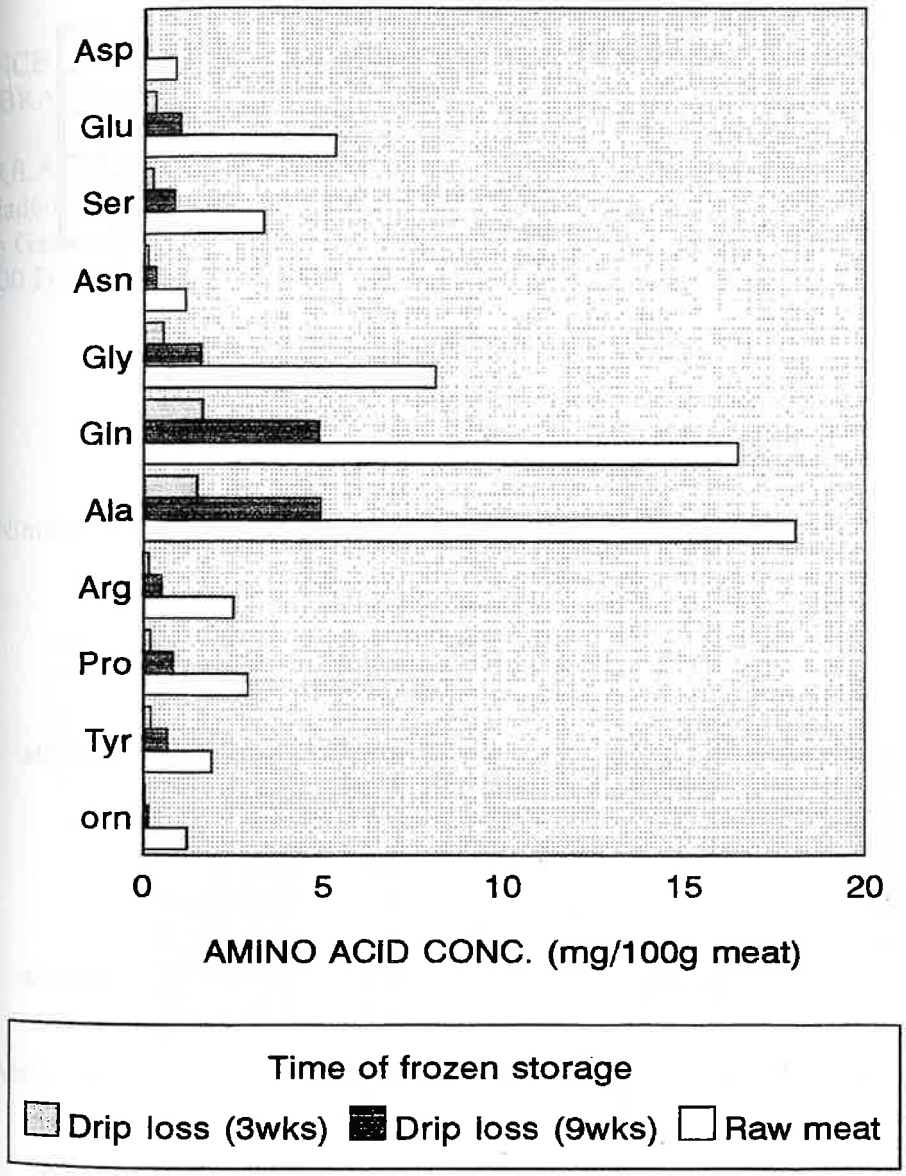

Figure 3. Non-essential amino acids in drip loss of frozen and thawed pork meat.

Species	Probe	Sequence	Satellite	Reference
Chicken	GMRS	GCGTTTTCTCTTCGCAAATCC	CNM	Matzke *et al.*, 1990
Turkey	MMRS	GTATTTGTGGGAGAAAAAGGG	TM	Matzke *et al.*, 1992
Pig	SSAS	ATTGAATCCACTGCATTCAATC	Ac2	Jantsch *et al.*, 1990
Horse	HMSR	CTACTTCAGCCAGATCAGGC	MES	Wijers *et al.*, 1993

Table I: Probes used in this study.

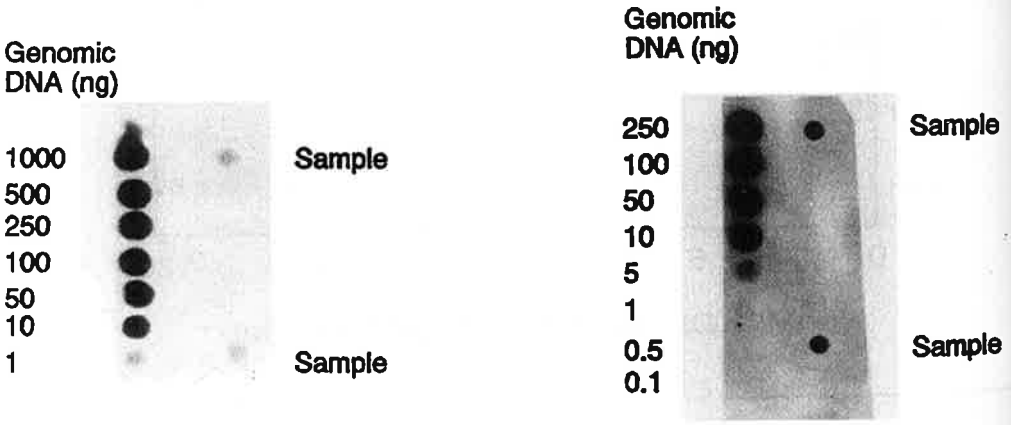

Fig. 1. Hybridizations of the HMSR (left) and the GMRS probe (right) to 2 µl DNA extracted from horse and chicken meat and to DNA standards. The standards consists of known amounts of genomic DNA purified from horse and chicken blood as described by Ciulla *et al.*, 1988).

NCIDENCE OF PSE IN COMMERCIAL PIG CARCASSES IN RIO GRANDE DO SUL STATE, BRAZIL.

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able 1. Number of swine carcasses analysed by pH measurement

actory	Seasons				
	spring	summer	autumn	winter	Total
	215	538	631	565	1949
	108	525	1114	1517	3264
	450	764	775	841	2830
	191	197	199	212	799
otal	964	2024	2719	3135	8842

ble 2. Means and standard deviation of initial pH in accordance to season and factory

ctory	Seasons				
	spring	summer	autumn	winter	Global
	6,04±0,31	5,86±0,31	6,01±0,28	6,03±0,31	5,99
	6,06±0,31	6,12±0,29	5,86±0,33	6,00±0,31	6,01
	6,09±0,27	6,18±0,27	6,02±0,28	6,04±0,28	6,08
	6,22±0,33	6,08±0,30	6,11±0,30	5,91±0,28	6,08
bal	6,10	6,06	6,00	6,00	6,04

Table 3. Analysis of variance of initial pH.

Variables	DF	SS	MS	F-value	R^2
Season	3	16,02	5,34	56,69***	
Factory	3	17,58	5,86	62,21***	
Error	8835	832,26	0,094		0,046

*** P<0,001

Table 4. Frequency (%) of PSE carcasses in accordance to season and factory

Factory	Seasons				
	spring	summer	autumn	winter	Global
01	28,84	56,13	27,73	29,03	35,43
02	24,07	16,38	53,68	33,68	31,95
03	20,22	8,25	24,48	25,56	19,63
04	10,94	26,34	21,82	43,40	25,63
Global	21,01	26,77	31,92	32,97	28,16

Distribution of Halothane genotypes within different PSE classifications

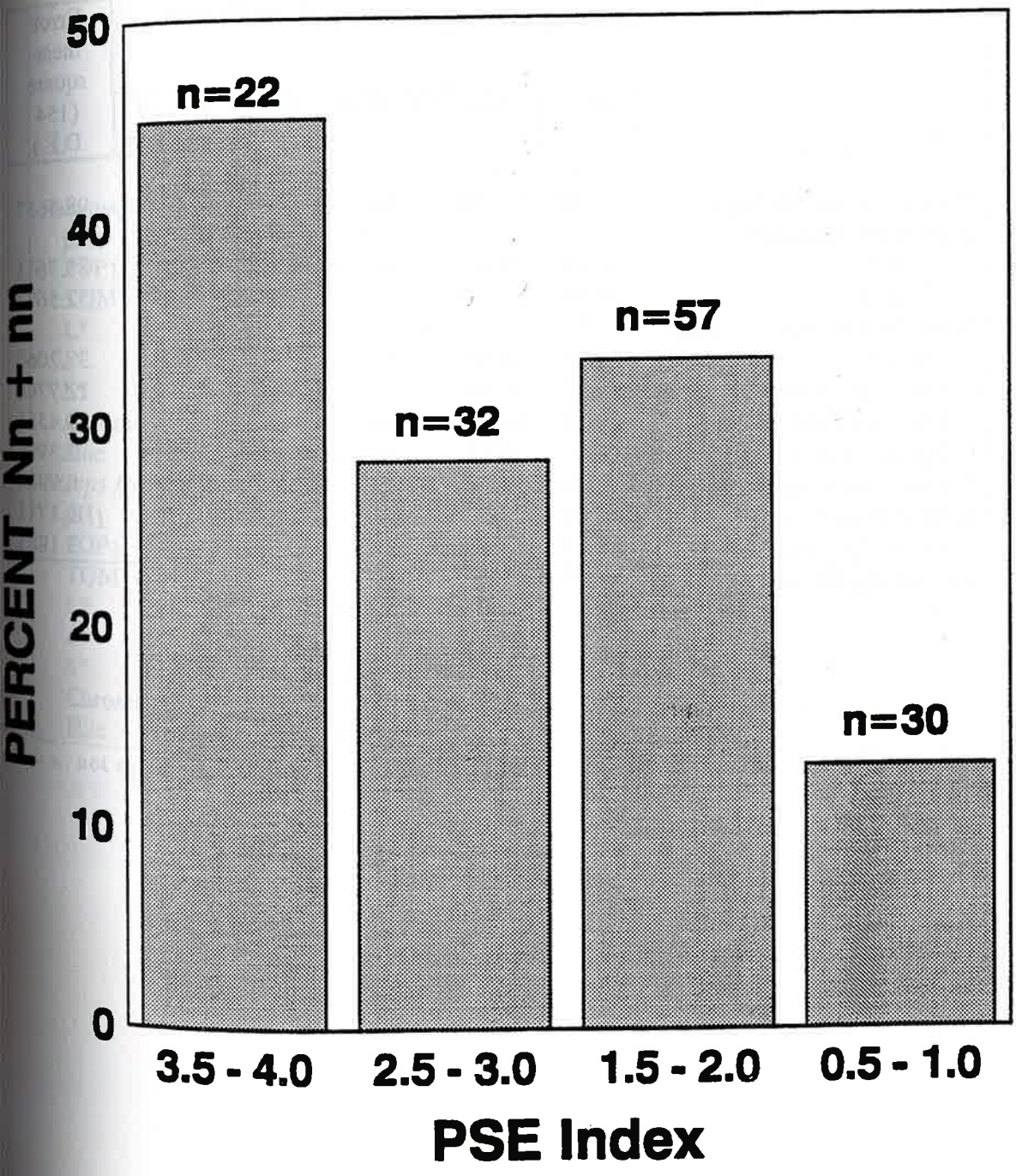

Figure 1. Distribution of Halothane genotypes within different PSE classifications

Table 1. Results of carcass and ham measurements in pigs of different halothane genotype (least squares means)

	Genotype		Level of significance			Error mean square (154 D.F.)
	NN	Nn	Genotype	Sex	Day of slaughter	
n	117	43				
Hot carcass weight (kg)	131.60	131.50	ns	ns	**	98.5657
Backfat tickness (mm):						
- 3/4LV	36.34	34.41	ns	**	ns	85.7611
- 3/4LR	32.03	28.72	*	**	ns	52.5677
Long.dorsi m. tickness (mm):						
- 3/4LR	59.11	62.97	**	*	**	37.2060
Carcass lean meat (%)	47.31	49.16	**	**	*	12.7766
Hot ham weight (kg)	16.38	16.46	ns	ns	ns	1.4351
Refrigerated ham weight (kg)	16.01	16.10	ns	ns	ns	1.3996
Trimmed ham weight (kg)	13.08	13.39	ns	ns	ns	0.9988
Refrigeration loss (%)	2.27	2.15	ns	ns	**	0.1711
Trimming loss (%)	18.05	16.43	**	**	**	3.1881

n.s.: not significant; * P<0.05; ** P<0.01.

Table 2. Results of meat quality measurements on *semimembranosus* and *biceps femoris* muscles at 45 min *post mortem* in pigs of different halothane genotype (least squares means)

	Genotype		Level of significance			Error mean square (154 D.F.)
	NN	Nn	Genotype	Sex	Day of slaughter	
n	117	43				
Semimembranosus m.:						
pH_1	6.33	6.17	**	**	*	0.0571
FOP_1	31.68	33.50	ns	ns	ns	106.0705
TQM_1	3.62	4.02	ns	*	ns	2.5181
L*	43.64	42.29	**	ns	**	6.4160
a*	4.16	5.19	**	ns	**	2.0448
b*	0.76	0.99	*	ns	ns	0.3411
Chroma	4.27	5.33	**	ns	*	2.0192
Hue	0.192	0.197	ns	ns	ns	0.0209
Biceps femoris m.:						
pH_1	6.36	6.20	**	**	**	0.0472
FOP_1	25.50	26.49	ns	**	ns	47.6440
TQM_1	3.05	3.56	*	**	*	1.9124
L*	40.29	39.94	ns	*	**	4.0911
a*	7.10	8.23	**	**	ns	2.9960
b*	2.26	2.65	*	*	ns	0.9721
Chroma	7.49	8.67	**	**	ns	3.4481
Hue	0.306	0.301	ns	ns	ns	0.0095

n.s.: not significant; * $P<0.05$; ** $P<0.01$.

Table 3. Results of meat quality measurements on *semimembranosus* and *biceps femoris* muscles at 24 h. *post mortem* in pigs of different halothane genotype (least squares means)

	Genotype		Level of significance			Error mean square (154 D.F.)
	NN	Nn	Genotype	Sex	Day of slaughter	
n	117	43				
Semimembranosus m.:						
pH_2	5.60	5.56	ns	ns	**	0.0172
FOP_2(1)	40.85	43.49	ns	*	ns	57.4502
TQM_2	6.31	7.96	**	ns	**	6.4475
L*	51.11	49.92	*	ns	**	11.1532
a*	7.23	7.97	*	ns	**	3.1572
b*	4.26	4.44	ns	ns	ns	1.6848
Chroma	8.47	9.18	*	ns	**	3.8223
Tinta	0.536	0.512	ns	ns	**	0.0158
Biceps femoris m.:						
pH_2	5.61	5.60	ns	ns	**	0.0121
FOP_2(1)	39.44	40.22	ns	*	ns	52.2689
TQM_2	7.97	8.98	*	ns	*	4.9319
L*	50.53	50.21	ns	*	**	8.8458
a*	8.71	9.55	*	ns	**	4.2818
b*	5.20	5.59	ns	ns	**	2.0519
Chroma	10.19	11.13	*	ns	*	5.6577
Hue	0.538	0.533	ns	ns	**	0.0073
Pigment content (ppm)(2)	69.80	70.69	ns	ns	ns	265.8991
Filter Paper Press (M/T)(2)	0.369	0.354	*	ns	**	0.0012

n.s.: not significant; * $P<0.05$; ** $P<0.01$.
(1) No. pigs: 89 NN and 31 Nn; D.F.= 114.
(2) No. pigs: 54 NN and 43 Nn; D.F. = 91.

Table 1 LEAST SQUARES MEANS AND STANDARD ERRORS BY PHENOTYPE FOR ANTE-MORTEM BIOPSY AND POST-MORTEM MUSCLE QUALITY TRAITS

	PHENOTYPE		
ANTE-MORTEM	HN(9)	NP(13)	HP(10)
pH contact	6.37[a] ± 0.06	5.90[b] ± 0.05	5.53[c] ± 0.06
WHC (F)	0.36[a] ± 0.01	0.44[b] ± 0.01	0.56[c] ± 0.01
pH pellet	6.54[a] ± 0.05	6.12[b] ± 0.04	5.81[c] ± 0.05
R value[d]	0.91[a] ± 0.02	1.05[b] ± 0.02	1.17[c] ± 0.02
POST-MORTEM			
pH contact	6.29[a] ± 0.10	5.90[b] ± 0.08	5.59[c] ± 0.10
WHC (F)	0.42[a] ± 0.03	0.49[ab] ± 0.02	0.53[b] ± 0.03
pH pellet	6.10[a] ± 0.10	5.77[b] ± 0.08	5.50[c] ± 0.10
R value	0.91[a] ± 0.04	0.99[ab] ± 0.03	1.06[b] ± 0.04
Color	49.20[a] ± 1.10	53.10[b] ± 1.0	57.00[c] ± 1.10
Conductivity	5.90[a] ± 1.10	5.90[a] ± 0.90	12.90[b] ± 1.10
Visual color	3.16[a] ± 0.21	2.21[b] ± 0.19	1.51[c] ± 0.20
Visual firmness	3.23[a] ± 0.23	1.88[b] ± 0.16	1.09[c] ± 0.19
Visual marbling	2.96[a] ± 0.23	2.11[b] ± 0.19	1.12[c] ± 0.22

[a,b,c] different letters means P<0.05

[d] number of observations 8.12 and 10 respectovely

HN homozygous negative, NP heterozygotes, HP homozygous positive

Table 2 LEAST SQUARES MEANS AND STANDARD ERRORS BY PHENOTYPE FOR PRODUCTION AND QUANTITATIVE CARCASS TRAITS

	PHENOTYPE		
	HN(8)	NP(10)	HP(8)
Days, 105 kg	$188^{ab} \pm 5^{ab}$	$183^{a} \pm 4^{a}$	$198^{b} \pm 4^{a}$
ADG weight/day, kg	$0.56^{ab} \pm 0.02^{ab}$	$0.58^{a} \pm 0.01^{a}$	$0.53^{b} \pm 0.0$
Live weight kg	$103.13^{ab} \pm 2.7$	$106.3^{a} \pm 2.2$	$100.7^{b} \pm 2.$
Carcass weight kg	$73.30^{a} \pm 2.0$	$77.5^{b} \pm 1.6$	$73.8^{a} \pm 1.$
Adj. Length (cm)	$79.60^{a} \pm 0.70$	$79.50^{a} \pm 0.50$	$77.80^{b} \pm 0.$
Yield (%)	$70.8^{a} \pm 0.6$	$72.9^{b} \pm 0.4$	$73.3^{b} \pm 0.$
Adj.backfat 10,cm	4.14 ± 0.16	3.86 ± 0.13	$3.92 \pm 0.$
Adj.Muscle area, MLD (cm^2)	$27.80^{b} \pm 2.20$	$34.0^{a} \pm 1.9$	$36.70^{a} \pm 2.$

THE EFFICIENCY OF PREDICTION OF PSE PORK MEAT ON THE BASIS OF HALOTHANE TEST AND HAL-GPI-A1BG-PGD HAPLOTYPING AND PCR/RFLP ANALYSIS

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TABLE 1

Meat quality in pigs dependent on HAL genotype and methods their identification

Traits	Methods of identy-fication Hal gene	HAL genotype		
		NN	Nn	nn
Number of animals	Hal-GPI-A1BG-PGD	30	43	32
	PCR/RFLP analysis	25	51	29
pH_1	Hal-GPI-A1BG-PGD	6.16±0.17 **a**	5.99±0.26 **b**	5.65±0.21 **c**
	PCR/RFLP analysis	6.15±0.20 **a**	5.98±0.26 **b**	5.66±0.25 **c**
R_1	Hal-GPI-A1BG-PGD	0.95±0.11 **a**	1.03±0.14 **a**	1.18±0.15 **b**
	PCR/RFLP analysis	0.93±0.11 **a**	1.02±0.13 **b**	1.21±0.13 **c**
Meat brightness	Hal-GPI-A1BG-PGD	15.76±2.85 **a**	17.70±3.66 **ab**	19.76±3.83 **b**
	PCR/RFLP analysis	15.57±2.40 **a**	17.17±3.54 **a**	20.72±3.51 **b**
% of PSE meat	Hal-GPI-A1BG-PGD	6.67	23.25	71.87
	PCR/RFLP analysis	4.00	21.57	79.31

Results are given as mean±s.d.; means in rows with different superscripts are different at the $P<0.05$ level.

TABLE 2

A significance of associacions between pH_1 and R_1 value and PSE meat on one side and HAL^nHAL^n genotype on the other in relation to the methods of HAL genotypes identification.

Methods of HAL genotype identification	Associacions	χ^2_{1df}	D	D_{max}	Ds	k
Hal-GPI-A1BG-PGD	HAL^nHAL^n-pH_1	39.26**	0.15	0.23	0.64	14.20**
	HAL^nHAL^n-R_1	25.58**	0.13	0.18	0.72	11.18**
	HAL^nHAL^n-%PSE	42.90**	0.17	0.21	0.81	19.20**
PCR/RFLP analysis	HAL^nHAL^n-pH_1	28.95**	0.14	0.15	0.92	12.84**
	HAL^nHAL^n-R_1	33.53**	0.16	0.20	079	15.56**
	HAL^nHAL^n-%PSE	24.20**	0.14	0.17	0.82	11.50**

** - $P<0.01$; D-linkage disequilibrium coefficient; D_S (D/D_{max})-standardized linkage disequilibrium; k-linkage strenght between traits acc. to Hill (1974) formula;

Table 1. Development of pH_1 of M. semimembranosus (SM) and M. longissimus dorsi (LD) of slaughter pigs in 1978, 1985 and 1992 in Austria

year	number	Ø pH_1 of SM	s	Ø pH_1 of LD	s
1978	67	5,99	0,43	5,72	0,35
1985	192	5,95	0,365	5,86	0,32
1992	506	5,98	0,37	6,02	0,40

Table 2. Mean values (Ø) of pH_1 of M. semimembranosus (SM) and of M.longissimus dorsi (LD) of different genotypes

	number	Ø pH_1 of SM	s	Ø pH_1 of LD	s
NN	33	6,05	0,34	6,25	0,30
Nn	87	5,97	0,39	5,99	0,33
nn	29	5,52	0,22	5,58	0,35

Table 3. Mean values of the Creatinkinase activity in different genotypes

genotype	number	Ø creatinkinase activity	s
NN	12	1 859,06 U/l	1 778,57
Nn	30	2 861,08 U/l	3 175,08
nn	10	16 927,17 U/l	18 465,17

Table 4. Lean Percentage (Pfeiffer und Falkenberg) of carcasses with different genotypes

Lean Percentage	NN (n=33)	Nn (n=87)	nn (n=29)
EE ≥ 57%	15,2%	28,7%	45%
E ≤ 57%	42,4%	46,0%	45%
I < 52%	36,4%	16,1%	10%
II < 47%	6,0%	6,9%	0%
III < 42%	0,0%	2,3%	0%

Table 5. Slaughter weight of different genotypes

weight groups	NN (n=33)	Nn (n=87)	nn (n=29)
60-69 kg	0,0%	1,1%	0,0%
70-79 kg	3,0%	11,5%	24,2%
80-89 kg	27,3%	41,4%	44,8%
90-99 kg	60,6%	34,5%	31%
100-110 kg	9,1%	11,5%	0,0%

Table 6. The comparison of MHS-genotypes

pH_1 of SM	NN	Nn
Nn	0,89	
nn	4,61**	4,60**
pH_1 of LD		
Nn	3,48**	
nn	7,30**	5,31**
Conductivity of SM		
Nn	1,07	
nn	5,48**	5,46**
Conductivity of LD		
Nn	0,12	
nn	5,65**	6,57**
WHC of SM		
Nn	1,18	
nn	5,21**	5,04**
Creatinkinase activity		
Nn	2,54*	
nn	7,28**	5,77**

Distribution-free multiple comparisons based on Kruskal-Wallis Rank Sums.

Approximations by Dunn

z (.05/k/[k-1]) = 2,40

z (.01/k/[k-1]) = 2,94

Table 1. Carcass and meat quality traits in pigs with or without the RN-gene

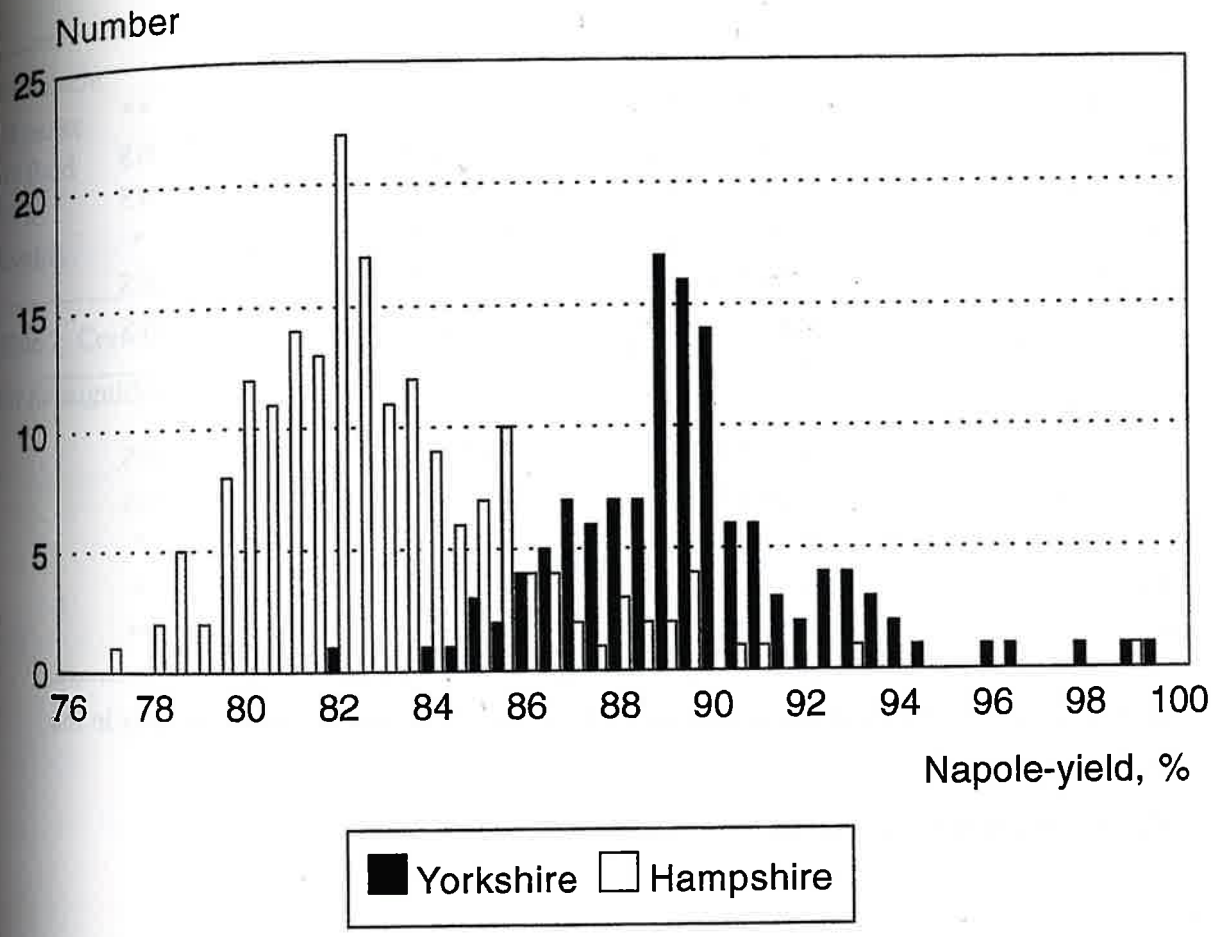
Trait	RN^-rn^+	rn^+rn^+	Level of significance
Lean meat, % at grading	61.3	61.5	n.s.
Carcass weight, kg[1]	73.3	73.2	n.s.
Lean meat and bone in back and ham, %[2]	39.3	38.9	*
pH_u LD	5.34	5.47	***
pH_u BF	5.44	5.68	***
Reflectance value			
EEL	20.9	19.4	***
FOP_{LD}	44.8	39.6	***
FOP_{BF}	41.8	34.5	***
Drip loss, %	5.8	4.8	***
Cooking loss, %	31.5	27.9	*
Napole yield, %	83.0	89.4	***
Protein extractability, mg/g wet weight			
Total	149.9	165.0	**
Sarcoplasmic	59.7	67.2	***
Glycolytic potential, µmol/g	222.4	141.6	***
Glycogen + glucose + glucose-6-P, µmol/g	57.1	20.2	***
Lactate, µmol/g	106.3	102.9	***
Shear force, kg/cm^2	3.5	3.8	**
Sensory testing[3]			
Tenderness	3.3	3.3	n.s.
Taste intensity	3.4	3.1	**
Smell intensity	3.2	2.8	**
Acidity	3.2	2.8	**

[1] Weight without head. [2] Percent of carcass without head. [3] Scale: 1 (low) to 5 (high).
Level of significance: n.s. = $P > 0.05$; * = $P \leq 0.05$; ** = $P \leq 0.01$; *** = $P \leq 0.001$.

Table 1. Technological meat quality in Hampshire (n=126) and Yorkshire (n=100) pigs.

Variable	Breed		Sign[a]
	Yorkshire	Hampshire	
Napole yield (%)	89.4	83.5	***
Cooking loss (%)	23.2	26.0	***
Shear force value (kg/cm^2)	4.4	4.1	**
Drip loss (%)	5.0	6.9	***
Filter paper wetness[b]	1.4	2.1	***
EEL-Y (400-700 nm)	19.0	18.6	n.s.
EEL-605 (550 nm)	26.5	25.2	n.s.
EEL-609 (680 nm)	18.1	19.0	*
FOP (900 nm)	32.9	35.0	**
pH_u	5.54	5.41	***
GP (µmol/g wet wt)	148	228	***
Lactate (µmol/g wet wt)	101	102	n.s.

[a] Level of significance: n.s. $p>0.05$, * $p<0.05$, ** $p<0.01$, *** $p<0.001$.
[b] The scores range from 0 (best) to 5 (worst).


Number
25
20
15
10
5
0
76
78
80
82
84
86
88
90
92
94
96
98
100
Napole-yield, %
Yorkshire
Hampshire

	Halothane-positive (n = 7)	Halothane-negative (n = 5)	P
Biopsy			
pH biopsy	5.66 ± 0.06	5.95 ± 0.18	**
pH pellet	5.74 ± 0.14	5.95 ± 0.35	NS
pH fluid	5.80 ± 0.11	6.01 ± 0.32	NS
WHC	0.50 ± 0.05	0.44 ± 0.05	*
R value	1.16 ± 0.05	1.08 ± 0.04	NS
soluble protein %	9.19 ± 1.37	10.16 ± 0.30	NS
Post mortem			
pH biopsy	5.55 ± 0.13	5.72 ± 0.33	NS
pH pellet	5.64 ± 0.19	5.92 ± 0.35	NS
pH fluid	5.63 ± 0.21	6.01 ± 0.32	*
WHC	0.53 ± 0.08	0.44 ± 0.05	*
R value	1.20 ± 0.05	1.08 ± 0.04	**

Table 1. Effects of the HAL phenotype on traits of biopsy and post mortem samples in the Pietrain pigs.

NS: nonsignificant; * $P < 0.05$; ** $P < 0.01$

	pH biopsy	pH pellet	pH fluid	WHC	R value
pH muscle	0.78	0.89	0.74	-0.58	-0.43 (NS)
pH pellet	0.74	0.87	0.70	-0.62	-0.38 (NS)
pH fluid	0.66	0.87	0.64	-0.53 (NS)	-0.32 (NS)
WHC	-0.66	-0.74	-0.40 (NS)	0.73	0.45 (NS)
R value	-0.72	-0.68	-0.49 (NS)	0.90	0.76

Table 2. Correlations between biopsy and post mortem (1 hour) data in the Pietrain pigs.

NS: nonsignificant at the $P < 0.05$ level

	pH biopsy	pH pellet	WHC
pH muscle	-0.92	0.94	-0.86 (NS)
pH pellet	0.95	0.96	-0.80 (NS)
pH fluid	0.81 (NS)	0.96	-0.83 (NS)
WHC	-0.72 (NS)	-0.95	0.89
R value	-0.80 (NS)	-0.87	0.96

Table 3. Correlations between biopsy and post mortem data in the halothane-negative pigs.

NS: nonsignifincant at the $P < 0.05$ level

	rn+ (n = 6)	RN- (n = 6)	P
sy	6.36 ± 0.22	6.29 ± 0.17	NS
iopsy	0.36 ± 0.03	0.41 ± 0.03	*
C	1.05 ± 0.06	1.06 ± 0.07	NS
lue	9.83 ± 0.67	8.95 ± 0.02	**
ble protein %			
mortem			
iopsy	5.40 ± 0.13	5.35 ± 0.33	NS
C	0.59 ± 0.03	0.60 ± 0.02	NS
ble protein %	8.56 ± 0.49	7.00 ± 0.88	**

e 4. Effects of the RN phenotype on traits of biopsy and post mortem samples in the Pen Ar pigs.

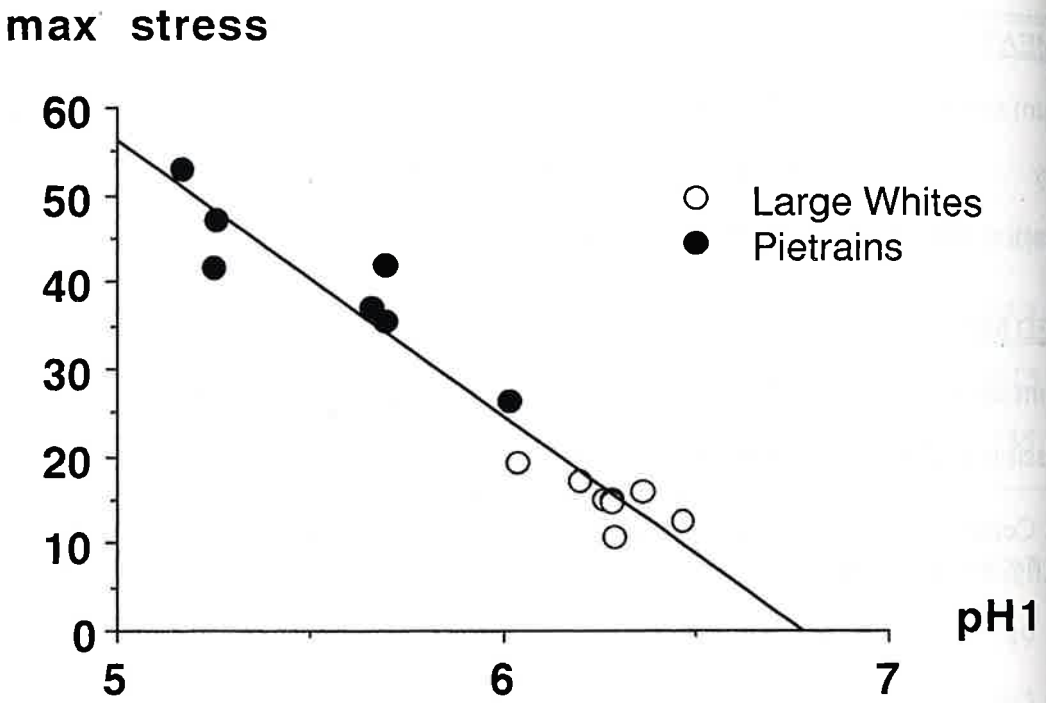
nonsignifincant; * $P < 0.05$; ** $P < 0.01$

	BREED			DAY POST MORTEM					
	LW	P	F(1)	1	2	3	6	14	F(2)
RAW MEAT									
pH1	6.28	5.54	**						
pH2	5.32	5.30	NS						
sarcomere length (µm)	1.83	1.85	NS	1.80	1.84	1.82	1.88	1.85	NS
maximum stress (N/cm^2)	16.1	38.5	**	28.1	27.6	26.9	26.3	27.7	NS
elasticity	0.12	0.12	NS	0.11	0.11	0.12	0.12	0.15	NS
compression modulus	77	200	**	146	134	139	120	135	NS
COOKED MEAT									
cooking loss %	32.5	33.0	NS	32.7	32.4	33.2	32.8	32.7	NS
maximum stress (N/cm^2)	158	203	**	209	191	183	171	149	*
compression modulus	154	231	**	183	189	202	215	163	NS

Table 1. pH values, sarcomere length and mechanical traits in meat from Large White and Pietrain pigs at various ageing time.
(1) significance of the breed effect, and (2) significance of the time effect: NS non-significant; * $P < 0.05$; ** $P < 0.01$

	DAY POST MORTEM				
	1	2	3	6	14
RAW MEAT					
maximum stress	-0.91**	-0.97**	-0.91**	-0.91**	-0.69**
elasticity	0.15	0.14	0.26	0.00	0.14
compression modulus	-0.94**	-0.92**	-0.89**	-0.93**	-0.40
COOKED MEAT					
maximum stress	-0.38	-0.27	-0.35	-0.18	-0.50
compression modulus	-0.76**	-0.62**	-0.33	-0.06	-0.29

Table 2. Correlations between pH1 and mechanical traits measured at various ageing times.
* $P < 0.05$; ** $P < 0.01$


max stress
60
50
40
30
20
10
0
5
6
7
pH1
Large Whites
Pietrains

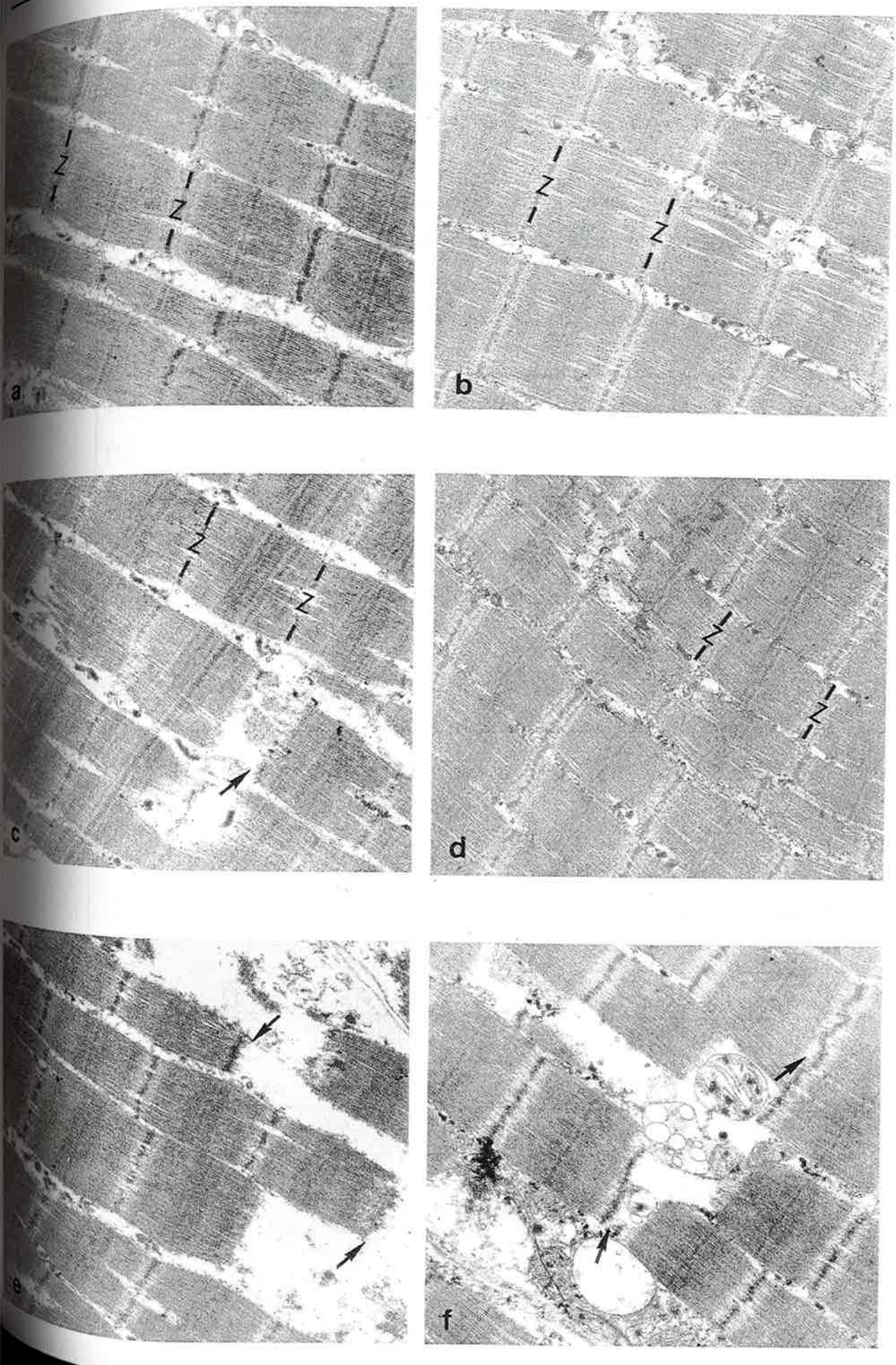

a
b
c
d
e
f

Figure 2. Electron micrographs of *longissimus* from Large White (left pictures) and Pietrain pigs (right pictures) at days 1 (a, b), 6 (c,d) and 14 (e, f) *post mortem*.

x 15500

Z-disk weakening is observrd in both types of pigs. Fragmentation of myofibrils (indicated by arrows) are seen more frequently in ageing tissue of Large Whites.;

Table 1: FOP and pH values (LSM±SE) in *m. longissimus dorsi* (MLD) and *m. semimembranosus* (MSM) in different pig breeds

Traits	Duroc	Large White	German Landrace	Swedish Landrace
FOP_{24MLD}	37.94 ± 1.93^{a}	28.48 ± 1.93^{b}	35.25 ± 1.93^{ac}	31.79 ± 1.94^{bc}
FOP_{24MSM}	33.31 ± 2.05^{ab}	28.43 ± 1.99^{a}	34.33 ± 2.03^{b}	29.69 ± 2.00^{ab}
pH_{24MLD}	5.48 ± 0.05^{a}	5.64 ± 0.05^{b}	5.64 ± 2.03^{b}	5.53 ± 0.05^{ab}
pH_{24MSM}	5.55 ± 0.05^{a}	5.80 ± 0.05^{b}	5.70 ± 0.05^{b}	5.71 ± 0.05^{b}

Values marked with different letters indicate statistically significant differences (P<.05)

Table 2: Relative fibre area (LSM±SE) in *m. longissimus dorsi* (MLD) and *m. semimembranosus* (MSM) in different pig breeds

Muscle/Fibre Type	Duroc	Large White	German Landrace	Swedish Landrace
MLD				
1	7.95 ± 0.41^{a}	6.73 ± 0.41^{b}	7.21 ± 0.40^{ab}	6.35 ± 0.39^{b}
2A	7.16 ± 0.46^{a}	5.50 ± 0.45^{b}	5.80 ± 0.44^{b}	4.67 ± 0.43^{b}
2B	84.69 ± 0.65^{a}	87.76 ± 0.64^{b}	86.91 ± 0.62^{b}	88.56 ± 0.61^{b}
MSM				
1	5.79 ± 0.41^{a}	4.49 ± 0.41^{b}	5.10 ± 0.40^{ab}	4.98 ± 0.39^{ab}
2A	6.90 ± 0.46^{a}	6.85 ± 0.45^{a}	6.27 ± 0.44^{ab}	5.15 ± 0.43^{b}
2B	87.13 ± 0.65^{a}	88.85 ± 0.64^{ab}	88.77 ± 0.62^{ab}	89.58 ± 0.61^{b}

Values marked with different letters indicate statistically significant differences (P<.05)

Experimental scheme

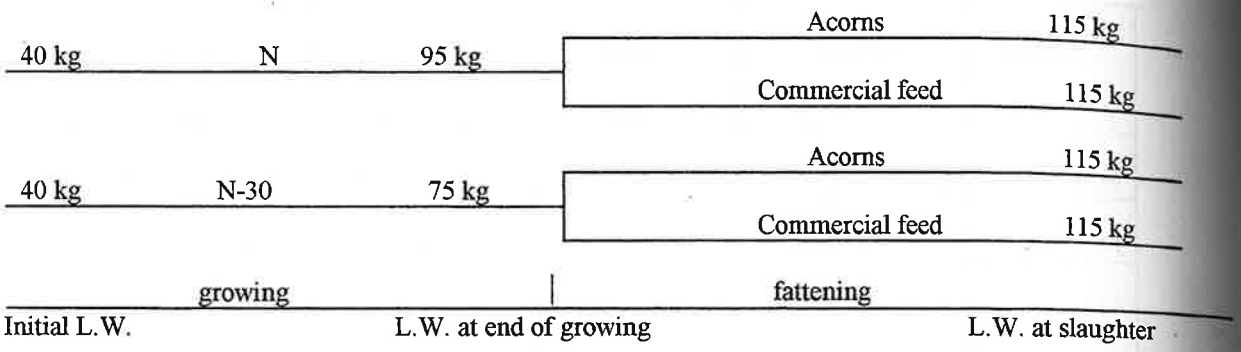


Table 1. Chemical composition of diets used in the trial (% DM)

	DM	Ash	CP	E.E.	NFE	CF	Dig. Energy	C16:0	C16:1	C18:0	C18:1	C18:2	C18:3
Acorn (pulp)	65	3,3	6,4	8,8	77,6	4,4	2800	12,95	0,26	4,43	61,8	17,71	1,33
Commercial feed	91	3,0	17,3	6,1	45,1	28,5	3150	20,48	1,34	10,83	30,49	30,82	2,26

ble 2. Effect of the level of intake during growing on muscle characteristics

	Acorns			Commercial feed		
	N	N-30%	Signif.	N	N-30%	Signif.
ater (%P)	72,25	72,99	ns	72,97	71,91	ns
pid (%P)	4,08	4,13	ns	3,44	3,96	ns
otein (%)	22,15	21,54	ns	21,92	21,54	ns
	41,93	44,45	ns	43,06	42,45	ns
	15,64	14,86	ns	14,65	15,76	ns
	9,61	10,13	ns	9,62	9,67	ns
ue*	31,55	34,41	ns	33,45	31,63	ns
oma*	18,43	18,02	ns	17,56	18,51	ns
turation*	0,44	0,41	ns	0,415	0,440	ns
HC	21,46	22,37	ns	21,17	20,59	ns
24	5,57	5,54	ns	5,67	5,55	ns
ear force	7,61	7,00	ns	7,43	5,26	ns
4:0	1,37	1,35	ns	1,46	1,46	ns
6:1	3,74	3,6	ns	3,79	3,48	ns
6:0	25,13	25,43	ns	25,91	25,67	ns
8:0	9,64	10,02	ns	10,50	10,71	ns
8:1	51,77	52,00	ns	49,39	49,12	ns
8:2	5,84	5,21	ns	6,53	6,89	ns
8:3	0,62	0,53	P<0,05	0,65	0,68	ns
sat.	63,56	62,94	ns	61,72	61,76	ns
onounsat.	56,4	56,47	ns	54,05	53,47	ns
lyunsat	7,16	6,47	ns	7,67	8,29	ns
lyunsat./Sat	0,20	0,17	ns	0,20	0,19	ns

Table 3 : Effect of the level of intake during growing on subcutaneous fat characteristics

	Acorns			Commercial feed		
	N	N-30%	Signif.	N	N-30%	Signif.
Water (%P)	5,15	5,63	ns	5,84	6,48	ns
Lipid (%P)	93,89	93,43	ns	93,17	92,41	ns
FFDM	1,01	0,94	ns	1,05	1,18	ns
L*	80,25	80,21	ns	78,83	79,33	ns
a*	0,34	0,17	ns	0,59	0,73	ns
b*	4,33	4,55	ns	4,61	4,66	ns
Tono*	85,28	88,21	ns	83,70	81,70	ns
Croma*	4,36	4,57	ns	4,68	4,74	ns
Saturation*	0,054	0,056	ns	0,06	0,06	ns
C14:0	1,41	1,27	P<0,001	1,49	1,45	ns
C16:1	1,57	1,42	P<0,05	1,62	1,55	ns
C16:0	20,34	19,98	ns	21,05	20,06	P<0,05
C18:0	9,88	9,58	ns	10,77	9,92	ns
C18:1	50,05	52,69	P<0,001	44,51	44,72	ns
C18:2	12,13	10,82	P<0,001	15,25	16,62	P<0,001
C18:3	1,23	1,12	P<0,01	1,47	1,56	ns
Unsat	67,88	68,79	ns	66,17	68,04	P<0,05
Monounsat	53,09	55,58	P<0,01	47,63	47,78	ns
Polyunsat	14,79	13,21	P<0,001	18,54	20,27	ns
Polyunsat./Sat.	0,464	0,425	P<0,05	0,550	0,640	P<0,01

le 4 . Diet effect on muscle characteristics

	N			N-30%		
	Acorns	Commercial feed	Signif.	Acorns	Commercial feed	Signif.
er (%P)	72,25	72,97	ns	72,99	71,91	ns
d (%P)	4,08	3,44	ns	4,13	3,96	ns
ein (P%)	22,15	21,92	ns	21,54	21,54	ns
	41,93	43,06	ns	44,45	42,45	ns
	15,64	14,65	ns	14,86	15,76	ns
	9,61	9,62	ns	10,13	9,67	ns
*	31,55	33,45	ns	34,41	31,63	ns
ma*	18,43	17,56	ns	18,02	18,51	ns
ration*	0,444	0,415	ns	0,41	0,44	ns
I C	21,46	21,17	ns	22,37	20,59	ns
:4	5,57	5,67	ns	5,54	5,55	ns
ar force	7,61	7,43	ns	7	5,26	ns
:0	1,37	1,46	ns	1,35	1,46	ns
:1	3,74	3,79	ns	3,6	3,48	ns
:0	25,13	25,91	ns	25,43	25,67	ns
:0	9,64	10,5	ns	10,02	10,71	ns
:1	51,77	49,39	P<0,01	52	49,12	P<0,001
:2	5,84	6,53	ns	5,21	6,89	P<0,05
:3	0,62	0,65	ns	0,53	0,68	P<0,05
at	63,56	61,72	ns	62,94	61,76	ns
nounsat	56,4	54,05	P<0,01	56,47	53,47	P<0,05
unsat	7,16	7,67	ns	6,47	8,29	P<0,05
unsat/Sat.	0,2	0,2	ns	0,17	0,22	ns

Table 5 . Diet effect on fat characteristics

	N			N-30%		
	Acorns	Commercial feed	Signif.	Acorns	Commercial feed	Signif.
Water (%P)	5,15	5,84	P<0,05	5,63	6,48	P<0,05
Lipid (%P)	93,89	93,17	P<0,05	93,43	92,41	P<0,05
FFDM	1,01	1,05	P<0,05	0,94	1,1	P<0,05
L*	80,52	78,83	P<0,001	80,21	79,33	ns
a*	0,34	0,59	ns	0,17	0,73	P<0,01
b*	4,32	4,61	ns	4,55	4,66	ns
Hue*	85,28	83,04	ns	88,21	81,7	P<0,01
Croma*	4,36	4,68	ns	4,57	4,73	ns
Saturation*	0,05	0,06	ns	0,06	0,06	ns
C14:0	1,41	1,49	P<0,05	1,27	1,45	P<0,001
C16:1	1,57	1,62	ns	1,42	1,55	P<0,05
C16:0	20,34	21,05	ns	19,98	20,06	ns
C18:0	9,88	10,77	ns	9,58	9,91	ns
C18:1	50,05	44,5	P<0,001	52,69	44,72	P<0,001
C18:2	12,13	15,25	P<0,001	10,82	16,62	P<0,001
C18:3	1,23	1,47	P<0,001	1,12	1,56	P<0,001
Unsat	67,88	66,17	ns	68,79	68,05	ns
Monounsat	53,09	47,63	P<0,001	55,58	47,78	P<0,001
Polyunsat	14,79	18,54	P<0,001	13,21	20,27	P<0,001
Polyunsat./Sat.	0,46	0,55	P<0,001	0,43	0,64	P<0,001

Table 2: Evolution of chemical composition of subcutaneous fat with slaughter weight

	95 Kg L.W.	115 Kg L.W.	130 KgL.W.	Signif.
Water (%P)	6,11a	5,15b	5,23b	P<0,05
Lipids (%P)	92,47a	93,89b	93,73b	P<0,01
FFDM	1,42a	1,01b	1,05b	P<0,01
L*	80.97	80.52	81.27	ns
a*	2,3a	0,34b	-0,52c	P<0,001
b*	5,82a	4,33b	4,64b	P<0,05
Hue*	68,81a	85,28b	96,54c	P<0,001
Croma*	6,29a	4,36b	4,69b	P<0,001
Saturation*	0,078a	0,054b	0,058b	P<0,001
C14:0	1.68	1.41	1.35	ns
C16:1	1,82a	1,57b	1,50b	P<0,01
C16:0	22,17a	20,34b	19,79b	P<0,001
C18:0	10,8a	9,88b	9,29b	P<0,001
C18:1	46,14a	50,05b	52,9c	P<0,001
C18:2	12,89a	12,13a	11,07b	P<0,01
C18:3	1,07b	1,23a	1,03b	P<0,001
Unsat	64,76a	67,88b	69,13b	P<0,001
Monounsat.	49,41a	53,09b	55,84c	P<0,001
Polyunsat.	15,35a	14,79b	13,29c	P<0,01
Polyunsat/Sat.	0,44c	0,46b	0,43b	P<0,01

Table 3. Chemical composition of the outer and inner layers of backfat and subcutaneous ham fat

	Backfat			Ham		
	Outer	Inner	Signif.	Outer	Inner	Signif.
Water (%P)	5.70	4.25	P<0,001	5.47	6.13	ns
Lipid (%P)	92.89	94.95	P<0,001	93.33	92.81	ns
FFDM	1.50	0.83	P<0,001	1.26	1.12	ns
L*	79.78	80.39	ns	81.09	82.23	P<0,05
a*	1.07	0.69	ns	0.60	0.47	ns
b*	5.08	4.88	ns	4.89	4.86	ns
Hue*	80.66	83.49	ns	84.46	85.57	ns
Croma*	5.36	5.06	ns	5.07	4.96	ns
Saturation*	0.067	0.063	ns	0.063	0.060	ns
C14:0	1.36	1.33	P<0,05	1.37	1.40	ns
C16:1	1.63	1.42	P<0,05	1.60	1.76	ns
C16:0	20.19	21.56	P<0,001	19.86	21.61	P<0,05
C18:0	9.26	11.65	ns	9.37	10.52	ns
C18:1	50.97	48.96	P<0,05	51.31	49.69	ns
C18:2	11.87	10.92	P<0,05	11.78	11.05	ns
C18:3	1.13	1.08	ns	1.14	1.04	ns
Unsaturated	68.70	65.03	P<0,01	68.93	66.00	P<0,05
Monounsat.	54.22	51.79	P<0,05	54.58	52.76	ns
Polyunsat.	14.48	13.24	P<0,05	14.35	13.24	ns
Polyunst./Sat	0.47	0.38	P<0,001	0.47	0.39	P<0,01

Table 4: Fatty acid composition of backfat three layers on pigs slaughtered at 130 Kg LW

	outer	inner	third	Signif.
C12:0	0.14	0.14	0.16	ns
C14:0	1.35	1.32	1.36	ns
C16:1	1.5	1.28	1.39	ns
C16:0	19,16a	20,72b	21,72b	P<0,01
C18:0	8,51a	10,84b	11,29b	P<0,001
C18:1	53,68a	51,45b	50,81b	P<0,05
C18:2	11,46b	10,56ab	9,96a	P<0,05
C18:3	1.04	1.02	0.96	ns
Unsat	70,51a	66,79b	65,2c	P<0,001
Monounsat	56,73a	54,12b	53,34b	P<0,01
Polyunsat	13,78b	12,66ab	11,86a	P<0,05
Polyunsat/Sat	0,47a	0,38b	0,34c	P<0,001

Table 1 - Influence of the genotype and sex on various carcass characteristics (Means ± s.d.)

	Genotype		Sex	
	C. H. C.(1)	IL x ILW(2)	Castrated males	Females
Liveweight (kg)	160.1 ± 14.2	161.6 ± 11.5 NS	160.8 ± 12.7	161.0 ± 13.1 NS
Cold carcass weight (kg)	129.5 ± 11.8	133.0 ± 9.9 *	131.4 ± 11.1	131.1 ± 11.0 NS
Mean backfat thickness (mm)	28.5 ± 4.5	38.6 ± 6.9 **	35.4 ± 7.7	31.7 ± 7.3 **
Lean meat (%)	50.3 ± 2.6	44.9 ± 3.3 **	46.6 ± 3.9	48.6 ± 3.9 **

(1) C. H. C. = Commercial Hybrid Cotswold. (2) IL = Italian Landrace ; ILW = Italian Large White. * = P<0.05 ; ** = P<0.01 ; NS = not significant.

Table 2 - Effect of genotype and sex on lipids and water content, fatty acid composition (%) and iodine value of the subcutaneous adipose tissue.

	Genotype		Sex		Error mean square
	C.H.C. (1)	IL x ILW (2)	Castrated males	Females	(149 DF)
Lipids	90.07	90.00 NS	90.09	89.98 NS	13.0168
Water	7.48	6.72 **	6.93	7.26 NS	1.8505
C14:0	1.27	1.38 **	1.33	1.33 NS	0.0138
C16:0	23.41	24.50 **	23.99	23.92 NS	0.9965
C17:0	0.32	0.29 **	0.31	0.30 NS	0.0038
C18:0	12.77	13.75 **	13.30	13.21 NS	1.0563
C20:0	0.19	0.20 NS	0.20	0.19 NS	0.0012
Total saturated	38.11	40.25 **	39.27	39.09 NS	2.5252
C16:1	1.92	1.82 **	1.86	1.88 NS	0.0540
C17:1	0.25	0.21 **	0.23	0.22 NS	0.0029
C18:1	42.09	42.67 *	42.39	42.37 NS	2.5059
C20:1	0.79	0.95 **	0.90	0.84 **	0.0194
Total monounsat.	45.05	45.65 *	45.38	45.32 NS	2.7006
C18:2	15.05	12.57 **	13.67	13.95 NS	3.0062
C18:3	0.80	0.66 **	0.73	0.72 NS	0.0144
C20:2	0.69	0.64 **	0.67	0.66 NS	0.0082
C20:4	0.22	0.19 **	0.20	0.20 NS	0.0019
Total polyunsat.	16.76	14.05 **	15.27	15.54 NS	3.5882
Polyuns./ Satur.	0.44	0.35 **	0.39	0.40 NS	0.0038
Iodine Value	69.84	65.39 **	67.95	67.28 NS	8.9580

Other fatty acids detected: C10:0, C12:0 e C20:3. (1) C.H.C = Commercial Hybrid Cotswold. (2) IL = Italian Landrace; ILW = Italian Large White.
* = $P < 0.05$; ** = $P < 0.01$; NS = not significant.

Table 3 - Effect of feeding and dietary protein levels on lipid and water content, fatty acid composition (%) and iodine value of the subcutaneous adipose tissue.(1)

	Feeding level		Dietary protein level	
	Ad Libitum	Restricted	H (16.5%)	L (14.6%)
Lipids	90.94	89.14 **	90.64	89.43 *
Water	6.93	7.26 NS	7.07	7.13 NS
C14:0	1.33	1.33 NS	1.35	1.31 *
C16:0	24.29	23.61 **	24.06	23.85 NS
C17:0	0.30	0.31 NS	0.31	0.30 NS
C18:0	13.62	12.89 **	13.39	13.12 NS
C20:0	0.20	0.19 NS	0.20	0.19 NS
Total saturated	39.87	38.49 **	39.45	38.91 NS
C16:1	1.84	1.90 NS	1.88	1.86 NS
C17:1	0.23	0.23 NS	0.23	0.23 NS
C18:1	42.60	42.16 NS	42.05	42.71 *
C20:1	0.88	0.86 NS	0.88	0.86 NS
Total monounsat.	45.55	45.15 NS	45.04	45.66 **
C18:2	13.03	14.59 **	13.82	13.80 NS
C18:3	0.68	0.77 **	0.76	0.70 **
C20:2	0.63	0.70 **	0.66	0.67 NS
C20:4	0.19	0.22 **	0.20	0.21 NS
Total polyunsat.	14.53	16.28 **	15.44	15.37 NS
Polyuns. / Satur.	0.37	0.43 **	0.39	0.40 NS
Iodine Value	66.18	69.05 **	67.30	67.93 NS

Other fatty acids detected: C10:0, C12:0 e C20:3. (1) Error mean square and DF as in table 2. * = $P < 0.05$; ** = $P < 0.01$; NS = not significant.

Table 1 : Live weight, carcass characteristics and tissue composition of pigs at the beginning and at the end of the fattening period in chestnut plantation.

	Fattening period	
	Beginning	End
Number of animals	6	6
Live weight (kg)	53 ^{a}	90 ^{b}
Carcass weight (kg)	38 ^{a}	72 ^{b}
Backfat thickness (mm)		
Kidney	10 ^{a}	45 ^{b}
Back	8 ^{a}	39 ^{b}
Neck	29 ^{a}	61 ^{b}
Tissue composition		
Muscle (g)	9700 ^{a}	15500 ^{b}
Fat (g)	2160 ^{a}	11200 ^{b}
Skin (g)	1080 ^{a}	2250 ^{b}
Bones (g)	2260 ^{a}	3060 ^{b}

Means with different subscripts on the same line differ significantly at the 5% level.

Table 2 : Lipid content and fatty acid composition of *Longissimus dorsi* and backfat at the beginning and the end of the fattening period in chestnut plantation.

	Longissimus dorsi				Backfat	
	Triglycerides		Phospholipids			
	Beginning	End	Beginning	End	Beginning	End
Lipid content (g/100g)	1.4 a	5.3 b	0.5	0.5	6 a	79 b
Fatty acids (%)						
14:0	1.4	1.4	1.2	1.2	1.7	1.4
16:0	23.4 a	26.9 b	23.9 a	20.2 b	25.3 a	23.1 b
18:0	11.7	11.8	15.1 a	11.6 b	9.3 a	11.0 b
Saturated	**36.5**	**40.1**	**40.2**	**33.0**	**36.7**	**35.8**
16:1	3.8	3.6	1.9	1.8	4.5 a	2.8 b
18:1	47.2 a	52.9 b	20.6	16.9	47.6 a	50.9 b
20:1	1.0 a	0.8 b	0.9 a	0.6 b	0.9	0.9
Monounsaturated	**52.0 a**	**57.3 b**	**23.4**	**19.5**	**53.4**	**54.3**
18:2	10.2 a	2.1 b	17.8 a	30.4 b	8.7	8.5
20:2			0.4	0.4	0.5	0.6
20:3			0.8 a	1.1 b		
20:4	0.6 a	0.2 b	11.9	11.2		
22:4			0.5	0.4		
n-6	**10.8 a**	**2.3 b**	**31.4 a**	**43.5 b**	**9.2**	**9.1**
18:3	0.6 a	0.2 b	1.1 a	0.6 b	0.7	0.8
20:5			1.7 a	1.0 b		
22:5			1.4	1.3		
22:6			0.8 a	0.3 b		
n-3	**0.6 a**	**0.2 b**	**5.0 a**	**3.2 b**	**0.7**	**0.8**
Polyunsaturated	**11.4 a**	**2.5 b**	**36.4 a**	**46.7 b**	**9.9**	**9.9**

For a given lipid fraction, means with different subscripts on the same line differ significantly at the 5% level.

Table 1 Muscle fibre distribution of *M. longissimus dorsi* (LD) and *M. biceps femoris* (BF) in relation to "confined" (C) or "exercised" (E) treatment and sex. Estimated means with standard error of the mean (SEM).

Muscle	LD					BF				
Treatment	C		E			C		E		
Sex	♀	♂	♀	♂	SEM	♀	♂	♀	♂	SEM
Frequency, %										
ST	10.9	12.2	9.5	9.2	1.8	22.1	21.4	19.5	23.8	4.4
FTa	3.2	6.7	9.4	6.0	1.9	8.1	7.2	9.6	10.0	1.1
FTb	85.2	80.3	81.0	83.3	2.9	68.5	70.8	67.9	64.6	4.0
FTa/FTb	3.7	8.2	11.8	7.5	2.5	10.9	10.3	12.4	15.5	1.2
Area, %										
ST	5.7	8.2	6.0	7.3	1.1	15.0	13.2	12.0	17.6	3.2
FTa	1.2	4.2	5.4	3.9	1.0	6.9	5.6	6.9	7.6	0.9
FTb	93.1	87.6	88.7	88.8	1.6	78.1	81.2	81.1	74.8	2.9
FTa/FTb	1.2	4.8	6.1	4.6	1.2	8.7	7.0	8.3	10.2	1.1

Table 2 Collagen and dry matter (DM) content and texture of *M. longissimus dorsi* (LD) and *M. biceps femoris* (BF) in relation to "confined" (C), "exercised" (E), or "Free" (F) treatment and sex. Estimated means with standard error of the mean (SEM).

Muscle	LD							BF						
Treatment	C		E		F			C		E		F		
Sex	♀	♂	♀	♂	♀	♂	SEM	♀	♂	♀	♂	♀	♂	SEM
Collagen, mg/g DM														
Total	14.9	15.3	16.4	14.6	15.2	14.7	1.5	30.7	32.3	36.0	33.8	33.8	31.4	1.6
Heat stable	8.8	8.0	9.4	7.5	9.3	8.0	1.5	18.4	18.8	23.2	19.0	23.1	18.4	1.6
Soluble, %	40.8	47.4	42.5	48.3	38.7	45.8	1.8	40.0	41.6	35.5	43.8	31.8	41.4	1.8
DM, %	25.6	24.6	25.6	24.9	24.5	24.5	0.2	24.7	24.2	24.7	23.8	24.8	23.6	0.2
Texture														
Bite force, N	56.2	66.2	63.1	55.4	52.6	53.6	5.1	76.6	85.1	69.0	77.4	74.5	81.4	5.1
Tenderness	7.3	6.7	6.8	7.2	7.2	6.8	0.2	6.7	6.2	6.4	6.4	6.5	6.6	0.2

Table 1: **Effects of recombinant porcine somatotropin (rpST) on dressing percentage and chemical composition of the edible whole body**

		mg rpST / animal + day							
		0 n = 19		2 n = 20			4 n = 18		
		LSM	SE	LSM	rel.2)	SE	LSM	rel.2)	SE
Slaughter weight	kg	83.6a	1.30	85.0ab		1.27	88.3b		1.33
Dressing percentage	%	77.8	0.36	75.5	(97)	0.29	76.3	(98)	0.42
Edible internal organs1)	%	4.52a	0.11	5.30b	(117)	0.10	5.46b	(121)	0.12
Edible whole body									
Water	%	48.52a	0.57	56.20b	(116)	0.54	59.37c	(122)	0.59
Protein	%	13.32a	0.24	16.43b	(123)	0.23	17.12c	(128)	0.25
Lipid	%	37.52a	0.69	26.58b	(71)	0.66	22.71c	(60)	0.72
Ash	%	0.63a	0.01	0.79b	(125)	0.01	0.82b	(130)	0.01
Water : Protein	%	3.67a	0.06	3.42b	(93)	0.06	3.48b	(95)	0.07

1) Data expressed on empty body basis
2) Data expressed on control group basis (0 mg rpST = 100 %)
a, b, c Means with different superscripts differ ($P \leq 0.05$)

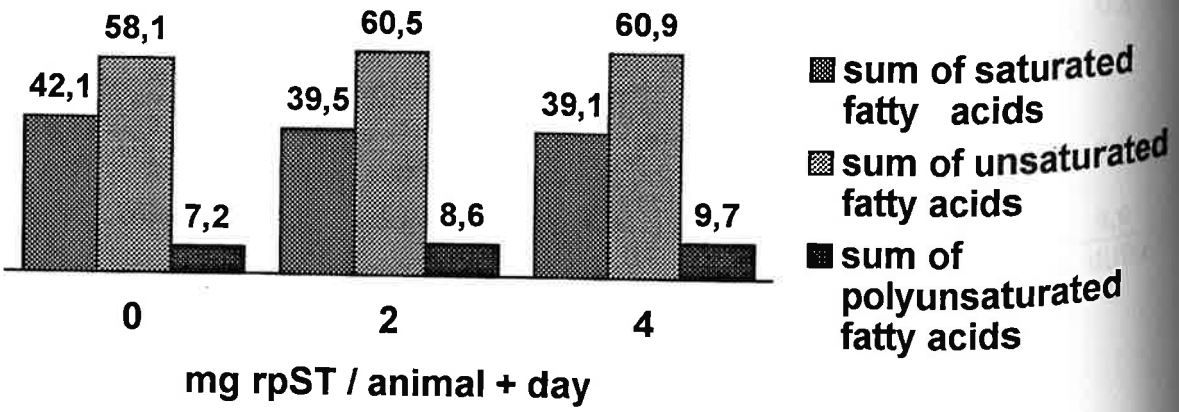


Figure 1: Effects of rpST treatment on the fatty acid profile of backfat (in %)

Table 2: **Effects of recombinant porcine somatotropin (rpST) on the chemical composition of the body fractions breast/belly, external fat, internal fat, head**

		mg rpST / animal + day							
		0		2			4		
		n = 19		n = 20			n = 18		
		LSM	SE	LSM	rel.x)	SE	LSM	rel.x)	SE
Breast / Belly									
Water	%	40.83^{a}	0.86	51.31^{b}	(126)	0.83	55.53^{c}	(136)	0.90
Protein	%	11.91^{a}	0.29	15.56^{b}	(131)	0.27	16.52^{c}	(139)	0.30
Lipid	%	46.73^{a}	1.11	32.46^{b}	(69)	1.06	27.18^{c}	(58)	1.16
Ash	%	0.55^{a}	0.02	0.69^{b}	(125)	0.02	0.75^{b}	(136)	0.02
Water : Protein	%	3.45^{a}	0.04	3.30^{b}	(96)	0.04	3.36	(97)	0.05
External fat									
Water	%	19.10^{a}	0.68	27.72^{b}	(145)	0.65	30.15^{c}	(158)	0.71
Protein	%	5.65^{a}	0.27	8.80^{b}	(156)	0.26	9.61^{c}	(170)	0.28
Lipid	%	75.06^{a}	0.86	63.16^{b}	(84)	0.82	59.87^{c}	(80)	0.89
Ash	%	0.19^{a}	0.01	0.31^{b}	(163)	0.01	0.37^{c}	(195)	0.01
Water : Protein	%	3.47	0.12	3.20	(92)	0.11	3.15	(91)	0.12
Internal fat									
Water	%	15.75^{a}	0.78	19.01^{b}	(121)	0.74	20.57^{b}	(131)	0.81
Protein	%	2.85	0.33	3.33	(117)	0.31	3.62	(127)	0.34
Lipid	%	81.24^{a}	1.00	77.48^{b}	(95)	0.96	75.61^{b}	(93)	1.04
Ash	%	0.15^{a}	0.02	0.18^{ab}	(120)	0.01	0.20^{b}	(133)	0.02
Water : Protein	%	6.68	1.76	9.08	(136)	1.68	7.31	(103)	1.84
Head									
Water	%	43.97^{a}	0.83	49.15^{b}	(112)	0.79	52.66^{c}	(120)	0.86
Protein	%	12.26^{a}	0.39	13.71^{b}	(112)	0.37	14.98^{c}	(122)	0.41
Lipid	%	43.22^{a}	1.11	36.50^{b}	(84)	1.06	31.70^{c}	(73)	1.15
Ash	%	0.55^{a}	0.02	0.64^{b}	(116)	0.02	0.65^{b}	(118)	0.02
Water: Protein	%	3.65	0.12	3.65	(100)	0.11	3.53	(97)	0.12

x) Data expressed on control group basis (0 mg rpST = 100 %)
a, b, c Means with different superscripts differ ($P \leq 0.05$)

Table 3: **Effects of recombinant porcine somatotropin (rpST) on the chemical composition of the body fractions loin, shoulder/foot, ham/foot, edible organs**

		mg rpST / animal + day							
		0		2			4		
		n = 19		n = 20			n = 18		
		LSM	SE	LSM	rel.x)	SE	LSM	rel.x)	SE
Loin									
Water	%	62.37^{a}	0.41	66.44^{b}	(107)	0.39	67.78^{c}	(109)	0.43
Protein	%	18.61^{a}	0.19	20.29^{b}	(109)	0.18	20.70^{b}	(111)	0.20
Lipid	%	18.18^{a}	0.57	12.29^{b}	(68)	0.54	10.53^{c}	(58)	0.59
Ash	%	0.83^{a}	0.03	0.98^{b}	(118)	0.03	0.98^{b}	(118)	0.03
Water : Protein	%	3.36^{a}	0.02	3.28^{b}	(98)	0.02	3.28^{b}	(98)	0.03
Shoulder / Foot									
Water	%	65.66^{a}	0.42	68.84^{b}	(105)	0.40	69.41^{b}	(106)	0.44
Protein	%	18.35^{a}	0.16	19.72^{b}	(107)	0.15	19.90^{b}	(108)	0.17
Lipid	%	15.11^{a}	0.55	10.48^{b}	(69)	0.52	9.73^{b}	(64)	0.57
Ash	%	0.88^{a}	0.01	0.96^{b}	(109)	0.01	0.96^{b}	(109)	0.01
Water : Protein	%	3.38^{a}	0.02	3.49^{b}	(97)	0.02	3.49^{b}	(97)	0.02
Ham / Foot									
Water	%	67.98^{a}	0.33	69.31^{b}	(102)	0.31	70.30^{c}	(103)	0.34
Protein	%	19.59^{a}	0.14	20.47^{b}	(104)	0.13	20.78^{b}	(106)	0.14
Lipid	%	11.48^{a}	0.40	9.23^{b}	(80)	0.38	7.92^{c}	(69)	0.42
Ash	%	0.95^{a}	0.01	0.99^{b}	(104)	0.01	1.00^{b}	(105)	0.01
Water : Protein	%	3.47^{a}	0.02	3.39^{b}	(98)	0.02	3.39^{b}	(98)	0.02
Edible organs									
Water	%	72.97^{a}	0.21	73.92^{b}	(101)	0.20	74.45^{b}	(102)	0.22
Protein	%	18.60	0.19	18.60	(100)	0.18	18.67	(100)	0.20
Lipid	%	7.20^{a}	0.19	6.22^{b}	(86)	0.18	5.70^{b}	(79)	0.20
Ash	%	1.24	0.03	1.27	(102)	0.03	1.19	(96)	0.03
Water : Protein	%	3.93	0.05	3.98	(101)	0.05	4.00	(102)	0.05

x) Data expressed on control group basis (0 mg rpST = 100 %)
a, b, c Means with different superscripts differ ($P \leq 0.05$)

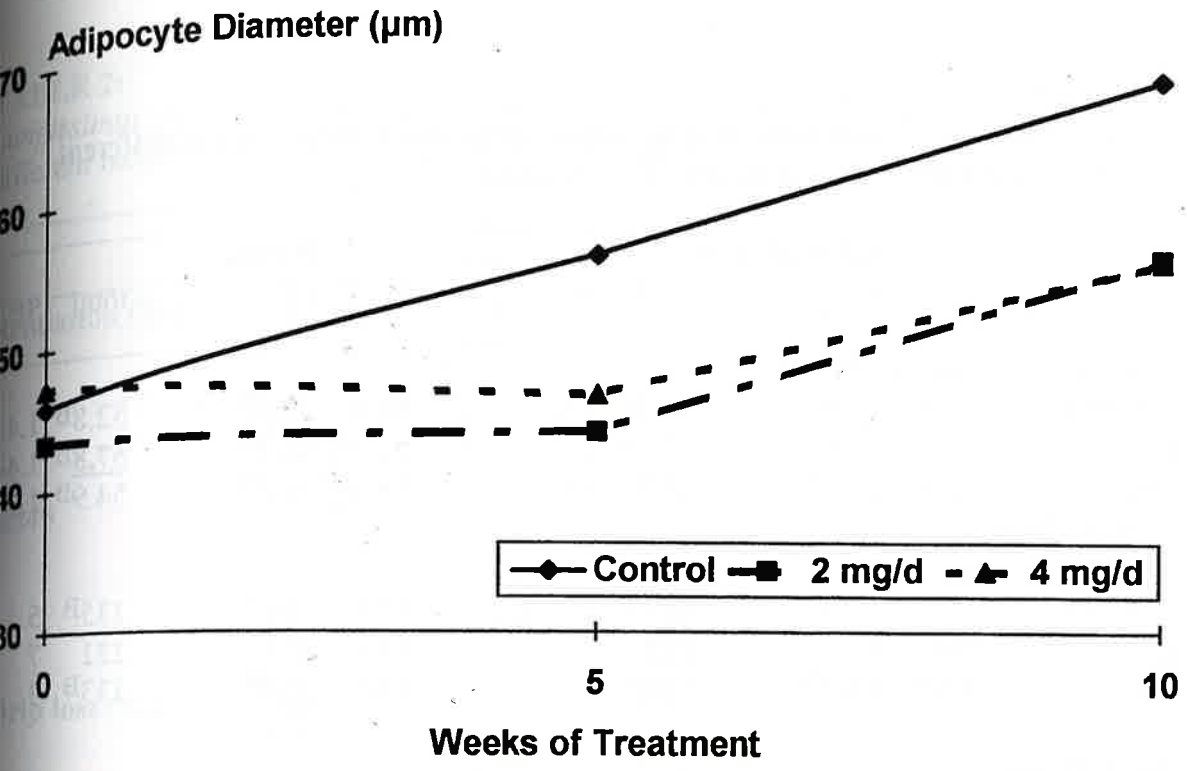


Figure 2: Effects of rpST treatment on fat cell hypertrophy in backfat from Landrace barrows

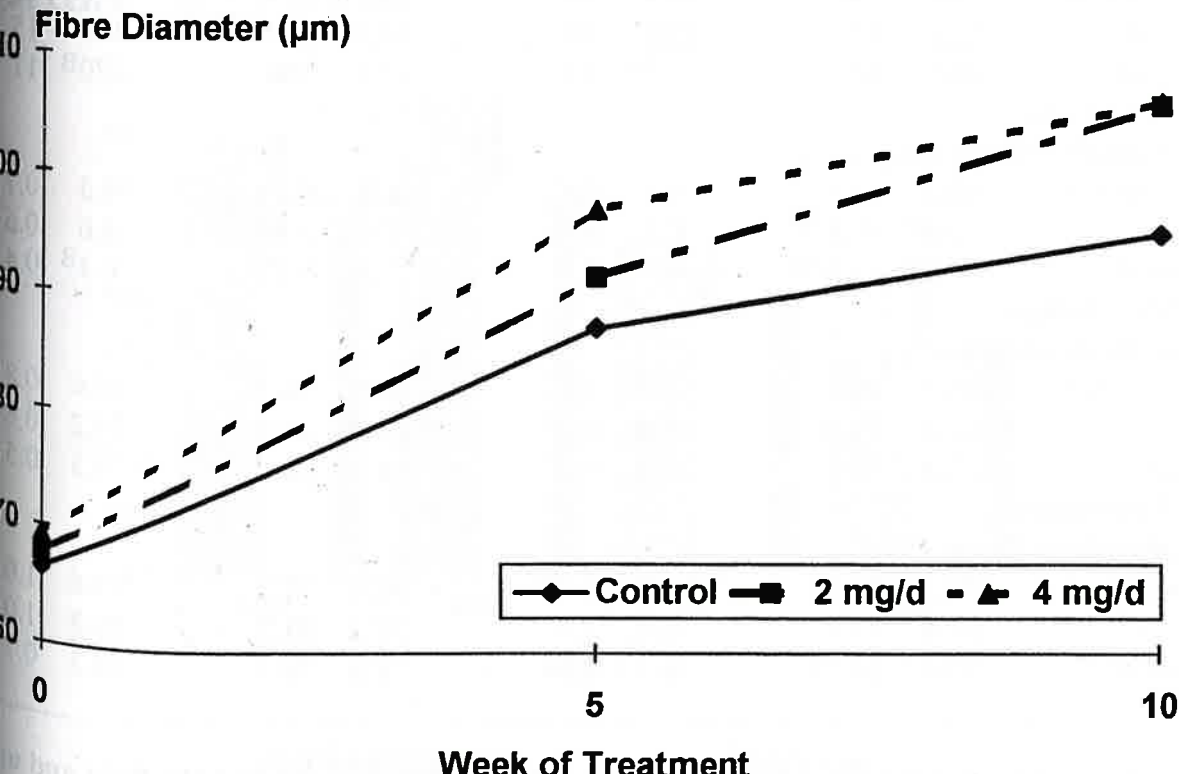


Figure 3: Effects of rpST on the hypertrophy of muscle fibres in *longissimus* muscle of barrows

TABLE 1:
Longissimus muscle characteristics in Schwerfurter and Piétrain pigs of different halothane sensivity in response to pST- treatment

	Schwerfurter				Piétrain			
	H^+	H^-	total	SE	H^+	H^-	total	SE
Loin muscle area (cm^2)								
Control	45.2	43.0^A	43.7^A	1.6	53.0	52.6^B	52.8^B	1.4
pST	46.5^A	47.8^A	47.5^A	1.3	57.4^B	58.4^B	**57.8**^{B}	1.4
total	45.8^A	45.7^A	45.7^A	1.1	55.9^B	54.7^B	54.9^B	1.1
Muscle fibre diameter (µm)								
Control	118	106^A	109^A	4	137	134^B	135^B	5
pST	136	114	**122**	4	131	131	131	7
total	129^a	110^{Ab}	116^A	3	134	132^B	133^B	3
Nuclei/fibre								
Control	2.31	1.93^A	2.05	0.07	2.19	2.31^B	2.26	0.07
pST	2.18	2.06	2.11	0.07	2.11	2.29	2.20	0.06
total	2.23^a	2.00^A	2.08^{Ab}	0.05	2.14	2.30^B	2.22^B	0.04
Fibre nuclei/ mm^2 fibre area								
Control	270	234	244	18	133	174	156	15
pST	**155**	212	**191**	11	162	194	179	15
total	201	222	215^A	11	151	186	170^B	11
Slow-twitch oxidative fibres (%)								
Control	10.2	7.9	8.5	0.9	6.8	6.4	6.3	0.7
pST	5.6^a	10.8^{Ab}	8.8	0.8	7.4	5.4^B	6.6	0.6
total	7.3^a	9.4^{Ab}	8.7^A	0.6	7.2	5.8^B	6.4^B	0.4
Fast-twitch oxidative fibres (%)								
Control	14.2	16.2	15.7	1.1	16.8	16.5	16.6	0.8
pST	12.8	16.0	14.8	0.7	15.0	13.5	**14.2**	0.6
total	13.3	16.1	15.2	0.6	15.8	14.9	15.3	0.5
Fast-twitch glycolytic fibres (%)								
Control	75.5	75.9	75.8	1.4	76.4	77.2	79.6	1.0
pST	81.6	73.1	76.4	1.4	77.5	81.2	**76.8**	1.0
total	79.4^a	74.5^b	76.1	1.0	77.0	79.3	78.3	0.7

A,B: significant differences between the breeds; a,b: between H^+ and H^-. **Bold and underlined numbers** indicate significant differences between control and pST ($P < 0.05$).

TABLE 2:
Longissimus muscle quality characteristics in Schwerfurter and Piétrain pigs of different halothane sensivity in response to pST-treatment

		Schwerfurter		Piétrain	
		Mean	SE	Mean	SE
Remission (%)	Control	29.1	1.3	30.3	1.2
	pST	**31.8**	1.1	**35.1**	1.8
	H^+	35.9^{a}	1.3	34.2	1.1
	H^-	28.7^{b}	0.9	30.9	1.9
pH45	Control	6.08	0.12	5.84	0.06
	pST	6.09^{A}	0.11	5.71^{B}	0.05
	H^+	5.61^{a}	0.07	5.70	0.04
	H^-	6.24^{Ab}	0.09	5.84^{B}	0.07
Drip loss (%)	Control	5.39	0.49	6.45	0.49
	pST	5.69	0.60	7.47	0.56
	H^+	6.14	0.42	7.81^{a}	0.46
	H^-	5.35	0.49	6.05^{b}	0.53

A,B: significant differences between the breeds; a,b: between H^+ and H^-. **Bold and underlined numbers** indicate significant differences between control and pST ($P < 0.05$).

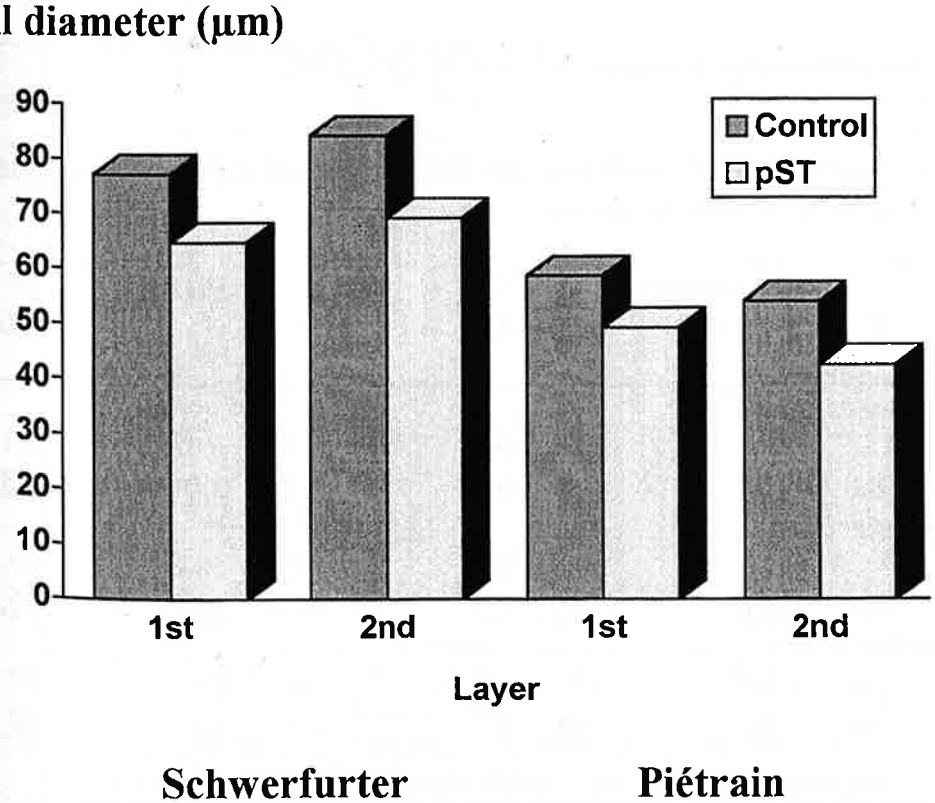


FIGURE 1: Fat cell size in the superficial (1st) and deeper (2nd) layer of backfat in Schwerfurter and Piétrain pigs in response to pST

TABLE 3:
Frequencies of abnormal muscle fibres in *longissimus* muscle in Schwerfurter and Piétrain pigs of different halothane sensivity in response to pST- treatment

		Schwerfurter		Piétrain	
		Mean	SE	Mean	SE
Giant fibres (%)	Control	0.85	0.19	1.26	0.16
	pST	0.86	0.26	0.99	0.20
	H^+	1.00	0.27	1.44[a]	0.14
	H^-	0.80	0.19	0.89[b]	0.18
Light violet fibres(%)	Control	0.86	0.17	1.05	0.25
	pST	0.81	0.20	1.18	0.19
	H^+	0.77	0.21	1.08	0.27
	H^-	0.87	0.17	1.15	0.18
Small dark angulated fibres (%)	Control	0.71	0.15	0.37	0.11
	pST	0.58	0.16	0.42	0.10
	H^+	0.50	0.12	0.38	0.11
	H^-	0.71	0.15	0.42	0.09

a,b: significant differences between H^+ and H^- ($P < 0.05$).

TABLE 4:
Backfat characteristics in Schwerfurter and Piétrain pigs of different halothane sensivity in response to pST- treatment

	Schwerfurter				Piétrain			
	H^+	H^-	total	SE	H^+	H^-	total	SE
Backfat thickness (mm)								
Control	13.2	13.4	13.4	0.7	5.5	6.4	6.1	0.7
pST	8.0	**7.4**	**7.6**	0.5	3.8	**3.0**	**3.3**	0.2
Fat cell diameter (µm)								
Control	74.6	83.0	80.5	2.3	52.1	58.6	56.3	2.2
pST	68.2	**66.1**	**66.9**	1.3	45.0	**46.8**	**46.0**	1.8
Fat cell number index								
Control	114	128	124	5	74	83	80	6
pST	91	**88**	**90**	4	67	**53**	**60**	5

Bold and underlined numbers indicate significant differences between control and pST ($P<0.05$).

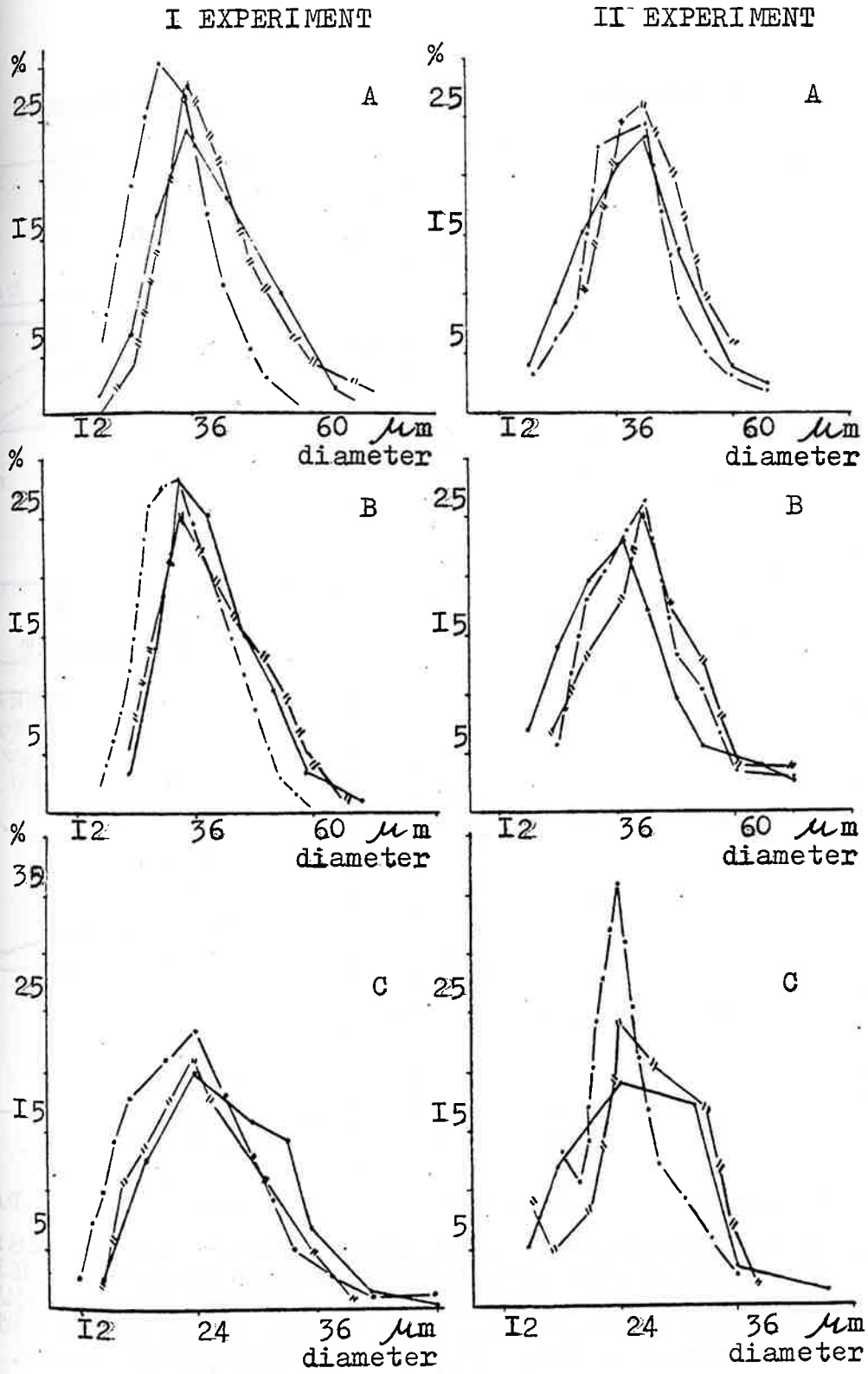


Fig.I ADIPOCYTE DIAMETER DISTRIBUTION OF PERIRENAL (A), INTERMUSCULAR (B) AND INTRAMUSCULAR ADIPOSE TISSUES OF HOGGETS. —— CONTROL GROUP; —·—EXPERIMENTAL GROUP I;-//-EXPERIMENTAL GROUP 2

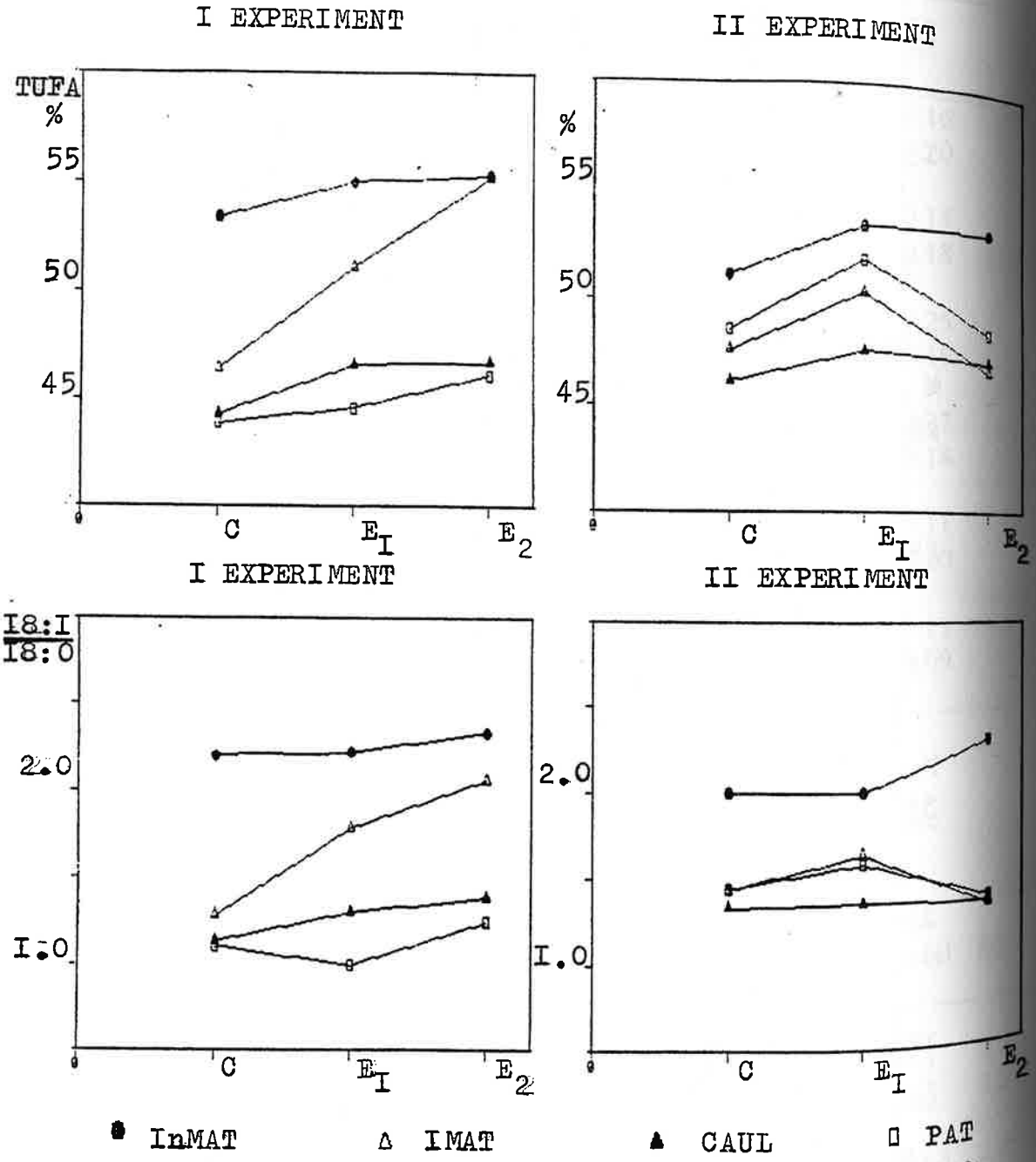


Fig.2 TOTAL UNSATURATED FATTY ACIDS (TUFA) AND I8:I/I8:0 RATIO IN TRIACYLGLYCEROLS FROM INTRAMUSCULAR ADIPOSE TISSUE (InMAT), INTERMUSCULAR ADIPOSE TISSUE (IMAT), CAUL AND PERIRENAL ADIPOSE TISSUE (PAT) OF HOGGETS. C - CONTROL GROUP; E_I, E_2 - EXPERIMENTAL GROUPS.

TABLE 1

STIDINE, SERINE AND THREONINE (MOLE PERCENT) IN DIFFERENT MUSCLES FROM BOB (BV) AND SPECIAL-FED VEAL (SFV)

ino Acid	BF	LG	SM	TB	SE
rine					
BV	6.2^{b}	5.6^{a}	5.6^{a}	5.8^{ab}	0.2
SFV	5.2^{a}	5.7^{c}	5.4^{b}	5.4^{b}	0.1
reonine					
BV	5.6^{b}	5.0^{a}	5.1^{a}	5.2^{ab}	0.2
SFV	4.7^{a}	5.3^{b}	5.0^{b}	5.1^{b}	0.1
stidine					
BV	4.3^{bc}	4.0^{ab}	4.4^{c}	3.9^{a}	0.1
SFV	4.4^{a}	4.8^{b}	4.8^{b}	4.2^{a}	0.1

, longissimus; SM, semimembranosus; TB, triceps brachii; BF, Biceps femoris

Mean values in rows with different superscripts are different ($P<0.05$)

TABLE 2

HYDROXYPROLINE, COLLAGEN AND PROTEIN IN BOB (BV) AND SPECIAL-FED VEAL (SFV)[1]

Parameter	BV	SE	SFV	SE
Hydroxyproline (mole %)	0.63[a]	0.06	0.47[b]	0.04
Collagen (mg/g tissue)	32.3[a]	1.6	16.7[b]	1.1
Protein (g/100g tissue)	20.5[a]	0.2	21.9[b]	0.1

[ab]Mean values in rows with different superscripts are different ($P<0.05$)

[1]A significant age x muscle interaction was noted for collagen and is presented in Table 4

TABLE 3

HYDROXYPROLINE, COLLAGEN AND PROTEIN IN MUSCLES FROM BOB AND SPECIAL-FED VEAL

Parameter	BF	LG	SM	TB	SE
Hydroxyproline (mole %)	0.49^{ab}	0.63^{b}	0.46^{a}	0.63^{ab}	0.05
Protein (g/100g tissue)	20.9^{ab}	21.4^{bc}	21.8^{c}	20.6^{a}	0.2
Collagen (mg/g)					
BV	33.2^{b}	33.4^{b}	18.2^{a}	44.4^{c}	3.2
SFV	20.2^{bc}	20.0^{bc}	10.4^{a}	16.3^{ab}	2.2

LG, longissimus; SM, semimembranosus; TB, triceps brachii; BF, Biceps femoris

[a,b,c]Mean values in rows with different superscripts are different ($P<0.05$)

Table 1.
Effects of treatment of veal calves with clenbuterol and salbutamol on performance, carcass characteristics and weights of non-carcass tissues and organs (g).

	Treatment#			
Item	A(15)	B(15)	C(15)	D(15)
LW before treatment (kg)	201.1 ± 2.9^{ab}	196.5 ± 2.5^{a}	200.8 ± 3.1^{ab}	203.9 ± 2.1^{b}
Rate of gain (g/day)	1246.0 ± 56.6^{a}	1378.8 ± 94.0^{ab}	1397.7 ± 62.0^{ab}	1436.8 ± 44.7^{b}
Final LW[1]* (kg)	234.8 ± 1.85	238.6 ± 1.89	239.0 ± 1.85	239.9 ± 1.87
Hot carcass weight* (kg)	132.6 ± 1.34^{a}	142.1 ± 1.37^{b}	139.9 ± 1.34^{b}	142.4 ± 1.36^{b}
Dressing %[2]	56.5 ± 0.4^{a}	59.4 ± 0.3^{b}	58.5 ± 0.5^{b}	59.5 ± 0.2^{b}
Hide	17597 ± 478^{a}	15066 ± 392^{b}	15765 ± 409^{bc}	16492 ± 334^{ac}
Liver	4506 ± 84^{a}	4336 ± 122^{ab}	4218 ± 119^{b}	4149 ± 98^{b}
Heart	1266 ± 30^{a}	1179 ± 21^{b}	1267 ± 37^{ab}	1246 ± 33^{ab}
Kidneys	860 ± 25^{a}	752 ± 25^{b}	839 ± 25^{ac}	789 ± 20^{bc}
Thymus[3]	739 ± 47^{a}	545 ± 34^{b}	655 ± 35^{a}	697 ± 40^{ac}
Spleen	649 ± 25^{a}	564 ± 32^{b}	610 ± 24^{ab}	616 ± 13^{ab}
Pancreas	148 ± 6^{a}	116 ± 7^{b}	127 ± 7^{b}	121 ± 7^{b}
Pituitary gland	2.19 ± 0.07^{a}	1.89 ± 0.06^{b}	2.02 ± 0.07^{ab}	2.11 ± 0.08^{ac}
Kidney fat	4376 ± 152^{a}	3266 ± 196^{b}	3794 ± 307^{ab}	3308 ± 157^{b}
Channel fat	726 ± 38^{a}	578 ± 32^{b}	689 ± 39^{ab}	624 ± 47^{ab}
Mesenteric fat	2342 ± 108^{a}	2006 ± 110^{b}	2079 ± 118^{ab}	1965 ± 85^{b}
Omental fat	3832 ± 224^{a}	3428 ± 117^{ab}	3449 ± 181^{ab}	3353 ± 162^{b}

A: control, B: clenbuterol (1.6 mg per head/day), C: salbutamol (60 mg), D: salbutamol (100 mg).

* Values adjusted by analysis of covariance using live weight at start of treatment as the covariate. Values given are means ± standard error of the mean; means in the same row with different superscripts are different ($P < 0.05$).

1 Based on fasted live weight.

2 Based on hot carcass weight and final live weight.

3 Cervical plus thoracic part.

Table 2. Effects of treatment of veal calves with clenbuterol and salbutamol on carcass components and on relative weights of carcass joints (kg/carcass side mass (kg) x 100 %).

	Treatment#		
Item	A(10)	B(11)	D(10)
Muscle (kg)	36.141 ± 0.855^{a}	40.194 ± 0.59^{b}	43.022 ± 0.652^{c}
Muscle %	57.91 ± 0.73^{a}	61.63 ± 0.42^{bc}	62.31 ± 0.64^{c}
Bone (kg)	10.268 ± 0.246^{ab}	9.964 ± 0.148^{a}	10.472 ± 0.104^{b}
Bone %	16.46 ± 0.24^{a}	14.83 ± 0.24^{bc}	15.19 ± 0.24^{c}
Fat (kg)	11.766 ± 0.483	11.459 ± 0.339	11.260 ± 0.546
Fat %	18.90 ± 0.71^{a}	17.60 ± 0.43^{ab}	16.30 ± 0.77^{b}
Other tissues (kg)	4.205 ± 0.116	3.894 ± 0.125	4.279 ± 0.179
Other tissues %	6.77 ± 0.24^{a}	5.97 ± 0.18^{b}	6.20 ± 0.24^{ab}
Muscle/fat ratio	3.10 ± 0.15^{a}	3.50 ± 0.11^{bc}	3.90 ± 0.22^{c}
Muscle/bone ratio	3.53 ± 0.08^{a}	4.16 ± 0.07^{bc}	4.11 ± 0.07^{c}
Cod fat (g)	937 ± 55	868 ± 49	833 ± 44
Joints			
Distal pelvic limb	6.69 ± 0.09^{a}	6.33 ± 0.14^{b}	6.49 ± 0.10^{ab}
Proximal pelvic limb	28.44 ± 0.15^{a}	29.62 ± 0.29^{b}	29.93 ± 0.28^{b}
Abdominal region	4.33 ± 0.14	4.26 ± 0.08	4.16 ± 0.12
Lumbar region	5.87 ± 0.04	6.08 ± 0.10	5.99 ± 0.09
Hindquarter	45.33 ± 0.26^{a}	46.42 ± 0.32^{b}	46.57 ± 0.29^{b}
Neck and thorax region	39.60 ± 0.28^{a}	38.74 ± 0.34^{ab}	38.44 ± 0.35^{b}
Proximal thoracic limb	11.15 ± 0.10	11.22 ± 0.08	11.35 ± 0.08
Distal thoracic limb	3.92 ± 0.04^{a}	3.62 ± 0.05^{b}	3.64 ± 0.04^{b}
Forequarter	54.67 ± 0.26^{a}	53.58 ± 0.32^{b}	53.43 ± 0.29^{b}

See Tabel 1 for explanation.
Values given are means ± standard error of the mean; means in the same row with different superscripts are different ($P < 0.05$).

Table 3. Effects of treatment of veal calves with clenbuterol and salbutamol on relative muscle weight within joints (kg/carcass side muscle mass (kg) x 100 %) and on relative weights of individual muscles (g/carcass side muscle mass (kg)).

	Treatment#		
Joints	A(10)	B(11)	D(10)
Distal pelvic limb	5.24 ± 0.09	5.19 ± 0.10	5.06 ± 0.11
Proximal pelvic limb	33.04 ± 0.18^{a}	34.12 ± 0.36^{b}	34.31 ± 0.31^{b}
Abdominal region	4.11 ± 0.17^{ab}	4.15 ± 0.07^{a}	3.90 ± 0.10^{b}
Lumbar region	6.49 ± 0.07	6.71 ± 0.12	6.51 ± 0.08
Hindquarter	48.88 ± 0.29^{a}	50.16 ± 0.34^{b}	49.78 ± 0.31^{b}
Neck and thorax region	36.40 ± 0.25^{a}	35.23 ± 0.40^{b}	35.61 ± 0.30^{b}
Proximal thoracic limb	11.88 ± 0.13	11.95 ± 0.12	12.04 ± 0.07
Distal thoracic limb	2.84 ± 0.06^{a}	2.66 ± 0.06^{b}	2.57 ± 0.03^{b}
Forequarter	51.12 ± 0.29^{a}	49.85 ± 0.34^{b}	50.22 ± 0.31^{b}
Muscles			
M. semimembranosus	57.77 ± 0.61^{a}	61.81 ± 0.92^{b}	62.19 ± 0.87^{b}
M. gluteus medius	35.34 ± 0.62^{a}	37.51 ± 0.54^{b}	37.38 ± 0.66^{b}
M. longissimus thoracis	35.69 ± 0.85^{a}	38.45 ± 0.70^{b}	37.40 ± 0.53^{ab}
M. longissimus lumborum	30.10 ± 0.76	30.90 ± 0.78	29.24 ± 0.69
M. adductor	19.44 ± 0.59^{a}	21.02 ± 0.52^{b}	20.54 ± 0.49^{ab}
M. tensor fasciae latae	11.21 ± 0.32^{a}	11.88 ± 0.23^{ab}	12.39 ± 0.27^{b}
M. serratus ventralis	39.60 ± 0.92^{a}	37.23 ± 0.83^{ab}	37.01 ± 0.56^{b}

See Tabel 1 for explanation.
Values given are means ± standard error of the mean; means in the same row with different superscripts are different ($P < 0.05$).

Table 1. pH1

Muscle	Ethnic group H	N	H x F	F	mean
LT	6.72	6.74	6.61	6.58	6.66 bc
St	6.54	6.61	6.56	6.55	6.57 ab
Ss	6.71	6.70	6.79	6.66	6.71 c
PP	6.55	6.57	6.56	6.46	6.53 a
mean	6.63	6.66	6.63	6.56	6.62

Table 2. pH24

Muscle	Ethnic group H	N	H x F	F	mean
LT	5.48	5.45	5.40	5.41	5.43
St	5.43	5.42	5.42	5.43	5.43
Ss	5.47	5.50	5.49	5.61	5.52
PP	5.52	5.55	5.58	5.67	5.58
mean	5.47	5.48	5.47	5.53	5.49

Table 3. pH7

Muscle	Ethnic group H	N	H x F	F	mean
LT	5.43	5.41	5.40	5.39	5.41
St	5.44	5.41	5.42	5.39	5.41
Ss	5.51	5.50	5.51	5.63	5.54
PP	5.47	5.48	5.49	5.47	5.48
mean	5.46	5.45	5.46	5.47	5.46

Table 4. Colour: lightness

Muscle	Ethnic group H	N	H x F	F	mean
LT	35.05	32.81	35.43	33.24	34.08 b
St	43.54	40.50	44.00	39.46	41.78 c
Ss	35.62	32.94	35.45	32.62	34.11 b
PP	33.63	30.65	32.20	32.54	32.19 a
mean	36.90 b	34.23 a	36.77 b	34.47 a	35.54

Table 5. Colour: redness

Muscle	Ethnic group H	N	H x F	F	mean
LT	18.11	17.68	19.30	18.50	18.36
St	15.48	17.95	16.23	18.08	16.97
Ss	18.73	19.20	18.25	17.03	18.31
PP	18.08	19.28	18.48	17.28	18.27
mean	17.60	18.53	18.06	17.72	17.98

a, b, c: Means with different superscripts differ ($P < 0.05$)

Table 6. Colour: yellowness

	Ethnic group				
Muscle	H	N	H x F	F	mean
LT	10.11	9.47	10.23	9.56	9.83 b
St	12.48	12.35	12.63	11.64	12.26 c
Ss	10.23	9.44	10.32	8.61	9.62 b
PP	9.49	8.96	9.16	9.08	9.17 a
mean	10.58 b	10.05 a	10.59 b	9.73 a	10.22

Table 7. Drip losses (%)

	Ethnic group				
Muscle	H	N	H x F	F	mean
LT	3.21	2.43	2.31	2.37	2.59 c
St	4.12	4.01	3.66	2.90	3.67 d
Ss	2.16	2.05	1.87	1.61	1.92 b
PP	1.36	1.28	1.47	1.30	1.35 a
mean	2.71 c	2.44 bc	2.33 ab	2.04 a	2.38

Table 8. Water bath losses (%)

	Ethnic group				
Muscle	H	N	H x F	F	mean
LT	31.02	34.63	32.06	34.16	33.01
St	36.72	38.50	35.88	38.04	37.34
Ss	37.63	38.85	37.06	38.54	38.06
PP	36.35	36.44	35.91	34.87	35.89
mean	35.43	37.10	35.23	36.40	36.08

Table 9. Filter paper press method (cm^2)

	Ethnic group				
Muscle	H	N	H x F	F	mean
LT	6.97	7.23	7.21	7.15	7.14 a
St	8.58	8.81	8.13	9.16	8.69 bc
Ss	9.28	8.71	8.59	9.38	9.00 c
PP	8.36	8.32	8.09	8.97	8.45 b
mean	8.30 ab	8.27 a	8.00 a	8.66 b	8.32

a, b, c, d: Means with different superscripts differ ($P < 0.05$)

TABLE 1: Effect of Diet, Muscle and Thermal Treatment on Intramuscular Lipid Content (%)

Main Effects and Interactions	Pr>F	Level	Lipids (%) Means ± SD	N
DIET (D)	0.0001	GRASS	2.6±0.62	40
		GRAIN	4.8±1.70	40
MUSCLE (M)	0.0001	LD	4.6±1.69	40
		ST	2.8±1.12	40
THERMAL TREATMENT (TT)	0.1230	RAW	3.6±1.67	40
		COOKED	3.8±1.67	40
D*M	0.0001			
D*TT	0.3726			
M*TT	0.3769			
D*M*TT	0.2943			

TABLE 2: Influence of Diet and Muscle Type on Lipid (%) of Raw and Cooked Samples

			Main Effect	Pr>F	Level	Lipids(%) Means±SD	N
R	DIET	GRASS	MUSCLE	0.0024	LD	2.9±0.60	10
					ST	2.2±0.34	10
		GRAIN	MUSCLE	0.0001	LD	6.1±0.79	10
					ST	3.1±1.12	10
	MUSCLE	LD	DIET	0.0001	GRASS	2.9±0.60	10
					GRAIN	6.1±0.78	10
		ST	DIET	0.0339	GRASS	2.2±0.34	10
					GRAIN	3.1±1.15	10
C	DIET	GRASS	MUSCLE	0.0011	LD	3.1±0.43	10
					ST	2.3±0.52	10
		GRAIN	MUSCLE	0.0001	LD	6.2±0.69	10
					ST	3.8±1.32	10
	MUSCLE	LD	DIET	0.0001	GRASS	3.1±0.43	10
					GRAIN	6.2±0.69	10
		ST	DIET	0.0025	GRASS	2.3±0.52	10
					GRAIN	3.8±1.32	10

R: RAW, C: COOKED

TABLA 3: Effect of Diet and Muscle Type on Dry Matter Percentage

Main Effects and Interactions	Pr>F	Level	Dry Matter (%) Means ± SD	N
DIET (D)	0.0112	GRASS	26.6 ± 1.63	20
		GRAIN	27.8 ± 3.06	20
MUSCLE (M)	0.0001	LD	29.0 ± 2.08	20
		ST	25.4 ± 1.28	20
D*M	0.0005			

TABLA 4: Influence of Diet and Muscle Type on Dry Matter Percentage

		Main Effect	Pr>F	Level	Dry Matter (%) Means ± SD	N
DIET	GRASS	MUSCLE	0.0054	LD	27.6 ± 1.30	10
				ST	25.7 ± 1.37	10
	GRAIN	MUSCLE	0.0001	LD	30.5 ± 1.67	10
				ST	25.2 ± 1.19	10
MUSCLE	LD	DIET	0.0004	GRASS	27.6 ± 1.30	10
				GRAIN	30.5 ± 1.67	10
	ST	DIET	0.3829	GRASS	25.7 ± 1.37	10
				GRAIN	25.2 ± 1.19	10

Figure 1: Fatty acids composition of *Longissimus* and *Semitendinosus* muscles total lipids.

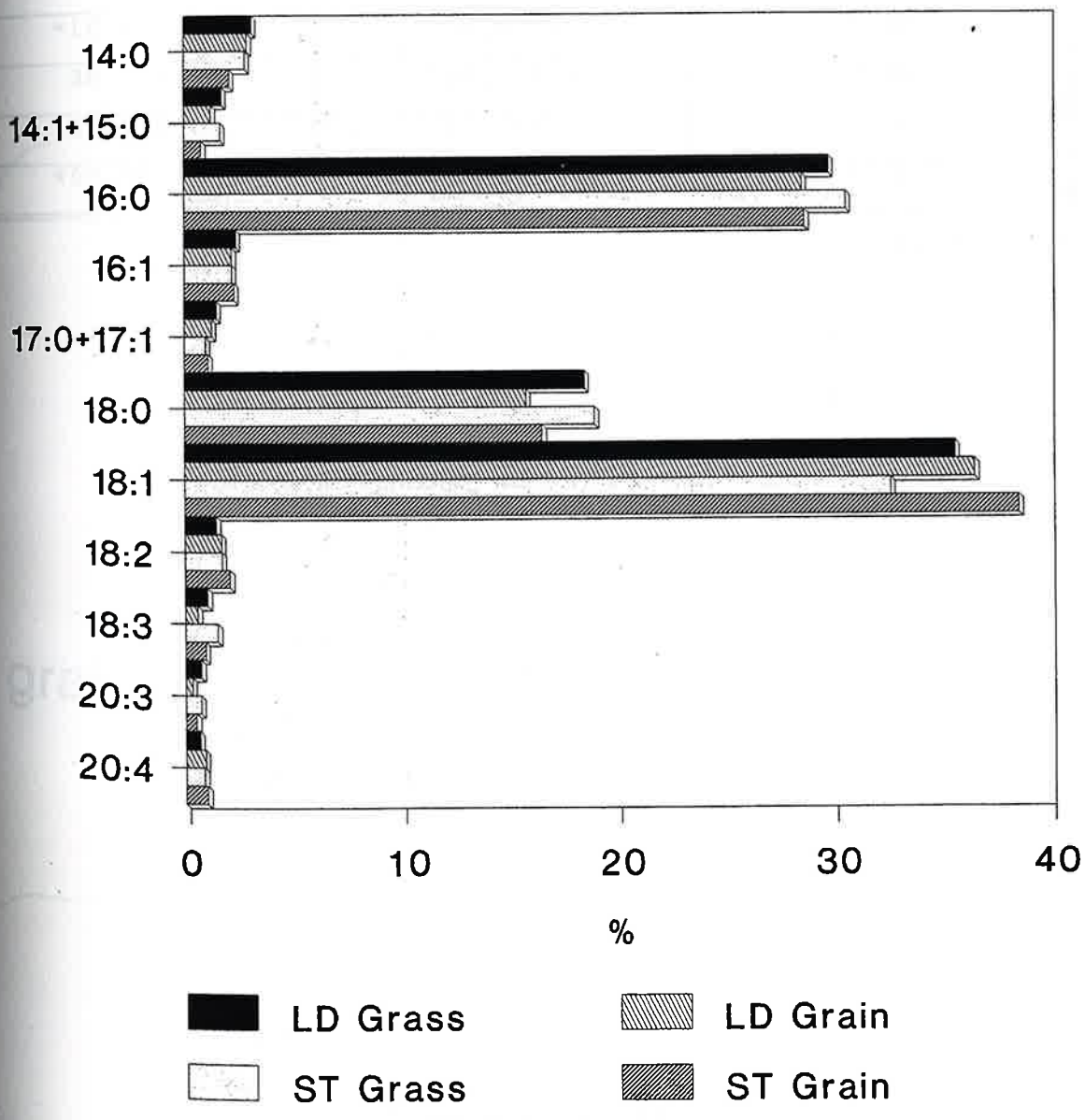
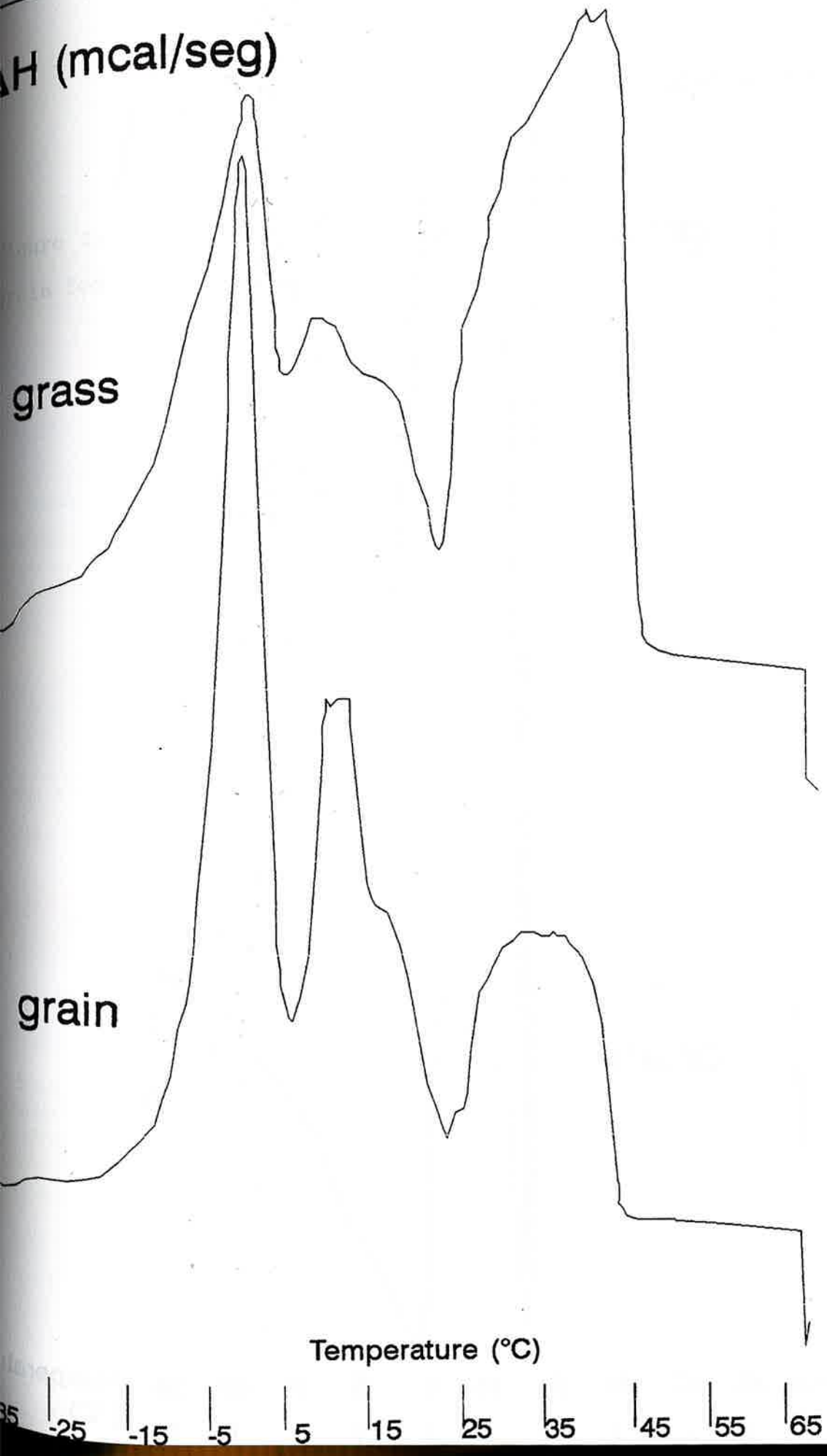


Table 1: Fatty acid composition of subcutaneous fat from grass or grain fed Aberdeen Angus steers.

Fatty acid	Grass	Grain
14:0	3.3±0.50	3.3±0.34
15:0	1.5±0.29	1.8±0.46
16:0	27.8±2.13	27.0±1.91
16:1	4.4±0.99	5.2±1.42
17:0	1.4±0.37	0.4±0.27*
17:1	0.8±0.13	0.8±0.13
18:0	16.9±0.86	14.1±1.51*
18:1	39.8±1.83*	44.8±1.88
18:2	1.3±0.19	1.3±0.16
18:3	1.5±0.17	0.7±0.09*

* $P < 0.05$


ΔH (mcal/seg)
grass
grain
Temperature (°C)
-25
-15
-5
5
15
25
35
45
55
65

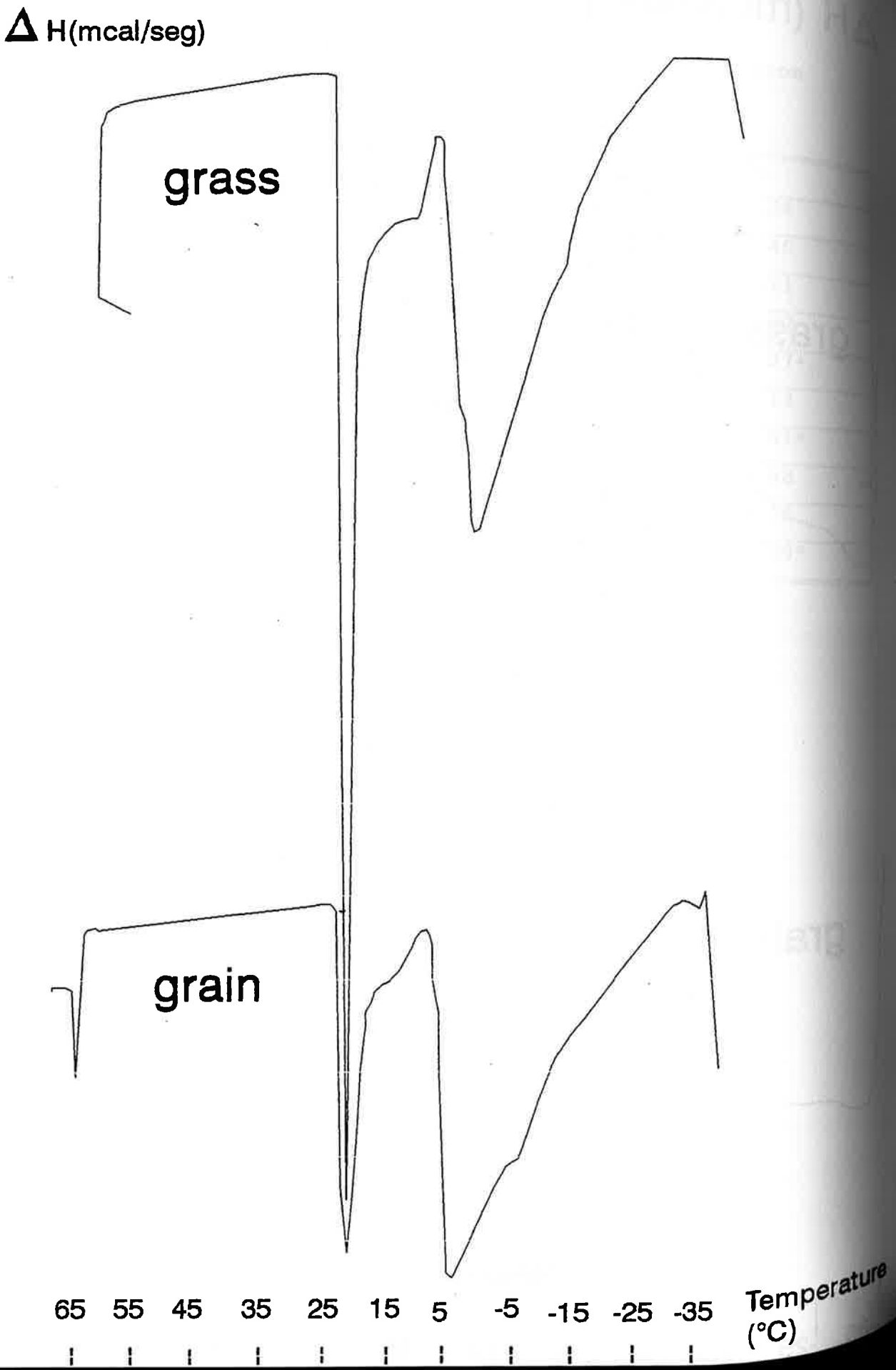

Δ H(mcal/seg)
grass
grain
65 55 45 35 25 15 5 -5 -15 -25 -35
Temperature (°C)

Figure 2: Cooling curves from subcuteneous fat from grass or grain fed steers according to procedure C.

Table 1. Animal performance

	group '+'		group '-'	
growing period				
duration (d)	202		202	
initial liveweight (kg)	234.3	(26.9)	232.5	(34.9)
final liveweight (kg)	462.5	(52.1)	301.7	(35.3)
average daily gain (kg/d)	1.13	(0.15)	0.34	(0.03)
fattening period				
duration (d)	82		194	
initial liveweight (kg)	478.4	(58.3)	309.5	(38.6)
final liveweight (kg)	596.8	(47.9)	592.3	(30.9)
average daily gain (kg/d)	1.44	(0.18)	1.46	(0.09)

Table 2. Effect of growth patterns on carcass characteristics

	group '+'		group '-'	
slaughter liveweight (kg)	581.4	(47.0)	581.7	(29.8)
carcass weight (kg)	377.0	(37.2)	370.2	(24.5)
killing-out proportion (%)	64.8	(1.6)	63.6	(1.2)
Carcass composition				
lean meat proportion (%)	58.1	(2.5)	55.6	(3.4)
adipose tissue proportion (%)	26.4	(2.2)	31.1*	(3.7)
bone proportion (%)	15.6	(2.1)	13.3	(0.9)

* $P < 0.05$

Table 3. Effect of growth patterns on chemical composition of the *longissimus thoracis* muscle

	group '+'		group '-'	
dry matter (%)	28.5	(1.0)	28.8	(0.9)
crude protein (% in dry matter)	86.9	(1.5)	80.2*	(4.2)
ether extract (% in dry matter)	6.8	(1.4)	8.7*	(1.6)
myoglobin (mg/g)	3.8	(0.7)	4.4	(0.6)

* $P < 0.05$

Table 4. Effect of growth patterns on quality characteristics of the *longissimus thoracis* muscle

	group '+'		group '-'	
temperature 1h *post mortem* (°C)	40.4	(0.5)	39.4	(0.3)
pH 1h *post mortem*	6.63	(0.18)	6.70	(0.07)
pH 48h *post mortem*	5.46	(0.03)	5.44	(0.02)
Hunter L* value	36.1	(2.4)	34.4	(0.7)
a*/b* value	1.80	(0.14)	1.85	(0.10)
expressed juice (%)	33.4	(0.4)	34.0	(1.1)
drip loss (%)	9.5	(1.5)	7.0 *	(1.3)
cooking loss (%)	33.3	(1.6)	31.1*	(1.0)
transmission (%)	2.4	(0.7)	4.3	(2.0)
Warner Bratzler peak shear force (N)	36.9	(5.7)	40.8	(6.4)

* $P < 0.05$

Table 1 - Least square means of fiber characteristics and fat cells by muscle

Area (mm^2)	Muscle			
Fiber type	TB	SM	ST	LT
Red	2738.3**ab**	2746.7**ab**	3732.5**a**	2402.8**b**
Intermed.	2910.0**ab**	2728.7**b**	4794.3**a**	3351.1**ab**
White	3383.3**ab**	3514.3**ab**	4766.2**a**	2847.1**b**
Fat cell	2645.0**a**	1687.2**b**	2031.5**ab**	2371.0**ab**
Fiber type (%)				
Red	24.0**ab**	21.5**a**	21.1**a**	30.4**b**
Intermed.	28.0**a**	28.5**a**	36.8**b**	39.2**b**
White	48.0**a**	50.0**a**	42.1**ab**	30.4**b**
Area (%)				
Red	21.2**ab**	18.8**ab**	17.3**a**	25.1**b**
Intermed.	26.3**a**	25.0**a**	38.7**c**	45.1**b**
White	52.5**a**	56.2**a**	44.0**b**	29.8**c**

a, b, c Means bearing different letters within a row and fiber trait are different $P < .05$.

Fig.1 - Size of muscle fibres and intramuscular fat cells by diet

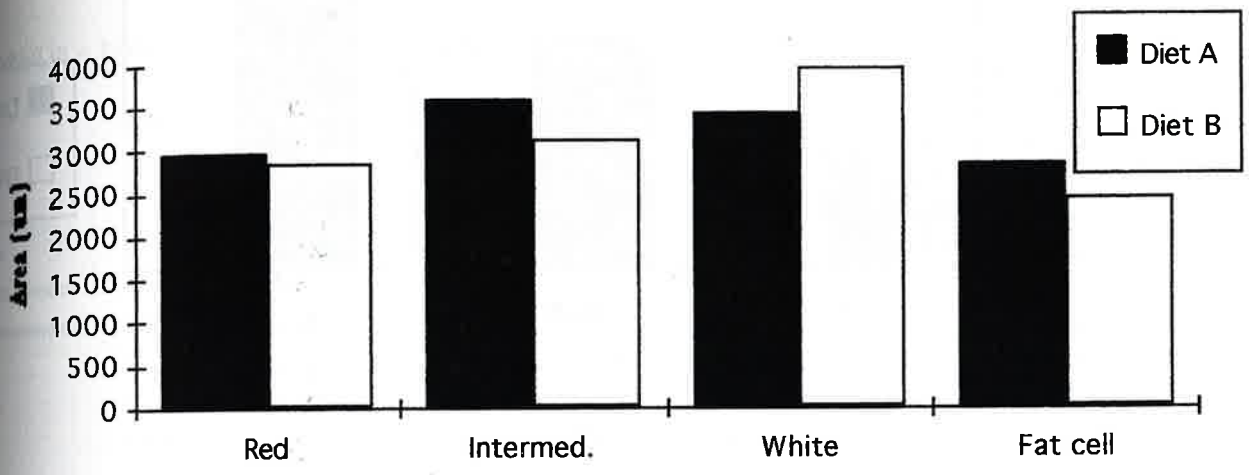


Fig.2 - Muscle fiber proportion by diet

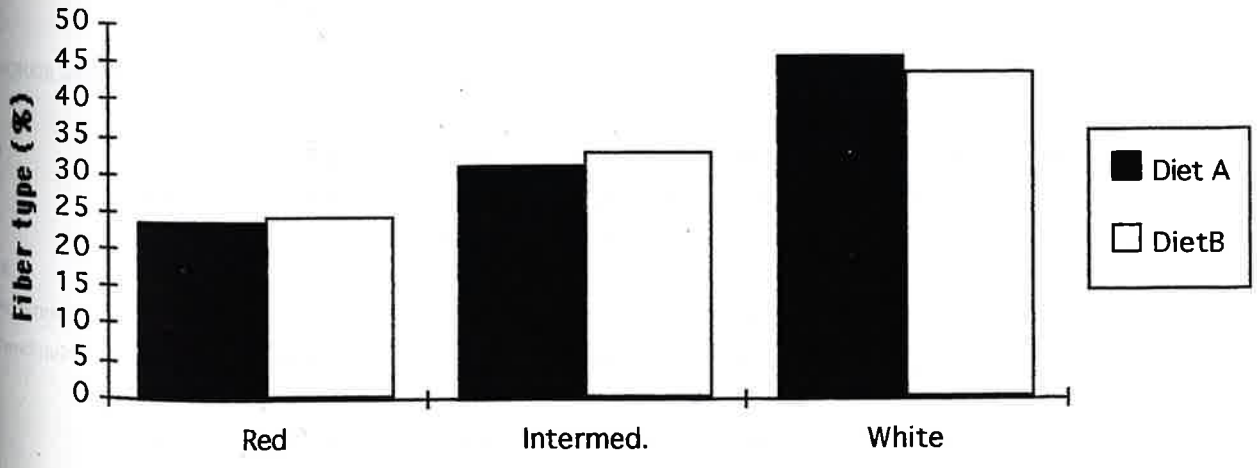


Fig.3 - Muscle fiber area percentage by diet

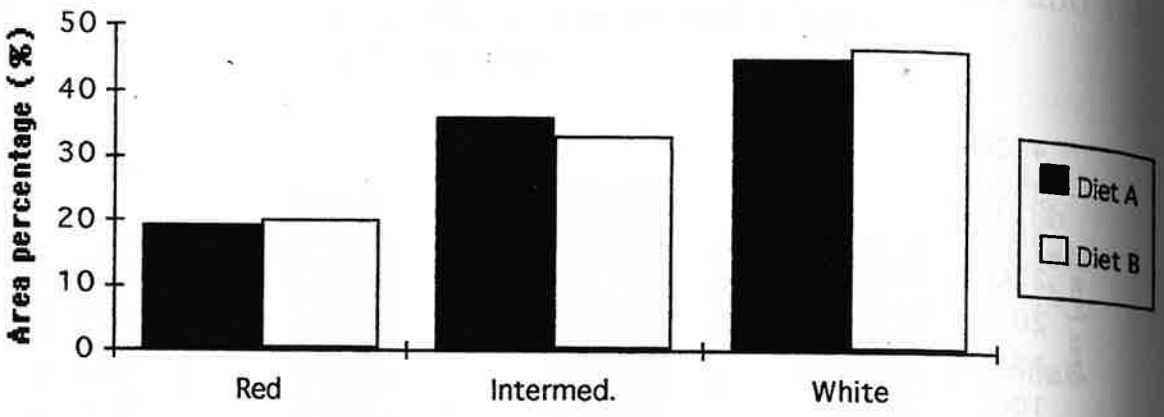


TABLE 1: MEANS FOR THE SENSORY CHARACTERISTICS AND SHEAR FORCE RESISTANCE OF MUSCLES AS INFLUENCED BY DIFFERENT AGES AND CARCASS FATNESS

	AGE			CARCASS FATNESS (%)				
	A (n=22)	B (n=19)	C (n=21)	1 (n=15)	2 (n=22)	3 (n=11)	4 (n=10)	5 (n=3)
TENDERNESS (8 = Extremely tender, 1 = Extremely tough):								
Prime rib	5,28^{a}	5,18^{a}	4,80^{b}	4,80^{a}	4,95^{a}	4,79^{a}	5,67^{b}	6,70^{c}
Wing rib	5,73^{a}	5,51^{a}	4,60^{b}	5,08^{a}	4,96^{a}	5,05^{a}	6,08^{b}	6,50b
Loin	4,80^{a}	4,66^{a}	4,17^{b}	4,48^{a}	4,34^{a}	4,21^{a}	5,31^{b}	4,77^{ab}
Silverside								
M. biceps femoris	5,55^{a}	4,75^{b}	3,48^{c}	4,50	4,71	4,29	4,52	5,47
M. semitendinosus	5,82^{a}	5,26^{b}	4,53^{c}	5,57^{b}	5,06^{a}	5,78^{a}	5,18^{ab}	6,67c
Rump	5,57^{a}	5,29^{b}	4,98^{c}	5,09^{a}	5,08^{a}	5,37^{ab}	5,59^{b}	6,07^{b}
Topside	5,29^{a}	4,76^{b}	4,41^{c}	5,17^{a}	5,04^{a}	5,20^{a}	5,24^{a}	6,17^{b}
Fillet	6,74^{a}	6,42^{b}	6,07^{c}	6,59^{a}	6,21^{b}	6,40^{ab}	6,47^{ab}	6,97^{a}
Thick flank	5,61^{a}	5,37^{b}	4,60^{c}	5,65^{ab}	5,12^{c}	4,96^{c}	5,31^{bc}	6,27^{a}
Chuck	5,74^{a}	5,46^{b}	4,51^{c}	5,07^{a}	5,16^{a}	4,87^{a}	5,64^{b}	6,50^{c}
Brisket	4,73^{a}	4,19^{b}	2,92^{c}	3,52^{a}	3,96^{b}	4,05^{b}	4,06^{b}	5,53^{c}
Neck	5,49^{a}	5,18^{b}	4,04^{c}	5,05^{a}	4,85^{a}	4,39^{d}	5,17^{a}	5,43^{a}
Shoulder	5,26^{a}	4,91^{b}	4,25^{c}	4,86^{ab}	4,80^{b}	4,29^{c}	5,02^{ab}	5,60^{a}
Thin flank	5,70^{a}	5,57^{a}	4,69^{b}	5,65^{ab}	5,12^{c}	4,95^{c}	5,31^{bc}	6,27^{a}
Shins	4,15^{a}	3,78^{b}	3,05^{c}	3,47^{a}	3,57^{a}	3,64^{a}	3,98^{ab}	4,63^{b}
SHEAR FORCE (N/2,54 cm)								
Prime rib	127,5	117,5	119,9	134,45	119,93	127,57	104,02	91,20
Wing rib	94,8^{a}	104,4^{ab}	121,5^{b}	106,1^{abc}	115,84^{ac}	123,13^{a}	82,37^{bc}	80,26^{c}
Loin	55,0	59,8	59,6	54,91	62,16	64,36	52,57	44,96
Silverside								
M. biceps femoris	85,4^{a}	112,6^{b}	153,9^{c}	116,71	117,14	124,75	110,89	99,23
M. semitendinosus	91,5^{a}	103,0^{b}	113,7^{b}	96,10	105,49	107,09	102,34	91,38
Rump	96,0	94,4	100,4	89,56	101,99	107,05	96,24	85,04
Topside	135,0	129,4	138,5	129,8	140,0	134,3	132,0	118,4
Fillet	79,5	79,8	77,8	78,36^{ab}	82,76^{a}	82,91^{ab}	72,83^{bc}	58,66^{c}
Thick flank	93,3^{a}	102,6^{a}	121,3^{b}	100,3	116,5	104,7	102,8	96,9
Chuck	61,9	66,1	74,1	70,17	69,12	68,73	61,26	57,72
Brisket	39,4	44,2	52,8	51,57^{a}	50,73^{a}	53,30^{a}	42,46^{b}	35,13^{b}
Shoulder	91,9^{a}	90,5^{a}	106,3^{b}	84,72	100,66	99,08	101,01	84,63
Thin flank	79,4^{a}	95,8^{a}	126,8^{b}	104,15^{a}	115,76^{a}	109,98^{a}	77,00^{b}	81,51^{ab}
Shins	52,7^{a}	62,4^{a}	103,5^{b}	62,25	62,21	71,71	61,26	55,50

Means in the same row for age and carcass fatness respectively with different superscripts differ significantly ($P \leq 0,05$)

TABLE 2: MEANS FOR COLLAGEN MEASURMENTS OF MUSCLES AS INFLUENCED BY DIFFERENT AGES AND CARCASS FATNESS

	AGE			CARCASS FATNESS (%)				
	A (n=16)	B (n=15)	C (n=14)	10 (n=11)	14 (n=16)	18 (n=10)	22 (n=3)	26 (n=1)
COLLAGEN CONTENT (Hypro N/Total N x 10^3)								
Prime rib	3,05	3,53	3,77	3,93	3,07	3,85	3,67	2,93
Wing rib	2,68	2,57	2,70	2,79	2,59	2,71	2,37	3,02
Loin	2,92	2,77	2,97	3,25	3,68	2,85	2,66	2,72
Silverside								
M. biceps femoris	6,26	6,09	5,77	6,13	6,60	5,72	5,04	5,28
M. semitendinosus	4,31	4,58	5,23	4,98	4,38	4,78	5,18	4,54
Rump	3,67	3,32	3,47	3,40	3,50	3,51	3,86	2,75
Topside	3,00	3,03	2,98	2,97	2,98	3,08	2,78	2,96
Fillet	2,23	2,75	2,52	2,54	2,71	2,20	2,76	1,45
Thick flank	4,04	4,18	3,95	3,97	4,00	4,44	3,68	3,55
Chuck	7,98[a]	9,37[b]	9,30[b]	8,43	9,05	7,71	10,62	9,95
Brisket	6,20	7,13	7,25	7,84	6,74	6,61	5,42	5,32
Neck	10,88	11,97	11,34	11,91	10,69	12,26	12,58	9,62
Shoulder	5,02	5,21	5,90	5,72	5,07	5,82	5,06	5,78
Thin flank	11,85	13,00	11,89	12,58	12,64	12,43	11,82	9,33
Hind shin	13,49	15,39	13,23	13,23	14,30	12,96	17,85	14,96
Fore shin	18,81	20,62	18,77	17,19	18,98	21,71	21,83	20,82
COLLAGEN SOLUBILITY (%)								
Prime rib	19,88[a]	14,98[b]	12,14[b]	15,20	16,76	14,70	17,38	11,96
Wing rib	18,88[a]	14,70[ab]	11,94[b]	13,89	16,56	14,46	16,10	14,77
Loin	21,54[a]	17,62[ab]	13,23[b]	16,20	17,43	18,54	21,08	16,18
Silverside								
M. biceps femoris	19,96[a]	16,56[b]	11,56[c]	14,61	17,35	15,34	15,09	16,95
M. semitendinosus	19,01[a]	15,95[b]	11,36[c]	14,94	16,00	15,20	15,91	14,22
Rump	21,12[a]	15,97[b]	11,91[b]	12,92	17,47	17,63	18,62	16,07
Topside	15,37[a]	12,11[b]	9,64[c]	10,57	13,36	12,29	13,81	12,87
Fillet	16,08[a]	14,56[a]	10,65[b]	12,43[ab]	14,55[ac]	13,34[ac]	16,64[a]	14,18[a]
Thick flank	25,28[a]	19,51[b]	14,10[c]	15,26	20,16	20,30	28,92	14,95
Chuck	28,59[a]	22,18[b]	16,05[c]	20,68	22,04	22,96	26,87	27,24
Brisket	17,76[a]	14,61[b]	11,73[c]	12,81	15,12	15,84	17,47	14,21
Neck	25,74[a]	19,98[b]	14,56[c]	19,68	19,41	21,86	19,69	22,14
Shoulder	27,84[a]	21,73[b]	17,10[c]	22,92	20,94	24,60	19,62	21,15
Thin flank	30,68[a]	22,01[b]	17,27[c]	22,29	22,98	24,22	23,78	18,47
Hind shin	36,97[a]	31,43[b]	20,86[c]	26,98	30,70	30,54	32,68	23,06
Fore shin	28,52[a]	22,57[ab]	16,21[b]	19,52	23,81	21,48[b]	23,98	16,87

[a,b,c] Means in the same row for age and carcass fatness respectively with different superscripts differ significantly ($P<0.05$)

	CONTROL	TREATED
LWG g/day	1,525 ± 0,15	2,075 ± 0,15*
H (1 d. pm.)	5,54 ± 0,09	5,57 ± 0,06
ross-sectional area of ongissimus Dorsi (cm^2).	97,673 ± 12,095	111,327 ± 5,037
tramuscular Fat of ongissimus Dorsi (%)	2,8 ± 1,476	2,965 ± 2,264
azymic activities:		
calpain activity(UI/g):		
- 3h pm.	0,071 ± 0,008	0,049 ± 0,006*
- 1 d. pm.	0,035 ± 0,004	0,016 ± 0,004
- 8 d. pm.		-
-calpain activity (UI/g):		
- 3h pm.	0,083 ± 0,070	0,055 ± 0,024
- 1 d. pm.	0,019 ± 0,014	0,029 ± 0,008
- 8 d. pm.	-	0,009 ± 0,011
lpastatin activity (UI/g):		
- 3h pm.	0,084 ± 0,012	0,125 ± 0,015*
- 1 d. pm.	0,003 ± 0,003	0,071 ± 0,042
- 8 d. pm.	0,004 ± 0,005	0,009 ± 0,013
μ-calp./calpast. (UI/g):		
- 3h pm.	0,843 ± 0,052	0,399 ± 0,08**
- 1 d. pm.	-	-
- 8 d. pm.	-	-

	CONTROL 1st day	TREATED 1st day	CONTROL 8th day	TREATED 8th day	CONTROL (8th-1st)d	TREATED (8th-1st)d
TENDERNESS AT FIRST CHEW	4,88±0,97ab	3,49±0,41b	6,31±0,80a	4,16±0,22b	1,43±0,43c	0,68±0,56c
OVERALL TENDERNESS	4,71±1,0ab	3,14±0,54b	6,03±0,85a	3,76±0,27b	1,31±0,27c	0,62±0,64c
JUICINESS	4,73±0,44ab	3,89±0,29b	5,20±0,36a	4,18±0,41ab	-0,47±0,21c	-0,28±0,42c
FIBROUSNESS	5,45±0,36ab	6,29±0,23a	4,87±0,50b	6,22±0,39a	0,58±0,17c	0,07±0,25c
RESIDUE	5,07±0,99ab	6,24±0,39a	4,02±0,46b	6,02±0,37a	1,05±0,62c	0,22±0,61c
OVERALL ACCEPTABILITY	4,79±1,16ab	3,50±0,51b	6,31±0,52a	3,92±0,38b	1,52±0,86c	0,42±0,57c

	CONTROL 1st d.	TREATED 1st d.	CONTROL 8th d.	TREATED 8th d.	CONTROL 1st - 8th d.	TREATED 1st - 8th d.
STRESS MAX (kg/mm^2)	0,09±0,01a	0,12±0,01a	0,05±0,01b	0,11±0,01a	0,05±0,01b	0,01±0,01c
TOUGHNESS (kg/mm^2)	0,04±0,01ab	0,05±0,01a	0,03±0,01a	0,04±0,01a	0,01±0,01b	0,01±0,01c
STRESS at YIELD (kg/mm^2)	0,09±0,01a	0,12±0,02a	0,05±0,01b	0,11±0,02a	0,05±0,01b	0,01±0,02c
ENERGY to YIELD (kg-mm)	17,6±8,07ab	37,05±18,7a	9,78±4,19a	26,83±14a	7,46±5,92a	7,26±5,91a
ENERGY to BREAK (kg-mm)	111,1±48,1a	158,2±73,1a	82,77±21,2a	130,3±46,1a	32,51±43,23a	22,94±40,91a
SLOPE after YIELD	4,57±0,83a	7,05±1,32a	1,43±0,33b	6,41±0,77a	3,29±0,71ab	0,18±1,92b

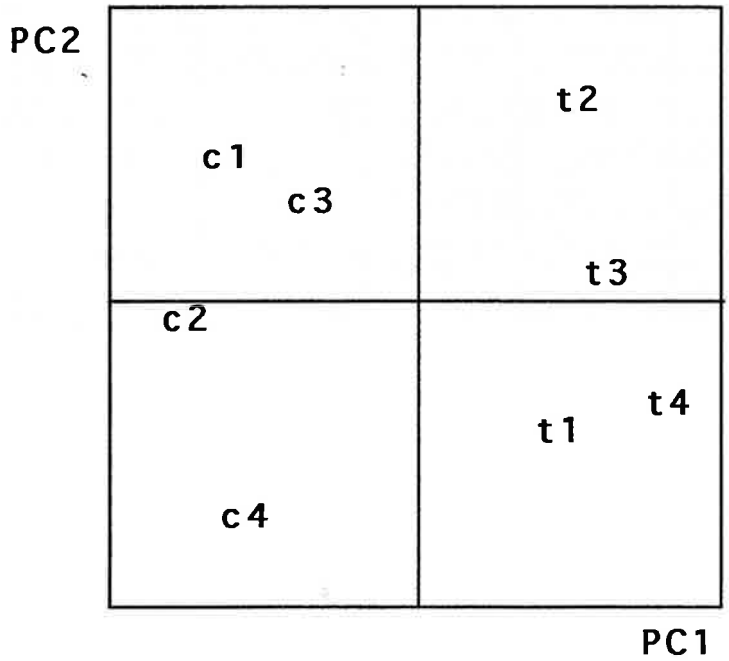

PC2
t2
c1
c3
t3
c2
t4
t1
c4
PC1

Table 1 - Composition and analysis of the diets used in the trial.
All values are expressed as kg/head per day.

PERIOD Days	PRE-TREATMENT 28	GROWER 105	FINISHER 50
Corn silage	8.00	6.37	6.67
Wet beet pulp (silage)	4.00	3.19	3.33
Wheat straw	1.20	1.21	1.20
Hay	1.00	-	-
Beet pulp, dehy	-	0.29	0.80
Corn	-	-	0.70
Soybean meal	1.20	1.21	1.40
Rice bran	1.00	1.01	1.00
Sweet potato, dehy	1.00	1.63	1.70
Barley	0.60	0.60	0.60
Sugarcane molasses	0.40	0.40	0.40
Vit./min. supplement	0.20	0.20	0.20
Urea	0.03	0.03	0.03
Sodium bicarbonate	-	*	0.10
Yeast	0.005	-	-
ANALYSIS:			
Total as fed (kg/d)	18.64	16.14	18.13
Total DM (kg/d)	9.39	8.63 (=100%)	10.14 (=100%)
Meat fodder units/kg DM *	0.81	0.86	0.89
Crude protein (% on DM)	14.4	14.2	14.0
NDF (% on DM)	35.8	31.4	30.7
ADF (% on DM)	23.2	20.4	19.4
Crude fibre (% on DM)	18.0	15.4	14.5
Ether extract (% on DM)	4.1	4.1	3.9
Starch+sugars (% on DM)	22.4	26.2	27.7
Ca (% on DM)	0.78	0.80	0.75
P (% on DM)	0.48	0.50	0.46

* 0.1 kg for Monensin and Avoparcin groups; 0 kg for Virginiamycin group.
** UFV of the French system where 1 UFV=1820 kcal NE for growth.

Table 2 - Feed intake of the animals on experiment.
(The foreseen intake is reported in table 1).
MS=Monensin Sodium; AV=Avoparcin; VM=Virginiamycin.

GROUP	MS	AV	VM
% of the foreseen intake:			
grower (105 days)	100.5	107.0	103.8
finisher (50 days)	86.8	94.9	85.5
TOTAL (155 days)	96.8	103.8	98.9
kg DMI/head daily:			
grower (105 days)	8.67	9.24	8.96
finisher (50 days)	8.80	9.63	8.66
TOTAL (155 days)	8.71	9.36	8.87

Table 3 - Bodyweights (kg) of the bulls on experiment (mean ± s.d.)

GROUP	MS	AV	VM
Start of pre-treatment	429.7 ± 32.5	427.2 ± 32.0	433.5 ± 31.5
Start of GROWER	469.4 ± 31.8	469.4 ± 32.8	470.7 ± 30.2
Mid GROWER	544.5 ± 44.3	556.2 ± 37.3	556.4 ± 33.0
Start of FINISHER	603.1 ± 48.5	609.8 ± 39.5	620.8 ± 37.6
End of the trial	655.8 ± 56.4	671.1 ± 39.0	685.9 ± 44.7
Liveweight at slaughter	671.3 ± 35.1	694.3 ± 17.9	706.6 ± 10.5
Cool carcass weight	419.4 ± 26.8	436.2 ± 13.6	437.3 ± 10.1

ble 4 - Daily weight gains (DWG, g) of the bulls on trial (mean ± s.e.).

	M (n=26)	AV (n=25)	VM (n=25)	VM *vs:* M	VM *vs:* AV	AV *vs:* M
-treatment (28 d)	1416 ± 70	1505 ± 72	1328 ± 72	NS	NS	NS
OWER (105 d) (1)	1273 ± 43	1312 ± 44	1456 ± 44	**	*	NS
ISHER (50 d)	1055 ± 59	1226 ± 60	1302 ± 60	**	NS	*
TAL (155 d) (1)	1203 ± 37	1277 ± 38	1413 ± 38	***	*	NS

<0.05; ** P<0.01; *** P<0.001
Least square means calculated from the DWG in the pre-treatment period as nificant covariate in the GLM analysis.

ble 5 - Feed conversion ratios (kg DMI/kg DWG) of the bulls on trial.

	M (n=4)	AV (n=4)	VM (n=4)	s.e.	VM *vs:* M	VM *vs:* AV	AV *vs:* M
ROWER (105 d)	6.84	6.98	6.27	0.28	NS	NS	NS
NISHER (50 d)	8.37	7.86	6.78	0.35	**	*	NS
HOLE TRIAL (155 d)	7.26	7.23	6.38	0.23	*	*	NS

<0.05; ** P<0.01

	First Group			Second Group		
	PM	LD	ST	PM	LD	ST
pH	5.75	5.76	5.72	5.58	5.63	5.55
Press J. %	46.8	42.1	47.4	48.8	43.3	48.9
Tot.Water %	74.8	75.2	75.1	75.1	75.4	75.6
Ash %	1.1	1.0	1.1	1.1	1.1	1.0
Protein %	21.3	21.2	21.2	20.8	20.7	20.7
Fat %	3.3	2.8	1.9	3.1	2.0	1.6
L	29.9	31.3	39.2	29.6	33.9	41.5
a	14.8	12.9	15.0	13.7	12.9	14.0
b	7.8	6.7	10.3	7.6	7.1	10.1
TBA mg/kg	0.15	0.12	0.08	0.11	0.11	0.08
HP µg/kg	341.6	366.4	1042.2	343.8	364.6	1042.2
Shear gr/cm	594	552	1531.4	608	567	1471.2

Table 1. Experimental results of buffalo muscles.

		Color Fresh	Color Cooked	Odour	Taste	Juic.	Tender.	Overall Accept.
1st Group	PM	4.5	4.6	4.5	4.6	4.3	4.7	4.6
	LD	4.1	4.7	4.6	4.3	4.2	4.3	4.4
	ST	3.8	4.0	4.2	3.2	2.7	3.9	3.4
2nd Group	PM	4.7	4.3	4.4	4.5	4.5	4.7	4.6
	LD	4.6	4.6	4.6	4.6	4.4	4.5	4.7
	ST	3.2	3.8	4.1	3.0	2.9	3.7	3.0

Table 2. Sensory evaluations of buffalo muscles.

TABLE 1

Fibre type distribution in Ld and Sm muscles from buffaloes fed ad libitum (Lib) or with fixed rations (Fix) and slaughterd at different ages (10, 14, 18 months)

			Ld muscle						Sm muscle					
			10		**14**		**18**		**10**		**14**		**18**	
			Lib	*Fix*	*Lib*	*Fix*	*Lib*	*Fix*	*Lib*	*Fix*	*Lib*	*Fix*	*Lib*	*Fix*
Fibre type %	**I**	μ	22.28	20.12	20.32	18.62	23.96	21.30	20.34	19.52	19.30	16.54	25.54	20.92
		σ	*2.79*	*1.18*	*3.27*	*2.24*	*6.25*	*2.13*	*3.16*	*2.84*	*6.52*	*5.10*	*8.60*	*5.19*
	IIA	μ	22.80	23.92	22.77	21.68	19.66	22.60	31.98	26.16	32.85	30.90	30.54	34.78
		σ	*9.16*	*7.01*	*7.60*	*3.71*	*9.87*	*6.96*	*5.26*	*7.26*	*7.19*	*10.60*	*6.27*	*5.69*
	IIB	μ	54.92	55.96	56.90	59.70	56.38	56.10	47.68	54.32	47.85	52.56	44.06	44.30
		σ	*7.08*	*6.10*	*7.52*	*4.35*	*6.80*	*7.54*	*7.20*	*6.00*	*2.10*	*14.37*	*9.66*	*9.70*

TABLE 2

Fibre type distribution in Ld and Sm muscles from buffaloes slaughtered at 6, 10, 14 and 18 months of age (groups Lib + Fix)

			Ld muscle				Sm muscle			
			6	**10**	**14**	**18**	**6**	**10**	**14**	**18**
			-	*Lib + Fix*	*Lib + Fix*	*Lib + Fix*	-	*Lib + Fix*	*Lib + Fix*	*Lib + Fix*
Fibre type %	**I**	μ	21.58 ^{a}	21.20 ^{a}	19.38 ^{a}	22.63 ^{a}	17.80 ^{a}	19.93^{a}	17.77 ^{a}	23.16 ^{a}
		σ	*5.54*	*2.27*	*2.70*	*4.62*	*6.56*	*2.87*	*5.57*	*7.10*
	IIA	μ	25.40 ^{a}	23.36 ^{a}	22.17 ^{a}	21.13 ^{a}	26.15 ^{a}	29.07^{a}	31.77 ^{a}	32.66 ^{a}
		σ	*3.48*	*7.71*	*5.37*	*8.20*	*4.12*	*6.71*	*8.75*	*6.08*
	IIB	μ	53.02 ^{a}	55.44 ^{a}	58.45 ^{a}	56.24 ^{a}	56.05 ^{a}	51.00^{ab}	50.47^{ab}	44.18 ^{b}
		σ	*8.16*	*6.25*	*5.73*	*6.77*	*6.39*	*7.16*	*10.54*	*9.13*

a, b for each muscle, means values in the same raw bearing different letter are significantly different (P< 0.05)

TABLE 3

Composition and colour (L* C* H°) in Ld and Sm muscles from buffaloes fed ad libitum (Lib) or with fixed rations (Fix) and slaughtered at different ages (10, 14, 18 months)

		Ld muscle						Sm muscle					
		10		**14**		**18**		**10**		**14**		**18**	
		Lib	*Fix*	*Lib*	*Fix*	*Lib*	*Fix*	*Lib*	*Fix*	*Lib*	*Fix*	*Lib*	*Fix*
Moisture %	μ	78.33	78.78	76.11	74.77	75.20	76.32	78.00	78.49	75.58	74.78	75.18	75.40
	σ	*0.72*	*0.47*	*0.17*	*1.25*	*1.09*	*1.40*	*1.26*	*0.33*	*1.43*	*1.42*	*0.88*	*1.98*
Protein %	μ	19.09	18.80	20.71	21.63	21.60	20.94	19.51	19.00	21.51	21.33	21.69	21.41
	σ	*0.85*	*0.29*	*0.95*	*0.99*	*1.05*	*1.04*	*1.30*	*0.33*	*1.27*	*1.57*	*1.13*	*1.26*
Fat %	μ	1.30	1.16	1.79	2.24	2.13	1.87	1.25	1.18	1.74	2.25	1.95	2.13
	σ	*0.11*	*0.13*	*0.49*	*0.24*	*0.41*	*0.31*	*0.13*	*0.12*	*0.39*	*0.55*	*0.41*	*1.00*
Ash %	μ	1.28	1.25	1.14	1.35	1.06	0.87	1.24	1.32	1.17	1.63	1.18	1.05
	σ	*0.18*	*0.21*	*0.15*	*0.43*	*0.59*	*0.22*	*0.17*	*0.19*	*0.18*	*0.75*	*0.20*	*0.36*
L*	μ	44.70	44.31	43.86	43.10	40.55	40.48	44.68	45.69	44.89	44.59	41.69	40.46
	σ	*2.08*	*1.31*	*1.57*	*4.41*	*3.11*	*2.18*	*2.08*	*2.45*	*2.12*	*1.60*	*0.80*	*1.17*
C*	μ	9.76	7.70	17.46	15.91	18.42	18.96	13.81	14.52	22.42	21.60	21.67	21.72
	σ	*1.19*	*3.21*	*4.15*	*4.10*	*3.01*	*1.94*	*1.92*	*1.78*	*5.00*	*4.03*	*1.60*	*2.84*
H°	μ	43.43	46.02	28.20	27.67	30.36	28.13	40.55	43.30	29.07	26.94	32.01	28.69
	σ	*7.79*	*9.66*	*2.54*	*3.37*	*6.57*	*6.96*	*5.57*	*2.73*	*1.94*	*3.71*	*2.62*	*4.66*

TABLE 4

Composition and colour (L C* H°) in Ld and Sm muscles from buffaloes slaughtered at 6, 10, 14 and 18 months of age (group Lib + Fix)*

		Ld muscle				Sm muscle			
		6 *L + F*	**10** *L + F*	**14** *L + F*	**18** *L + F*	**6** *L + F*	**10** *L + F*	**14** *L + F*	**18** *L + F*
Moisture %	μ	78.04 a	78.56 a	75.44 b	75.76 b	77.34 a	78.25 a	75.18 b	75.29 b
	σ	1.79	0.61	1.09	1.32	0.89	0.89	1.39	1.45
Protein %	μ	19.07 a	18.95 a	21.17 b	21.27 b	20.59ab	19.26 a	21.42 b	21.55 b
	σ	0.88	0.61	1.02	1.05	0.12	0.99	1.32	1.14
Fat %	μ	1.28 a,	1.23 a,	2.01 b	2.00 b	0.55 a	1.21 a	1.99 b	2.04 b
	σ	0.27	0.13	0.43	0.37	0.35	0.12	0.52	0.73
Ash %	μ	1.61 a	1.26ab	1.25ab	0.96 b	1.52 a	1.28 a	1.40 a	1.12 a
	σ	0.64	0.18	0.32	0.43	0.43	0.18	0.56	0.28
L*	μ	48.40 a	44.51 b	43.48 b	40.51 c	50.53 a	45.19 b	44.74 b	41.07 c
	σ	4.72	1.62	3.15	2.53	2.63	2.17	1.77	1.15
C*	μ	15.59 a	8.73 b	16.69 a	18.69 a	18.17ab	14.16 a	22.01 b	21.70 b
	σ	2.49	2.50	3.97	2.40	6.09	1.76	4.30	2.17
H°	μ	35.34ab	44.73 a	27.94 b	29.24 b	39.96 a	41.92 a	28.00 b	30.35 b
	σ	17.63	8.24	2.82	6.49	16.75	4.32	3.00	3.97

a, b, c for each muscle, means values in the same raw bearing different letter are significantly different ($P < 0.05$)

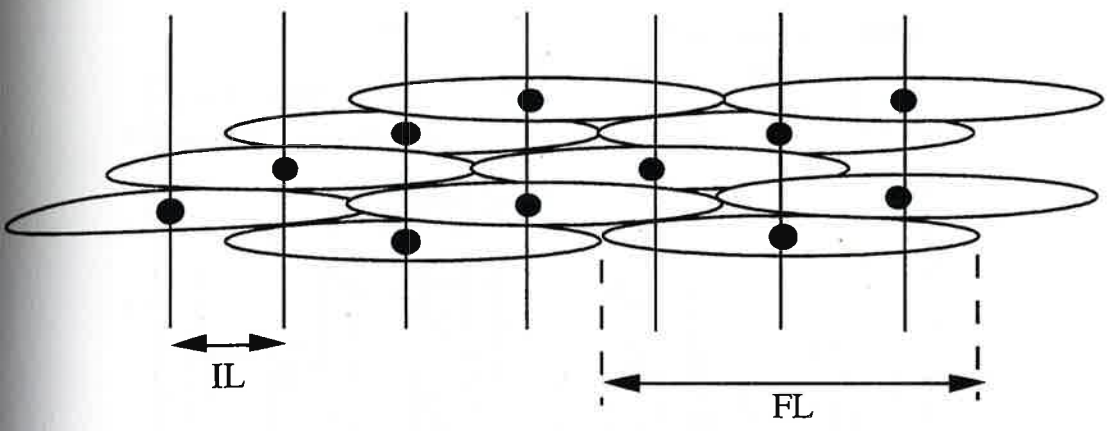


Fig. 1. The staggered overlap arrangement of discontinuous fibres in series fibred muscles. The degree of longitudinal overlap between adjacent fibres (OD) is given by the relationship OD= 1-(IL/FL), where IL is the spacing between motor end plates (black dots) and FL is the fibre length (Trotter, 1993). For bovine sternomandibularis, OD is in the order of 64% (Purslow & Trotter, 1994)

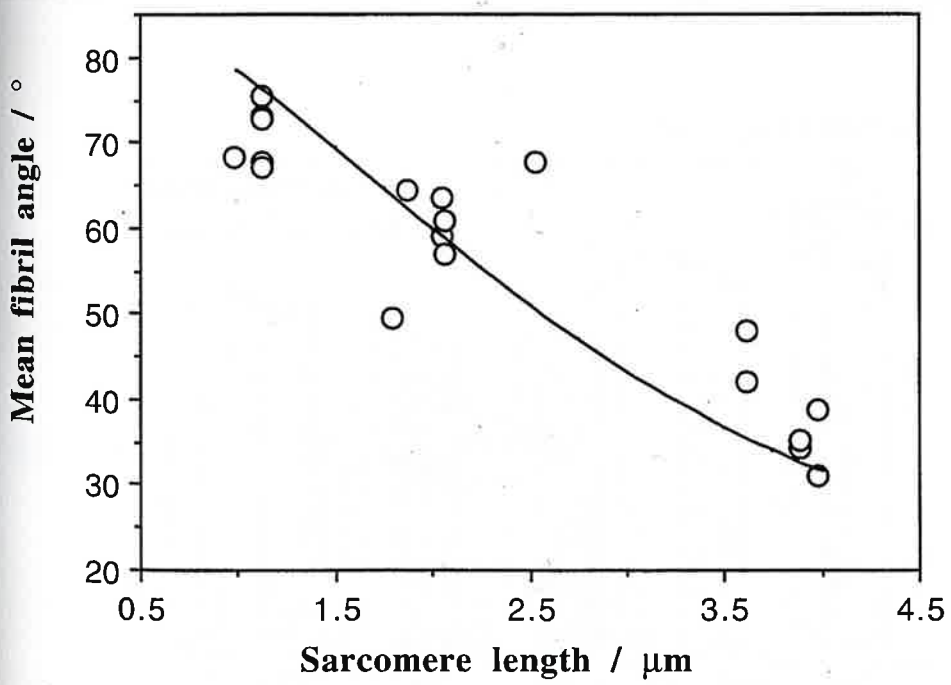


Fig.2. Mean of collagen fibril orientation in endomysium v. muscle sarcomere length. Data points shown are numerically-weighted means from analysed orientation distributions (from Purslow & Trotter, 1994). The line shown is the predicted mean orientation v sarcomere length from the model fitted to perimysial collagen orientation in the same muscle (Purslow, 1989). Adapted from Purslow & Trotter, 1994, with permission.

Table 1: Tissue composition of the shoulder joint, organ weight and meat quality characteristics of lambs fed a milk diet or roughage diet.

Parameter	Milk diet (n = 9)	Roughage diet (n = 9)	SED	Sig.
Carcass composition (%):				
Subcutaneous fat	16.55	12.87	1.818	NS[1]
Intermuscular fat	9.83	7.03	1.346	NS[1]
Total fat	26.38	19.90	2.097	**
Lean	51.13	54.63	2.206	NS
Bone	22.50	25.48	1.963	NS
Lean / Fat	2.11	2.78	0.294	*
Organ weight (g):				
Reticulo-rumen	322.8	902.3	33.99	***
Liver	699.1	931.8	64.56	**
Meat quality:				
pHi	6.50	6.49	0.944	NS
pHu	5.66	5.62	0.026	NS
Cooking loss (%)	31.80	30.79	0.994	NS
Sarcomere length (um)	1.60	1.64	0.040	NS
Shear force (kg)	4.81	4.42	0.538	NS
L*	38.41	37.50	3.013	NS
a*	9.46	9.93	1.338	NS
b*	7.19	9.30	0.656	**
C* (metric chroma)	11.94	13.73	1.290	NS
Hue angle	37.70	44.79	3.685	NS[2]

[1]P = 0.06; [2]P = 0.07; NS = not significant; * = P < 0.05; ** = P < 0.01; *** = P < 0.001.

Table 2: Per cent fatty acid distribution of the back fat[a].

Fatty acid	Milk diet (n = 9)	Roughage diet (n = 9)	SED	Sig.
$C_{10:0}$ (capric acid)	0.04	0.17	0.021	***
$C_{12:0}$ (lauric acid)	1.28	0.28	0.094	***
$C_{14:0}$ (myristic acid)	6.84	3.86	0.185	***
$C_{14:1}$ (myristoleic acid)	0.42	0.28	0.020	***
$C_{15:0}$ (pentadecylic acid)	0.33	0.63	0.065	***
$C_{16:0}$ (palmitic acid)	22.60	25.43	0.509	***
$C_{16:1}$ *trans.* (palmitelaidic acid)	0.00	0.27	0.051	***
$C_{16:1}$ *cis* (palmitoleic acid)	3.78	2.30	0.116	***
$C_{16:1}$ *cis + trans*	3.78	2.57	0.115	***
$C_{17:0}$ (margaric acid)	0.95	2.32	0.285	***
$C_{18:0}$ (stearic acid)	14.27	15.86	0.523	**
$C_{18:1}$ *cis* (oleic acid)	43.97	42.21	0.713	*
$C_{18:2}$ *cis* (linoleic acid)	4.56	4.97	0.258	NS
$C_{18:2}$ *trans* (linoelaidic acid)	0.05	0.21	0.016	***
$C_{18:2}$ *cis + trans*	4.61	5.18	0.253	*
$C_{18:3}$ (linolenic acid)	0.83	1.05	0.064	**
$C_{20:0}$ (arachidic acid)	0.04	0.06	0.020	NS
Totals:				
Saturated fatty acids	46.40	48.72	0.869	*
Monounsaturated ,, ,,	48.17	45.07	0.734	***
Polyunsaturated ,, ,,	5.43	6.23	0.296	*

NS = not significant; * = P < 0.05; ** = P < 0.01; *** = P < 0.001.

[a]Expressed as percentage of total fatty acids measured.

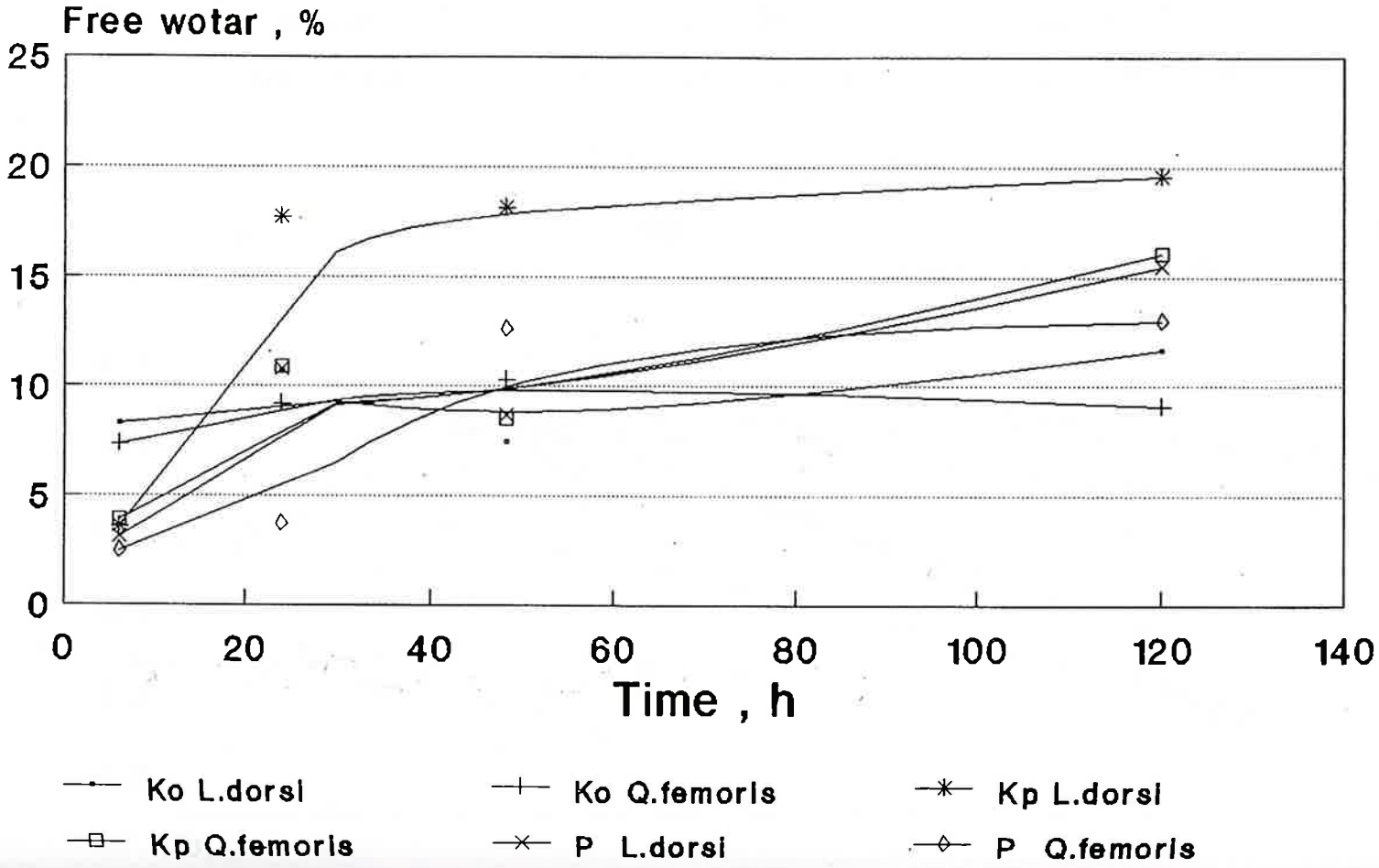


Figure 1. Changes of the free water content of the samples of lamb during its refrigaration preservation.

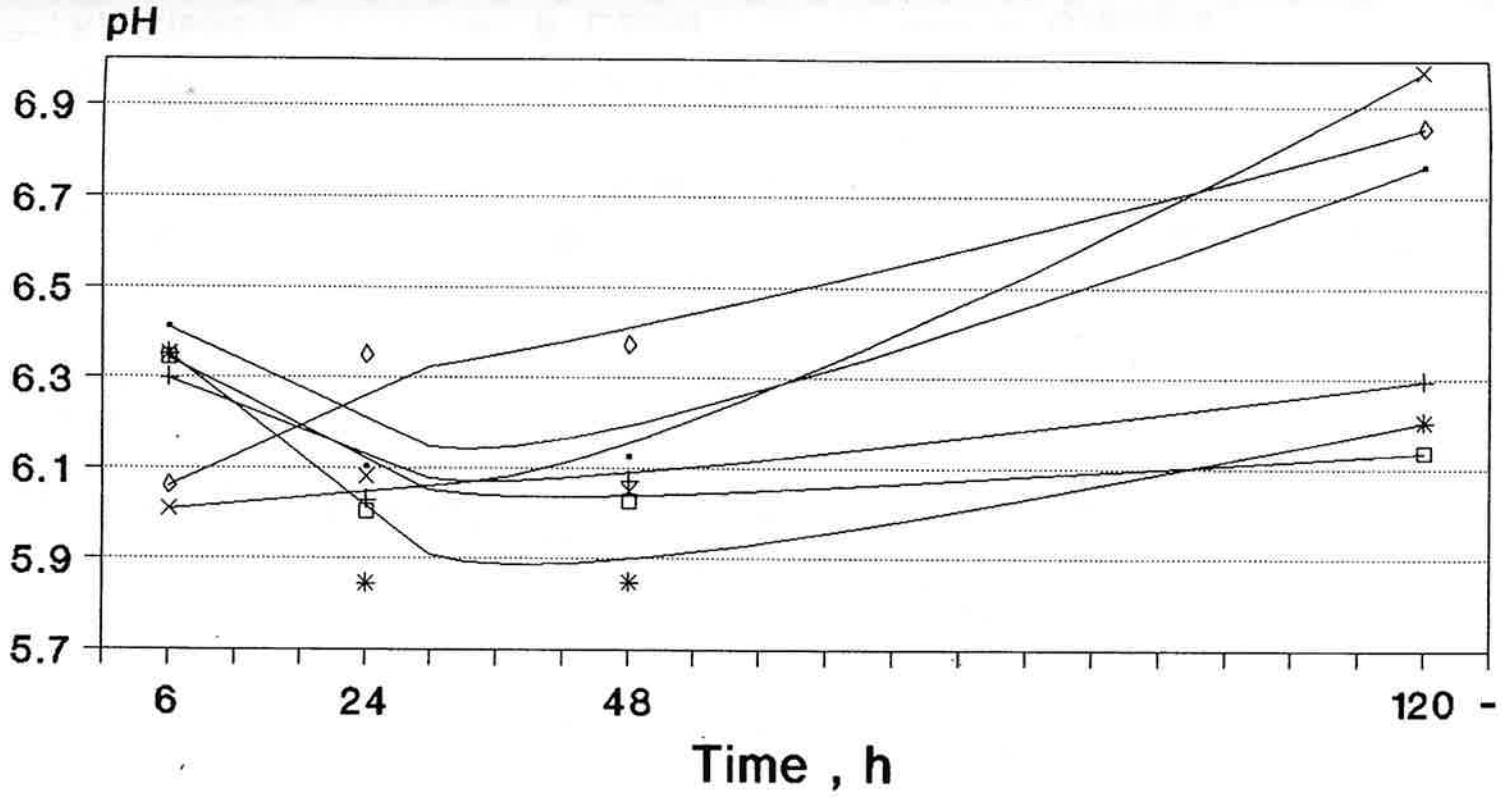


Figure 2. Chenges of pH of the samples of lamb during its refrigaration preservation.

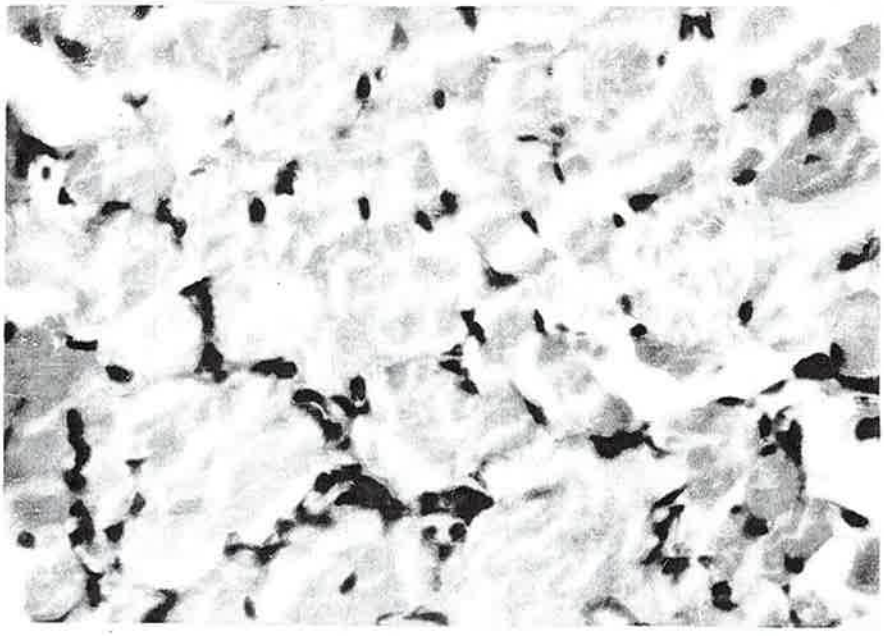


Figure 3. Microscipic photography of the transversse sectors of m. Quadriceps femoris of the lamb. 400x.

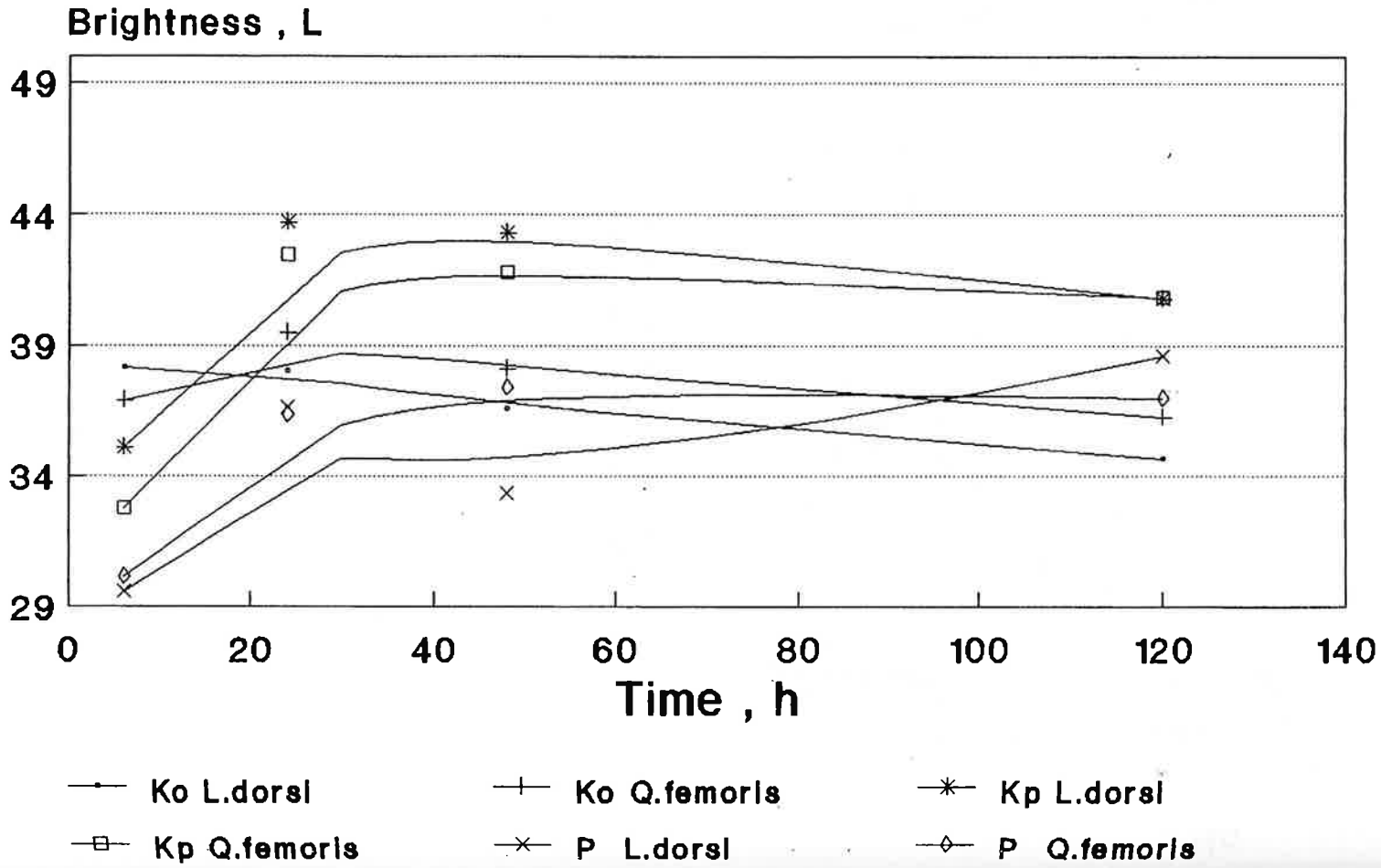


Figure 1. Brightness of the samples labm muscles during its refrigeration preservation.

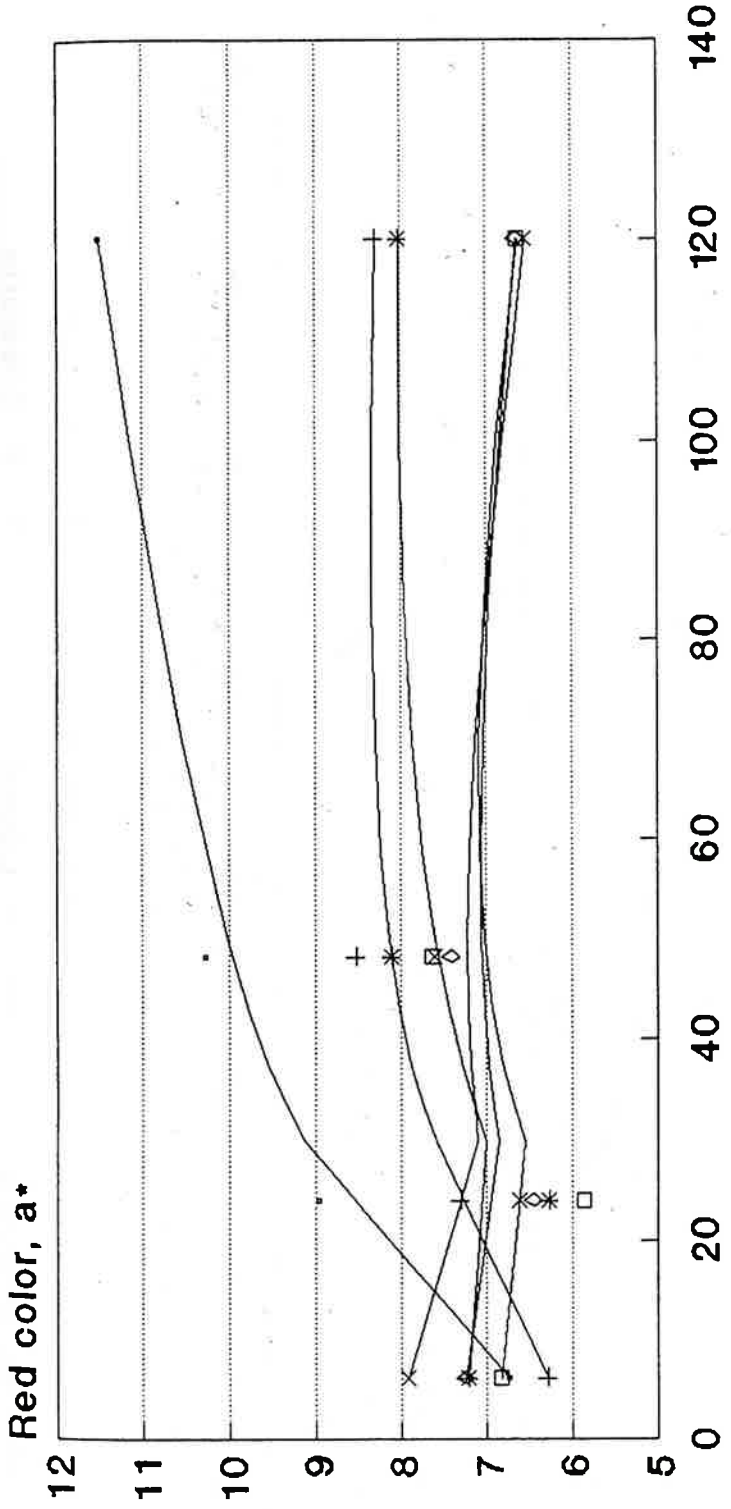


Figure 2. Red colour component (a*) of the samples lamb muscles during its refrigaration preservation.

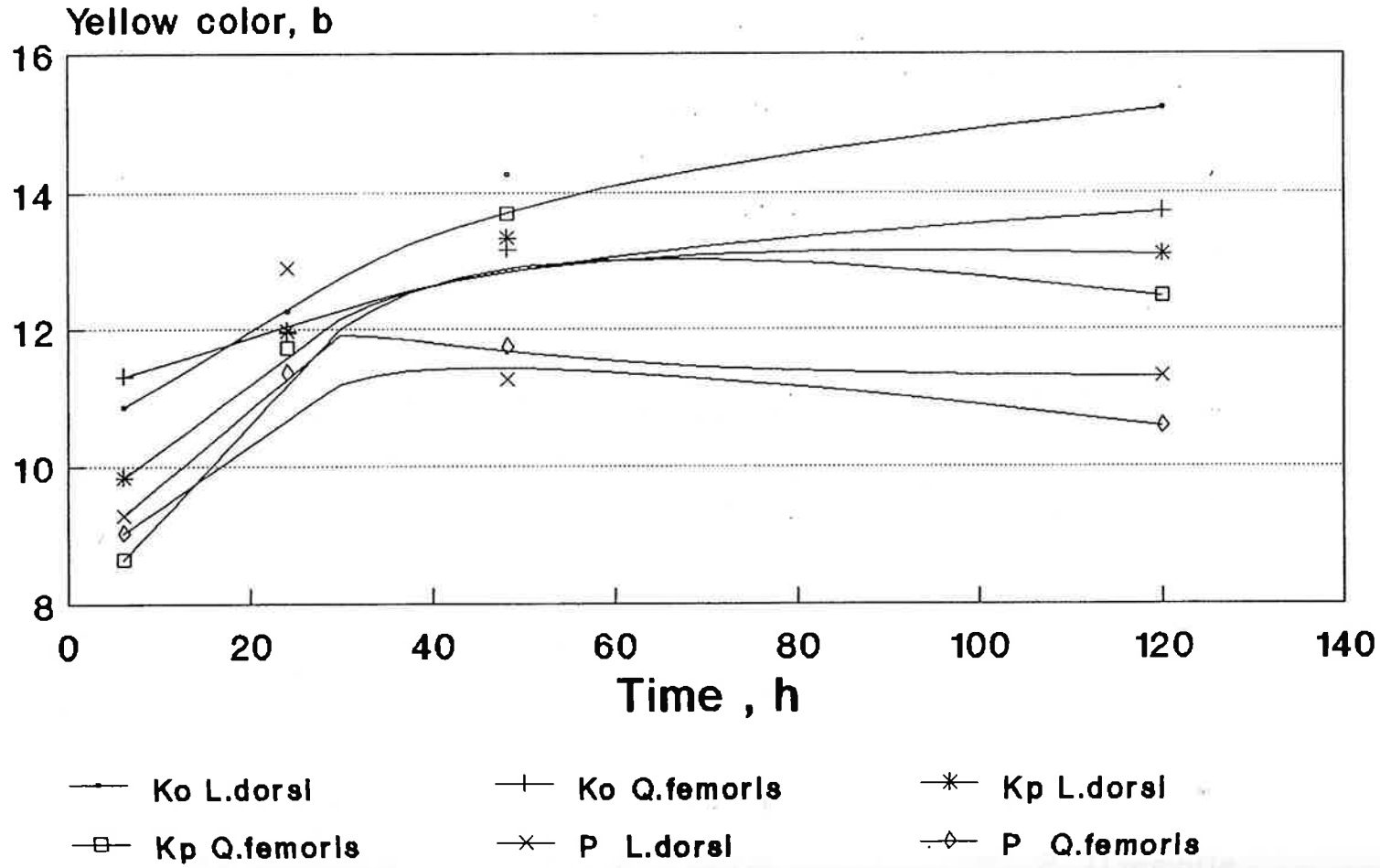


Figure 3. Yellow colour component (b*) of the samples lamb *muscles during its re-*frigaration preservation.

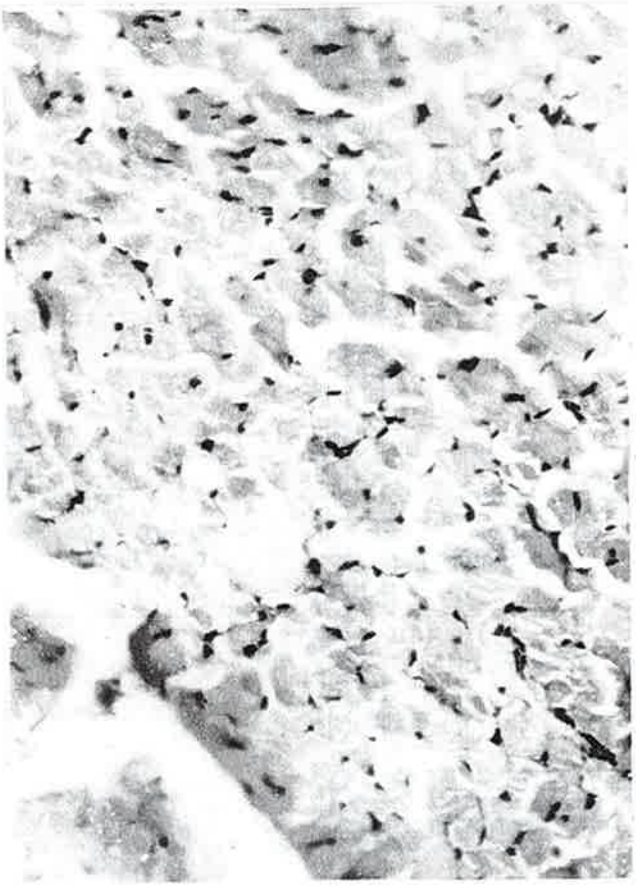


Figure 4. Microscopic photograph of the transversse sections of the m. Quadriceps femoris of the lamb. 200x.

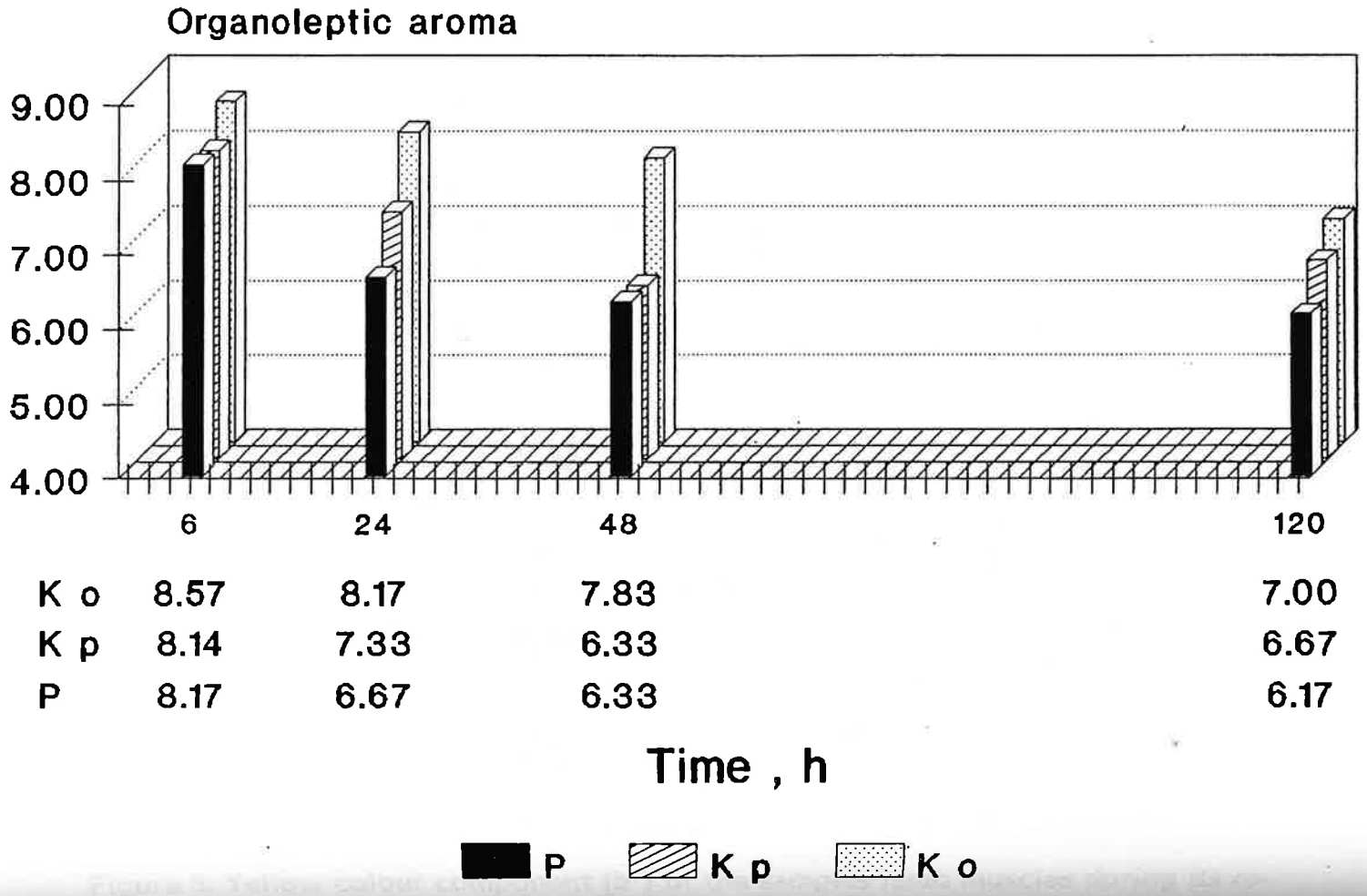


Figure 5. Organoleptic aroma of the examined samples of lamb.

Tab. 1 - Composition and nutritive values of finishing diets

	Weeks	Suppl.	Maize silage	NH3 straw	Gluco-protil	Maize grain	Total (100kg)	
	n	%	%	%	%	%	kg DM	ME (MJ)
Groups								
A	12	---	50	43	7	---	58.60	8.24
B	8	---	43	37	6	14	62.72	9.44
E	12	2	98	---	---	---	34.42	10.17
D	8	2	98	---	---	---	34.42	10.17

Tab. 2 - Curve coefficients (Y=a+b(1-exp(-cx))) of colour

		LIGHTNESS			CHROMA			HUE		
	N°	a	b	c10-2	a	b	c10-2	a	b	c10-2
Feed										
C	34	28.43b	10.12a	5.21	17.99ab	21.58a	4.80	24.16b	10.79a	5.35
A	29	28.35b	10.17a	5.54	17.64b	20.47ab	6.03	25.48ab	10.08ab	4.71
B	24	29.30b	9.23ab	6.02	16.95b	18.82b	5.75	24.82ab	10.56ab	4.77
D	16	31.05a	8.00b	5.09	20.36a	19.71ab	4.62	26.36a	9.06b	4.71
E	16	29.63ab	9.38ab	4.80	17.69ab	20.53ab	6.61	25.44ab	10.12ab	4.59
NES	60	29.06	9.34	4.73b	17.09b	20.07	5.73	24.79	10.76a	4.58
ES	59	29.64	9.43	5.95a	19.16a	20.37	5.39	25.71	9.48b	5.07
Age										
<5Y	71	29.06	9.30	5.07	17.99	20.01	5.54	24.79	10.19	4.54
>5Y	48	29.64	9.46	5.60	18.26	20.44	5.58	25.71	10.05	5.11
Mean	119	29.06	9.63	5.29	17.93	20.37	5.56	25.10	10.29	4.80
Root MSE		2.052	2.254	2.510	4.041	4.166	3.019	2.621	2.757	1.718

NOTE: different letters mean significant differences(p<0.005).

Tab. 3 -Curve coefficients (Y=a+bxlg(cx)) of pH and water losses

	N°	pH a	pH b10-2	pH c10-2	WATER LOSSES a	WATER LOSSES b10-2	WATER LOSSES c10-2
Feed							
C	72	6.15a	2.55a	1.02a	2.16a	1.51a	0.42c
A	54	6.08a	2.72a	1.18a	1.41c	0.62c	0.59ab
B	96	5.77b	0.32b	0.48b	1.68b	0.67c	0.57b
D	52	5.75b	0.27b	0.47b	1.53bc	0.75bc	0.66a
E	64	5.77b	0.34b	0.47b	1.52bc	0.84b	0.53b
NES	174	6.05a	1.53a	0.62b	1.65	1.02a	0.55
ES	164	5.75b	0.94b	0.83a	1.67	0.74b	0.56
Age							
>5Y	174	6.04a	2.07a	0.92a	1.63	0.84	0.52b
<5Y	164	5.77b	0.41b	0.52b	1.69	0.92	0.59a
Muscles							
St	76	5.92a	1.59a	0.87a	2.12a	1.04a	0.51bc
Gb	76	5.97a	1.62a	0.79a	1.31c	0.78b	0.44c
Sm	76	5.93a	1.60a	0.84a	1.84b	1.01a	0.58b
LD	110	5.75b	0.13b	0.40b	1.37c	0.68b	0.68a
Mean	338	5.99	1.86	0.89	1.66	0.88	0.56
Root MSE		0.338	1.540	0.600	0.505	0.526	0.267

See note tab. 2

Tab. 4 - Curve coefficients of WBS (Y=a+b(1-exp(-cx)))

	HARDNESS a	HARDNESS b10-2	HARDNESS c10-2
Feed			
C	2.19b	16.37bc	2.65a
A	1.93c	16.60b	2.63a
B	2.26ab	13.43c	2.51ab
D	2.14bc	19.51ab	2.91a
E	2.41a	21.18a	1.79b
NES	2.12b	18.99a	2.31
ES	2.26a	15.94b	2.68
Age			
>5Y	2.22	18.23	2.46
<5Y	2.15	16.61	2.53
Muscles			
St	3.23a	14.67	1.73bc
Gb	1.89b	25.39	2.29b
Sm	1.87b	19.95	1.25c
LD	1.76b	9.67	4.73a
Mean	2.16	16.57	2.56
Root MSE	0.588	8.810	2.220

le 1.

Display time (days)	Level of vitamin E (IU) 0	500
0	7.0[a]	7.0[a]
1	6.6[a]	6.9[a]
3	5.4[a]	6.7[b]
5	4.0[a]	6.0[b]
7	3.6[a]	5.6[b]

coloration: 7=0% discoloration; 1=100% discoloration.
leans in the same row with a common superscript are not significantly (P>0.05) different.

le 2.

Display time (days)	Level of vitamin E (IU) 0	1000	2000
0	6.9[a]	7.4[a]	7.4[a]
2	4.9[a]	6.9[a]	7.0[b]
4	1.9[a]	5.7[b]	5.6[b]
6	1.0[a]	4.7[b]	4.1[b]
8	1.0[a]	1.0[a]	1.0[a]

rall appearance: 8=extremely desirable; 1=extremely undesirable.
leans in the same row with a common superscript are not significantly (P>0.05) different.

le 3.

Beef cut	Level of vitamin E (IU) 0	500
T-bone steak	18.1	3.1
Knuckle steak	14.6	5.2
Ground chuck	17.9	2.2

Table 4.

Display time (days)	Level of vitamin E (IU)	
	0	500
1	0.18a	0.35^{b}
7	0.90^{a}	0.42^{b}

^{ab}TBA numbers in the same row with different superscripts are significantly ($P<0.05$) different.

Table 5.

Vitamin E (IU)	Display time (days)			
	0	2	4	8
0	3.24^{a}	3.39^{a}	5.12^{a}	7.94^{a}
1000	3.06^{a}	3.12^{ab}	4.28^{b}	7.61^{b}
2000	2.98^{a}	3.00^{b}	4.41^{b}	7.49^{c}

^{abc}Means in the same column with a common superscript are not significantly ($P>0.05$) different.
CFU: colony forming units.

Table 6.

Vitamin E (IU)	Display time (days)		
	0	2	4
0	>3.0	6.04	6.41
1000	>3.0	5.68	6.82
2000	>3.0	5.74	6.82

No significant ($P>0.05$) differences among treatments on the same day of storage.
MPN: Most probable number.

Table 7.

Vitamin E (IU)	Display time (days)			
	0	2	4	8
0	3.93^{a}	3.96^{a}	3.81^{a}	4.00^{a}
1000	3.96^{a}	3.96^{a}	3.81^{a}	4.08^{a}
2000	3.85^{a}	3.73^{b}	3.72^{a}	4.15^{a}

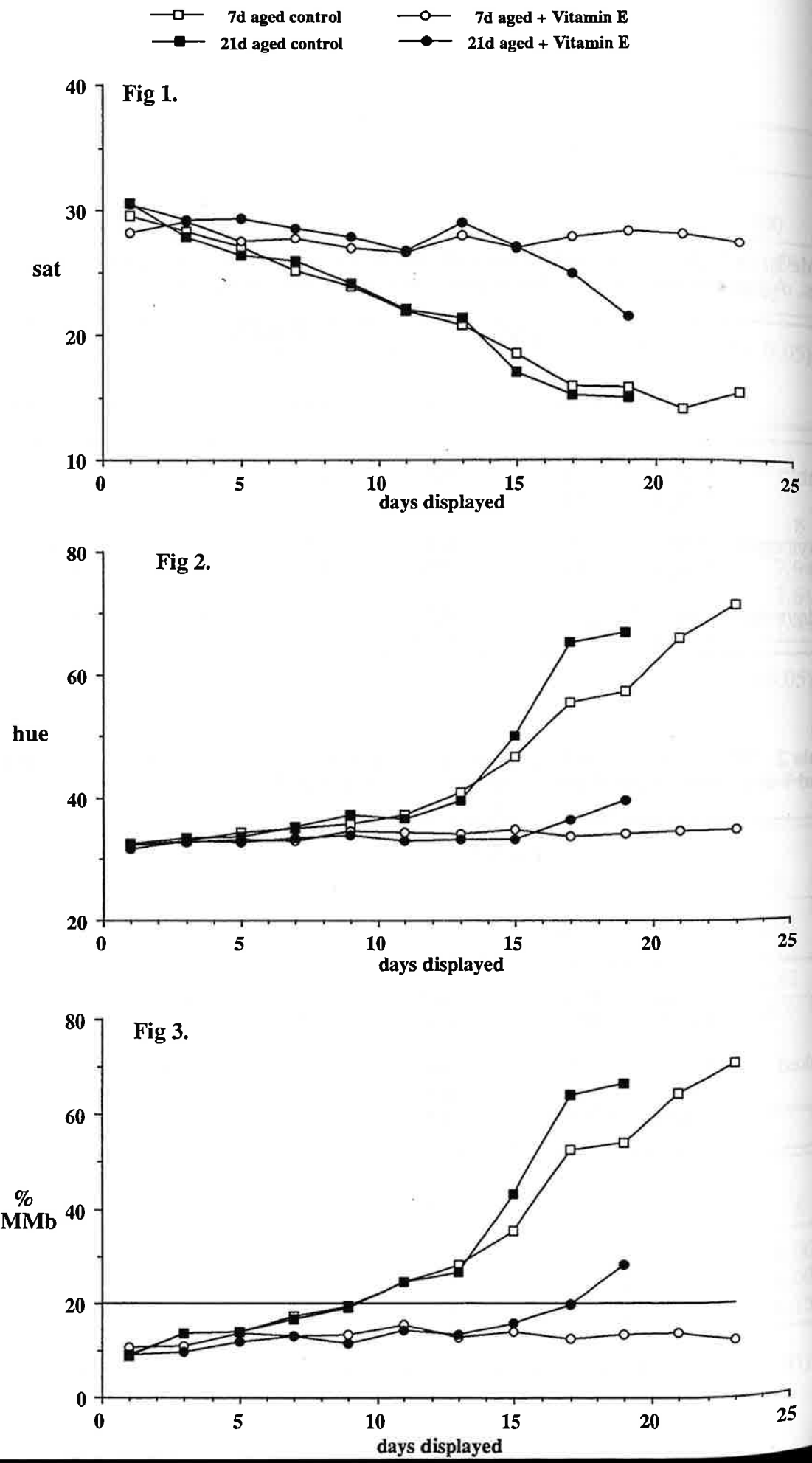
^{ab}Means in the same column with common superscript are not significantly ($P>0.05$) different.
CFU: Colony forming units.

Table 1. Drip (% initial weight of meat) from LD slices aged in vacuum pack for 7 and 21 days. Accumulation of drip is shown over 2 days and 7 days storage at 1°C.

		Control		Vitamin E		
	Storage	Mean	SE	Mean	SE	significance
Fresh	2 days	3.4	0.35	1.9	0.53	*
	7 days	7.7	1.16	4.1	0.77	*
days aged	2 days	2.8	0.74	2.5	0.34	NS
	7 days	4.3	0.98	4.2	0.51	NS
1 days aged	2 days	1.7	0.22	1.8	0.24	NS
	7 days	3.7	0.76	3.3	0.54	NS

Table 2. TBA values for beef LD aged for 21 days (LD21), raw and cooked, measured after and 7 days (raw) and 2, 5 and 7 days (cooked) storage at 4°C.

		Control		Vitamin E		
	Storage	Mean	SE	Mean	SE	significance
Raw	2 days	0.36	0.05	0.08	0.01	*
	7 days	0.98	0.16	0.15	0.02	*
Cooked	2 days	5.28	0.61	4.42	0.49	NS
	5 days	6.83	0.41	6.58	0.50	NS
	7 days	9.14	0.38	8.14	0.37	NS



Changes in 1) saturation (sat) 2) hue and 3) accumulation of metmyogoblobin (MMb) of MA packed LD slices during simulated retail display

ble 1. Surface metmyoglobin % and microbial growth on beef from cattle supplemented with vitamin E at levels of 0 (E-0), 500 (E-500) and 2000 (E-2000) mg/head/day. Beef samples were inoculated with and without a fluorescent pseudomonad culture (10^6 CFU/cm^2) and stored at 4°C for 3 days.

	Surface MetMb%	Total Bacteria Count (log CFU/cm^2)
Pseudomonad Inoculation		
E-0	4.6	5.3
E-500	4.9	5.0
E-2000	0	5.2
ith Pseudomonad Inoculation		
E-0	85.0	7.0
E-500	61.3	7.2
E-2000	26.0	6.7

ble 2. Sensory evaluation of loin steaks from cattle supplemented with vitamin E at levels of 0 (E-0), 500 (E-500) and 2000 (E-2000) mg/head/day.

	Treatment	Storage Day at 4°C					
		0	3	6	9	12	14
		Numbers of Panelist Responding "Yes"					
sual Qualities							
Discolored	E-0	0	1.5	9	9	9	9
	E-500	0	3	7.5	6	9	9
	E-2000	0	0	2.5	8	9	9
Appearance accepted	E-0	9	9	4.5	6	0.5	1.5
	E-500	9	9	5.5	5	3	2.5
	E-2000	9	9	9	6	7	5
factory Quality							
Spoiled	E-0	0	0	1	2.5	5	7.5
	E-500	0	0.5	1.5	1.5	4	7.5
	E-2000	0	0	1	2	3.5	7.5
verall Quality							
Accepted	E-0	9	9	4.5	3.5	1	0.5
	E-500	9	8.5	5.5	5	2.5	0.5
	E-2000	9	9	8	6	5	1

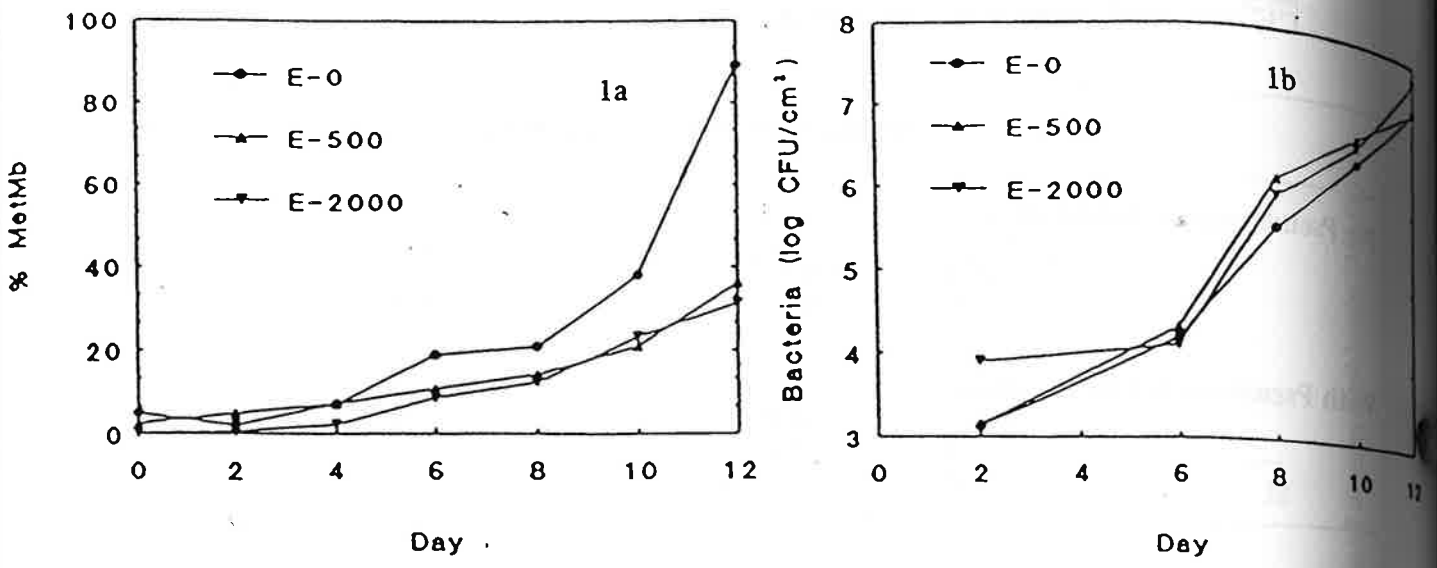


Figure 1. Surface metmyoglobin (1a) and aerobic plate count (1b) of beef loin samples obtained from cattle supplemented with vitamin E at levels of 0 (E-0), 500 (E-500) and 2000 (E-2000) mg/head/day and stored at 4°C for 12 days.

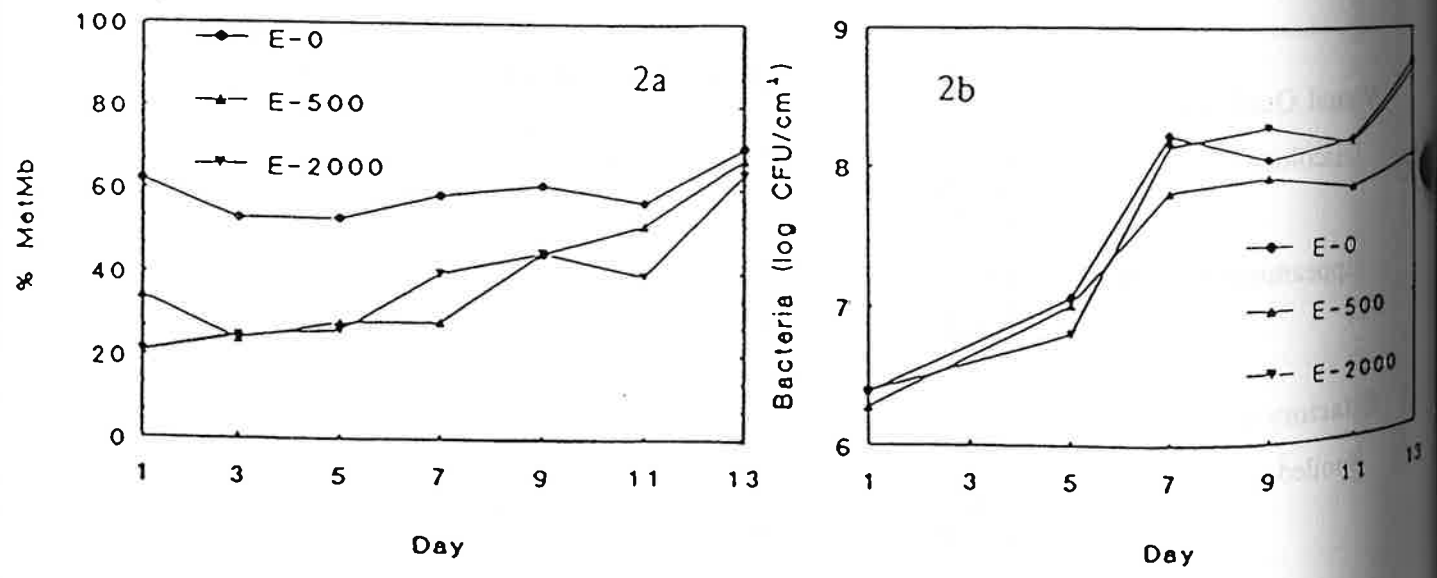


Figure 2. Surface metmyoglobin (2a) and aerobic plate count (2b) of beef loin samples obtained from cattle supplemented with vitamin E at levels of 0 (E-0), 500 (E-500) and 2000 (E-2000) mg/head/day. Beef loin samples were temperature-abused at 25°C for 24 hr. and subsequently stored at 4°C for 12 days.

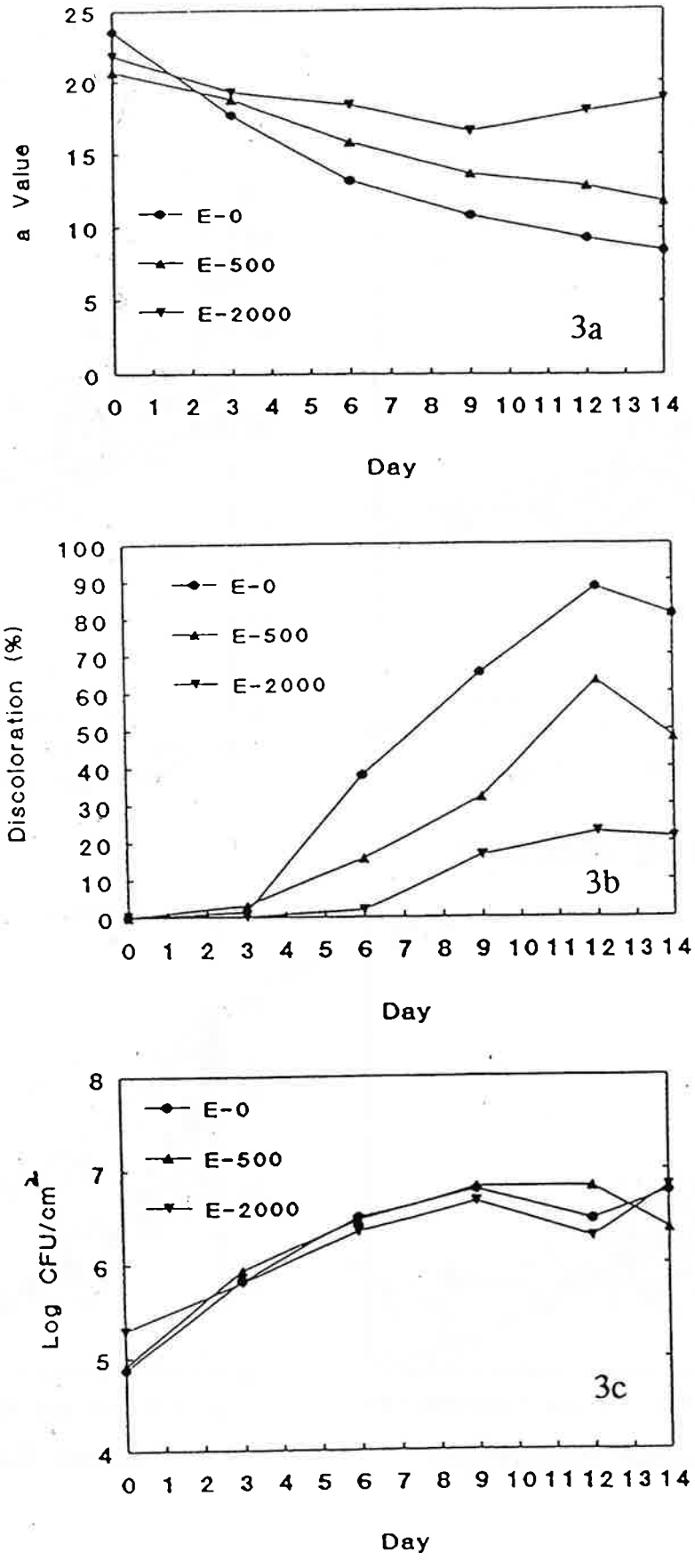


Figure 3. Sensory analysis of a* value (3a); % surface discoloration (3b); and microbial load (3c); of beef loin steaks from cattle supplemented with vitamin E at levels of 0 (E-0), 500 (E-500) and 2000 (E-2000) mg/head/day. Beef steaks were stored at 4°C for 14 days.

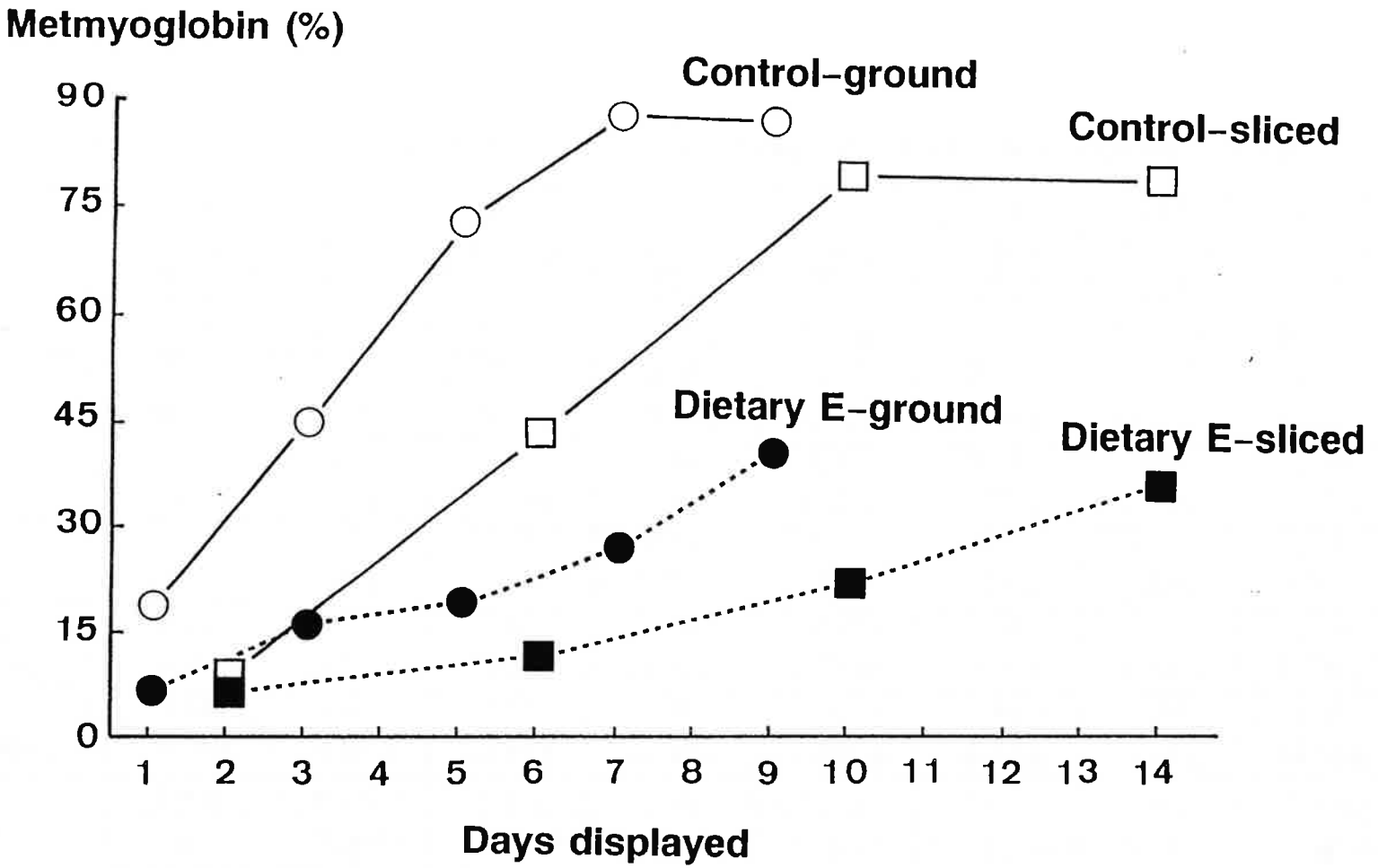


Fig. 1. Relationship of dietary vitamin E supplementation x days displayed on surface metmyoglobin percentages in ground and sliced beef longissimus. Control-ground = control ground beef; Control-sliced = control sliced beef; Dietary E-ground = ground beef with dietary vitamin E supplementation; Dietary E-sliced = sliced beef with dietary vitamin E supplementation.

TBARS (mg MDA/kg muscle) Control-ground Control-sliced

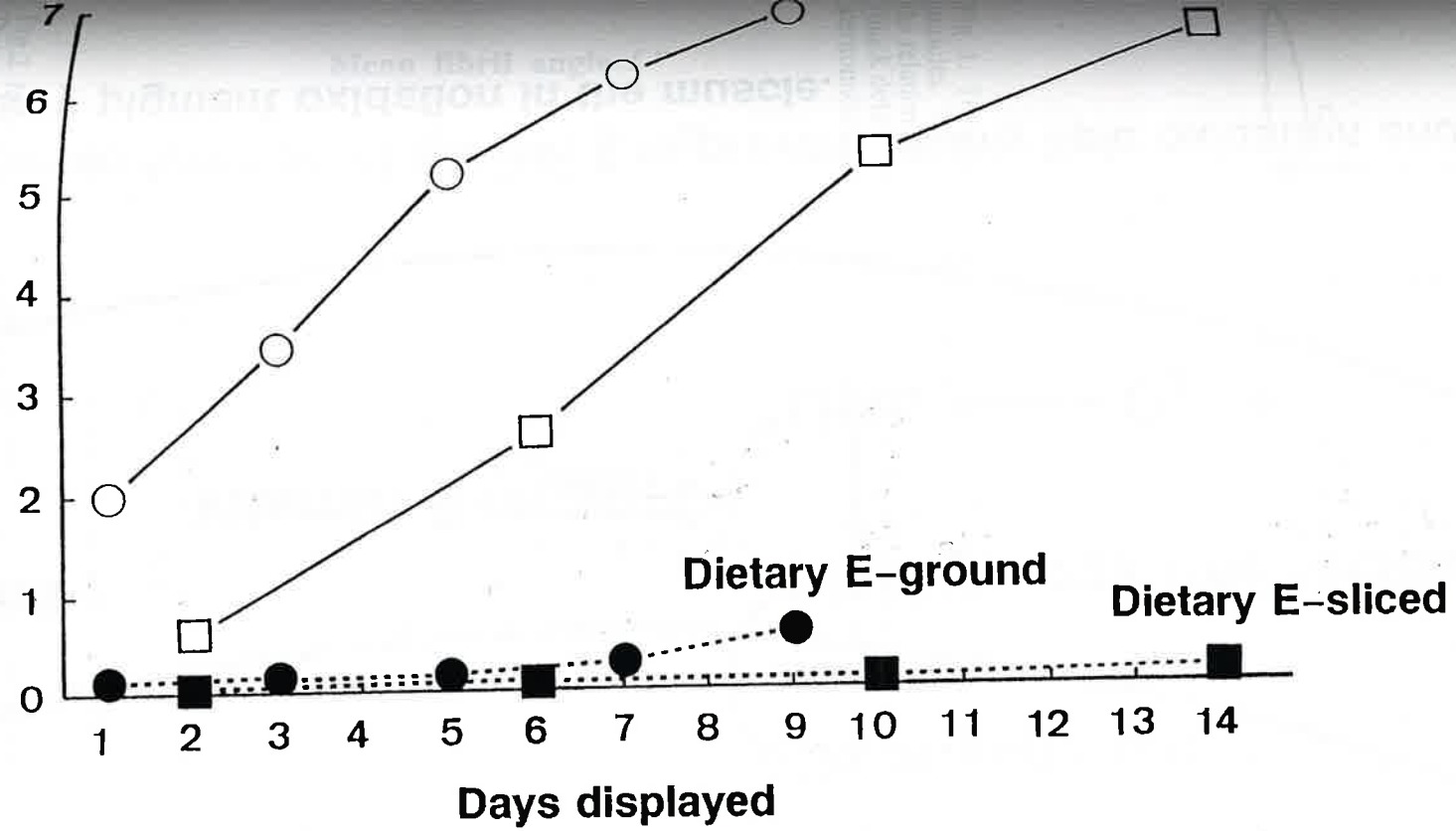


Fig. 2. Relationship of dietary vitamin E supplementation x days displayed on TBARS values in ground and sliced beef longissimus. Control-ground = control ground beef; Control-sliced = control sliced beef; Dietary E-ground = ground beef with dietary vitamin E supplementation; Dietary E-sliced = sliced beef with dietary vitamin E supplementation.

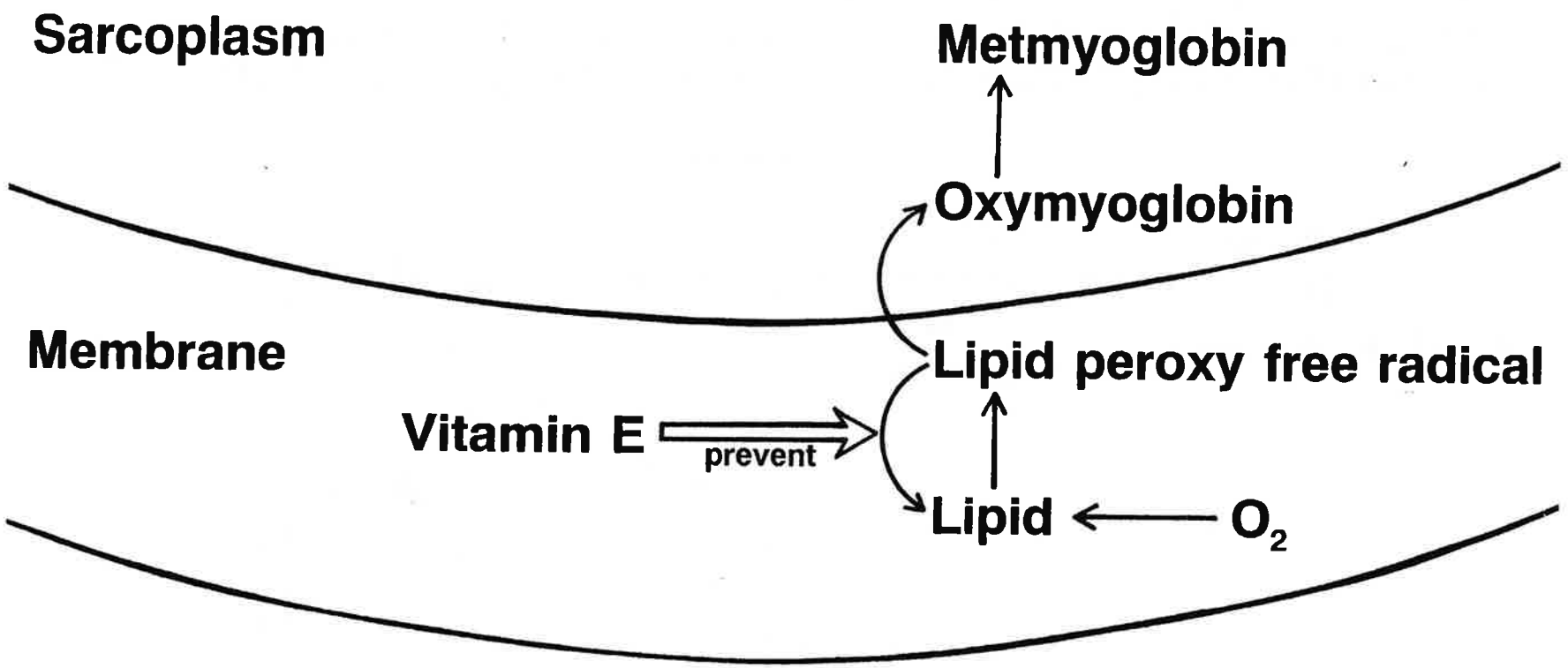
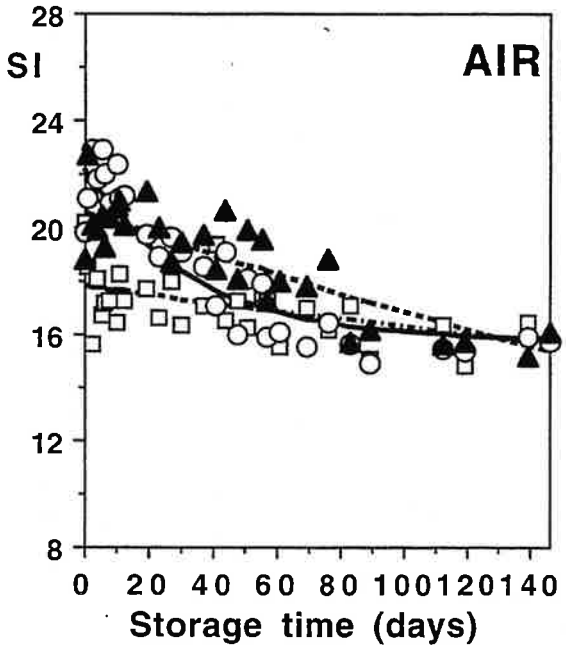
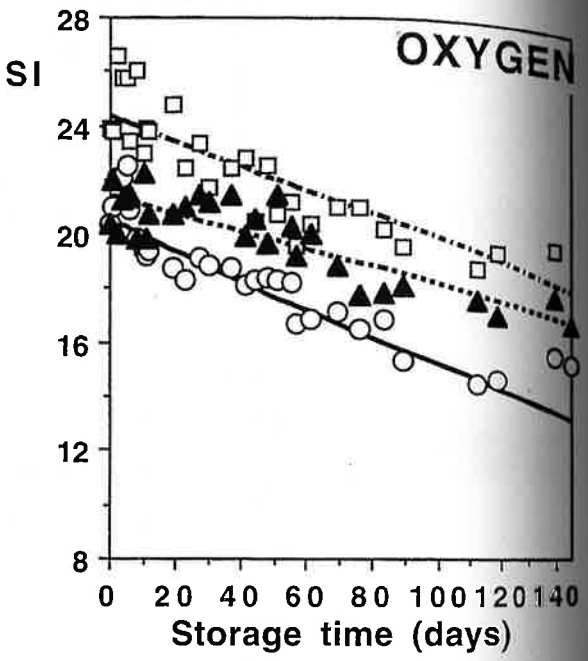


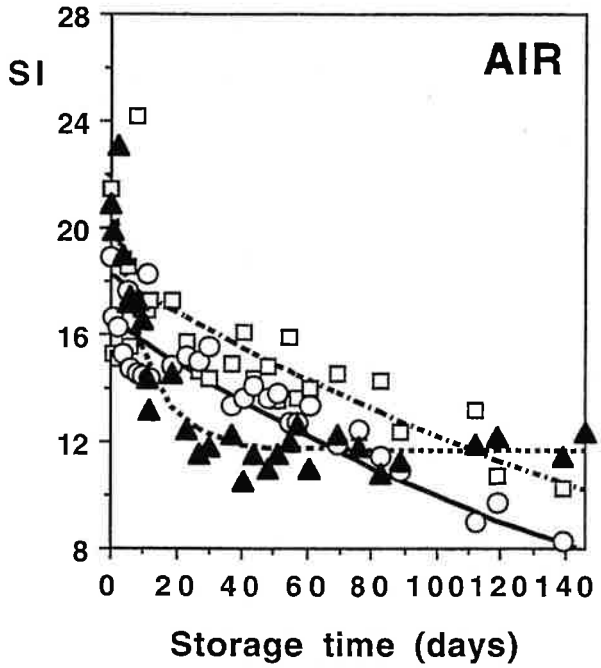
Fig. 3. Proposed function of vitamin E to prevent mainly lipid oxidation and secondary pigment oxidation in the muscle.

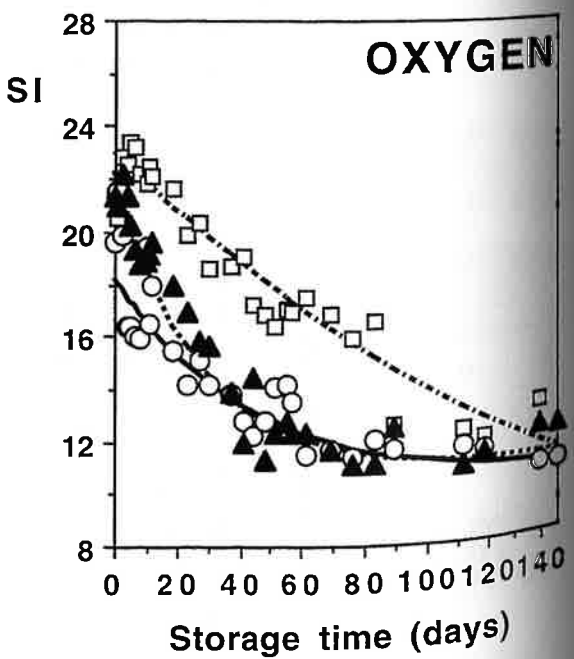
Figure1
Dark storage





Illuminated storage





ure 2
r display
(days)

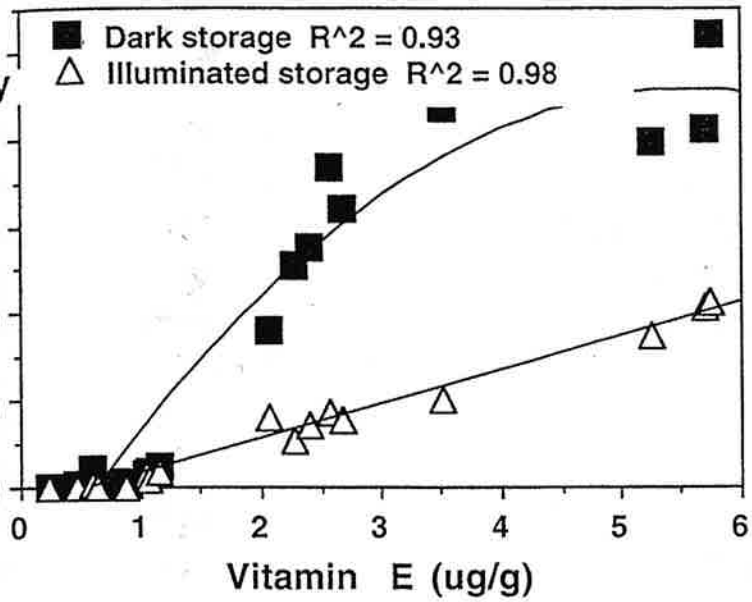


Table 1

Mean value and 95% confidence interval (CI) of the color display life (days) for control and supplemented LL.

			Display life			
Vitamin E	ATM[1]	BT[2]	Dark storage		Illuminated storage	
			mean	CI	mean	CI
CONTROL	air	1	62	56-68	0	
		6	79	73-85	0	
		48	0		1	0-2
CONTROL	O_2	1	65	61-69	0	
		6	85	79-90	10	9-12
		48	45	38-51	25	22-29
SUPPLEMENTED	air	1	96	72-119	7	2-12
		6	125	108-141	9	8-10
		48	118	88-148	32	27-38
SUPPLEMENTED	O_2	1	83	75-91	15	12-17
		6	182	157-206	21	18-23
		48	212	181-243	73	68-78

[1]atmosphere; [2]blooming time (h)2

Table 1 - Carcass traits of Suffolk lambs.

Trait	mean	s. e.
Slaughter weight (SW), kg	35.9	0.9
Age at slaughter (A), days	86.3	4.3
Hot carcass weight (HCW), kg	18.2	0.5
Cold carcass weight (CCW), kg	17.7	0.5
Dressing (HCW/SW), %	49.76	0.22
HCW/A, g	215	11
Conformation score	8.5	0.3
Fatness score	9.6	0.5
Leg, % CCW	32.30	0.25
Long loin, % CCW (1)	18.44	0.14
Shoulder, % CCW	16.47	0.22
Brisket and flank, % CCW	17.72	0.23
Neck, % CCW	10.55	0.16
Kidney knob and channel fat, % CCW	2.28	0.18

(1) long loin= LTL with all thoracic and lumbar vertebrae.

Table 2 - Meat quality characteristics (1).

Trait	1 hr p.m.		Time T(2)	
	mean	s. e.	mean	s. e.
pH	6.08	0.08	5.54	0.03
Temperature	32.4	0.6	14.7	0.7
WHC: wet surface, cm^2	4.2	0.3	5.5	0.2
expres. juice, %	21.64	1.66	33.05	0.72
Instr. colour: L*	40.12	0.59	42.96	0.61
a*	15.15	0.48	17.98	0.41
b*	3.86	0.21	4.51	0.15
Chroma	15.64	0.51	18.54	0.40
Hue	14.2	0.5	14.0	0.6
Sensory colour (3)	5.5	0.1	5.2	0.2

(1) All traits on LTL (last rib) except for colour 1 hr p.m. (PP).
(2) T = 24 hr p. m. for pH and WHC, 48 hr p. m. for colour.
(3) 1 = pale pink, 6 = dark red.

Table 3 - Cooking losses of rib-loin and leg determined at selected time (see text for explanation).

Trait	Time 0	Time 1	Time 2	Time 3	Significance (1) C	T	CxT
Evaporative loss, % (2)							
- rib-loin	14.26b@	14.59b	16.55a	18.46a	***	***	***
- leg	26.46b	26.92b	28.80a	29.44a			
Drip loss, %							
- rib-loin	2.70c	3.46b	4.65a	4.72a	***	***	***
- leg	4.85b	5.87a	6.18a	6.22a			
Total loss, %							
- rib-loin	16.96c	18.05c	21.20b	23.18a	***	***	***
- leg	31.32c	32.79b	34.98a	35.66a			

(1) *** P<0.001.
(2) At any given time and type of loss, the difference between cuts is always significant (P<0.001).
@ Means within a row followed by different letters differ significantly (P<0.05).

Table 4 - Chemical composition of raw and cooked meat from rib-loin and leg (% wet weight).

Trait	Rib-loin raw	Rib-loin cooked	Leg raw	Leg cooked	Significance (1) C	S	CxS
Moisture	76.49a@	66.54b	76.89a	63.80c	**	***	***
Protein	20.36c	28.72b	19.96c	31.08a	*	***	***
Fat	2.67b	4.22a	2.53b	4.53a	n.s.	***	*
Ash	1.11ab	1.09b	1.13a	1.08b	n.s.	***	*

(1) *P<0.05; ** P<0.01; *** P<0.001; n.s.= non significant.
@ Means within a row followed by different letters differ significantly (P<0.05).

Table 5 - Instrumental colour of raw and cooked Mm. *longissimus thoracis et lumborum* (LTL), *biceps femoris* (BF) and *semimembranosus* (SM).

Trait	LTL		BF		SM		Significance(1)		
	raw	cooked	raw	cooked	raw	cooked	M	S	MxS
L*	42.96b@	61.46a	44.98b	59.39a	43.16b	60.48a	n.s.	***	**
a*	17.98a	10.89b	16.30a	10.76b	18.23a	10.75b	n.s.	***	n.s.
b*	4.51b	11.43a	5.08b	11.68a	5.28b	11.05a	n.s.	***	n.s.
Chroma	18.54a	15.83b	17.08ab	15.93b	18.98a	15.46b	n.s.	***	*
Hue	14.0b	46.5a	17.2b	47.5a	16.0b	45.9a	n.s.	***	n.s.

(1) * P<0.05; ** P<0.01; *** P<0.001; n.s. = non significant.
@ Means within a row followed by different letters differ significantly (P<0.05).

Table 6 - Total (TC, mg/g wet weight) and soluble (SC = %TC) collagen, Warner-Bratzler shear value (WB, kgf) of raw and cooked Mm. *longissimus thoracis et lumborum* (LTL), *biceps femoris* (BF) and *semimembranosus* (SM).

Trait	LTL		BF		SM		Significance(1)		
	raw	cooked	raw	cooked	raw	cooked	M	S	MxS
TC(2)	3.14c	4.27z	5.61a	6.59x	4.33b	5.50y	***	***	n.s.
SC(2)	27.40b	6.13y	34.03a	25.94x	22.58c	6.87y	***	***	***
WB	2.30e@	4.67d	2.97e	2.78e	2.12e	3.28de	*	***	***

(1) * P<0.05; *** P<0.001; n.s. = non significant.
(2) The difference between raw and cooked state within each muscle is always significant (P<0.05). Within a state, different letters denote significant (P<0.05) differences (a, b, c = raw; x, y, z = cooked).
@ Means within a row followed by different letters differ significantly (P<0.05).

able 1. Gross chemical composition of pork (LD muscle).

eed type	Component, %			
	Moisture	Fat	Protein	n
ormal	72.7	2.5	21.6	13
nergy	73.6a	1.3a	22.1	21
arley	72.9	2.3	22.3	17
arley+animal fat	72.0b	3.4b	21.9	9

eans within a column with different superscripts are ignificantly different (P<0.05)a,b.

able 2. Intramuscular fatty acid contents in different pig types.

atty cid	Content, %			
	Normal	Energy	Barley	Barley+ animal fat
14:0	1.3	1.3	1.3	1.4
16:0	23.9	23.2	23.8	24.3
16:1	3.3a	2.8b	2.9	2.8
18:0	11.4a	11.6a	12.6	13.3b
18:1	42.9	41.4	40.0	40.8
18:2	8.4	10.4	10.1	9.0
18:3	0.6A	0.7	0.5	0.5B
Saturated (S)	37.7	37.1	38.6	39.9
Monounsaturated (M)	47.0	45.1	43.7	44.4
Polyunsaturated (P)	12.1	14.3	14.3	12.4
P/S	0.32	0.39	0.37	0.32
n	7	9	7	3

Means within a row with different superscripts are significantly different (P<0.05)a,b or (P<0.01)A,B.

Table 3. L, a, b values of backfat (Minolta Chroma Meter CR 200).

Feed type	L	a	b	n
Normal	70.3a	2.9a	5.8a	139
Energy	69.9a	3.0a	6.2ac	51
Barley	68.2b	2.4b	5.0b	97
Barley+animal fat	68.4b	3.1a	6.5c	232

Means within a column with different superscripts are significantly different (P<0.05)a,b,c.

Table 4. Fatty acid contents in backfat.

Fatty acid	Content, %			
	Normal	Energy	Barley	Barley+ animal fat
14:0	1.3	1.3	1.4	1.4
16:0	22.5a	21.1A	25.6Bb	23.1
16:1	1.7	2.0	2.1	1.8
18:0	13.4m	10.5an	16.1b	13.1m
18:1	41.0	41.5m	37.3n	39.7
18:2	14.2	16.8a	12.2bm	14.5
18:3	1.3	1.8am	1.2b	1.3
Saturated (S)	38.0m	33.7an	43.9bp	38.3
Monounsaturated (M)	43.7	44.5m	40.3n	42.7
Polyunsaturated (P)	16.7	19.7a	14.3bm	16.9
P/S	0.45m	0.59An	0.33Bap	0.44
18:0/18:2	0.99m	0.64an	1.37b	0.91m
n	5	6	7	3

Means within a row with different superscripts are significantly different (P<0.05)m,n,p, (P<0.01)a,b or (P<0.001)A,B

Table 5. Chemical composition and organoleptic quality of fermented dry sausage (factory 1).

Component	Feed type		
	Normal	Energy	Barley
Moisture, %	29.9	30.8	31.3
Fat, %	43.4	42.5	43.2
Protein, %	19.7	19.9	18.4
pH	5.0	5.0	4.9
FFA, %	4.6	4.8	4.6
Salt, %	4.3	4.1	4.3
Consistency, kp	8.2	7.8	6.5
Appearance (0-3)	3.0	3.0	2.5
Texture (0-5)	4.0	3.5	3.0
Flavour (0-7)	5.5	5.5	5.0
Total scores (0-15)a	12.5	12.0	10.5
Comments	Second softest, fine chopped, slightly pungent taste	Fatty surface	Softest, porous and crumbly texture greyish colour

a) Total scores 9.0-11.5 for an acceptable and 12-15 for a good product.

le 6. Chemical composition and organoleptic quality of fermented dry sausage (factory 2).

ponent		Feed type			
		Normal	Energy	Barley	Barley+ animal fat
sture,	%	26.3	26.9	26.0	29.2
,	%	45.5	46.3	45.9	42.5
tein,	%	21.2	20.8	20.8	22.3
		4.7	4.7	4.6	4.7
	%	3.7	4.5	4.2	4.2
,	%	4.5	3.6	4.8	4.1
t,					
sistency,	kp	16.6	8.1	18.8	12.2
earance	(0-3)	3.0	3.0	3.0	3.0
ture	(0-5)	4.0	3.5	4.0	4.0
vour	(0-7)	5.5	5.0	5.0	5.0
al scores	(0-15)a	12.5	11.5	12.0	12.0
ments		Firmest in texture	Softest, porous texture, greyish colour, raw core	Grey surface, second firmest in texture	Slightly dried surface

Total scores 9.0-11.5 for an acceptable and 12-15 for a good product.

le 7. Fatty acid contents of fermented dry sausage (factory 1).

ty d	Content, %		
	Normal	Energy	Barley
0	22.9	21.9	23.3
1	2.3	2.0	2.0
0	12.1	12.2	13.5
1	42.6	42.6	40.6
2	11.5	11.8	12.6
3	1.4	1.5	1.4
urated (S)	37.5	36.5	39.1
ounsaturated (M)	45.8	45.7	43.5
yunsaturated (P)	14.4	14.7	15.4
	0.38	0.40	0.39

Table 8. Fatty acid contents of fermented dry sausage (factory 2).

Fatty acid	Contents, %			
	Normal	Energy	Barley	Barley+ animal fat
16:0	24.3a	23.0b	23.9c	23.3b
16:1	2.3	2.1	2.1	1.8
18:0	13.6ab	13.3b	14.4a	14.8c
18:1	41.9a	40.6b	39.0c	40.3b
18:2	9.3a	12.1bc	12.1c	11.5b
18:3	0.9	1.6	1.3	1.1
Saturated (S)	40.5a	38.8b	40.8a	40.5a
Monounsaturated (M)	45.2a	43.6b	41.9c	43.1d
Polyunsaturated (P)	11.3a	14.9b	14.5b	13.8c
P/S	0.28a	0.38b	0.35b	0.34c

Means within a row with different supercripts are significantly different ($P<0.05$)a,b,c,d.

Table 1: Composition of corn oil, coconut oil, and tallow diets.

Ingredient	Corn Oil	Coconut Oil	Tallow
Corn	64.92	64.92	64.92
Soybean meal (44% protein)	16.66	16.66	16.66
Dicalcium phosphate	2.04	2.04	2.04
Ground limestone	0.43	0.43	0.43
Salt (sodium chloride)	0.34	0.34	0.34
Vitamin premix	0.17	0.17	0.17
Mineral premix	0.17	0.17	0.17
Choline chloride	0.17	0.17	0.17
Cholesterol (USP)*	0.10	0.10	0.085
Fat	15.00	15.00	15.00
TOTAL	100.00	100.00	100.00

*Cholesterol content of tallow assumed to be 100 mg/100g; USP cholesterol added to all diets to provide a total of 0.10% cholesterol in each diet.

Table 2: Effects of diet (corn oil, coconut oil, and tallow) and genetic selection (high or low cholesterol) on body weight, serum cholesterol, and carcass characteristics of growing swine.

Trait	Genetic Group		Diet		
	High	Low	Corn oil	Coconut oil	Tallow
Cholesterol, day 1, mg	130[a] (6)	104[b] (5)	115 (9)	110 (8)	124 (7)
Cholesterol, day 29, mg	168[a] (10)	138[b] (7)	129 (10)	151 (8)	178 (11)
Cholesterol, day 46, mg	151[c] (10)	130[d] (7)	123 (10)	146 (12)	152 (11)
Live wt, day 1, kg	35 (2)	34 (1)	35 (2)	35 (2)	34 (2)
Live wt, day 29, kg	45 (2)	54 (2)	57 (2)	57 (3)	50 (2)
Live wt, day 46, kg	56 (2)	69 (3)	72 (3)	71 (4)	67 (3)
Hot carcass, kg	50 (2)	47 (2)	50 (2)	49 (3)	46 (2)
Length, cm	72.8 (.7)	71.6 (.8)	72.6 (.7)	72.8 (1.0)	71.3 (1.1)
Longissimus muscle area, cm^2	21.0[a] (.8)	18.1[b] (1.0)	21.7[a] (1.2)	19.4[ab] (1.0)	17.7[b] (1.3)
First rib fat, cm	4.1 (.1)	4.5 (.1)	4.2 (.1)	4.2 (.2)	4.5 (.2)
10th rib fat, cm	2.9 (.2)	3.0 (.1)	2.9 (.2)	3.1 (.2)	3.0 (.2)
Last rib, cm	2.4 (.1)	2.5 (.1)	2.4 (.1)	2.4 (.1)	2.4 (.2)
Last lumbar vertebra, cm	3.2 (.1)	3.3 (.2)	3.2 (.2)	3.3 (.2)	3.3 (.2)
Muscle score	2.1[a] (.1)	1.7[b] (.1)	2.0 (.1)	1.9 (.2)	1.7 (.2)

[a,b]Within a main effect, means lacking a common superscript differ ($P < .05$).
[c,d]Within a main effect, means lacking a common superscript differ ($P < .10$).

Figure 1. Oxygen uptake during oxidation of meat fibres at Aw 0.96

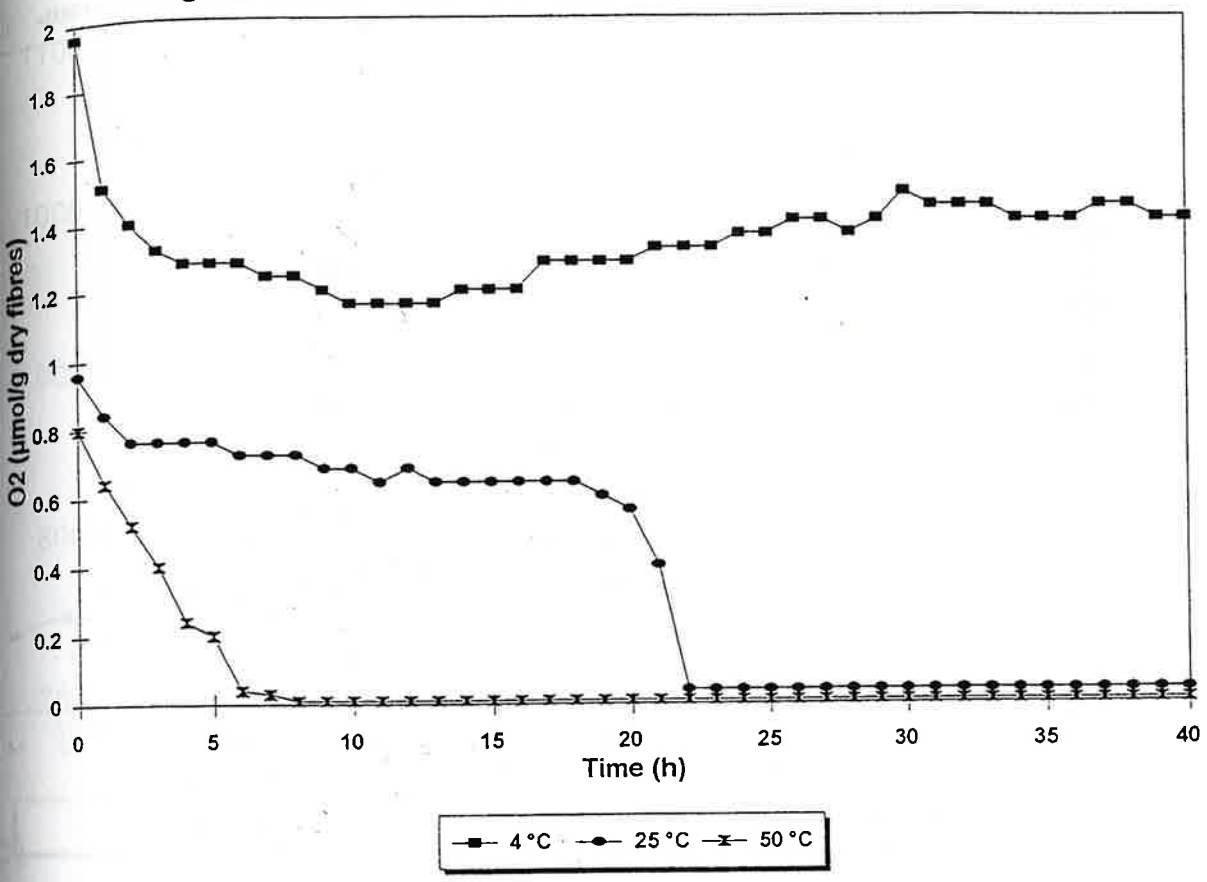


Figure 2. Oxygen uptake during oxidation of meat fibres at Aw 0.70

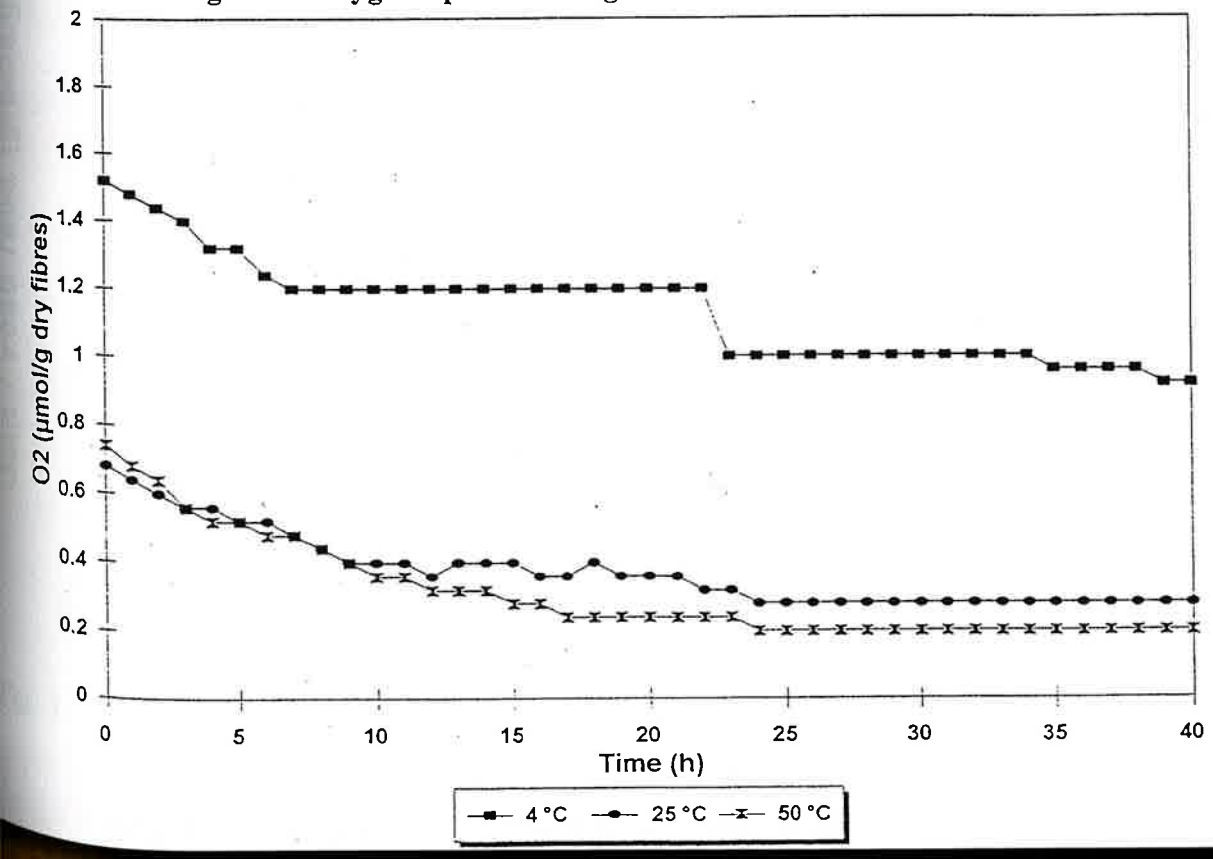


Figure 3. Effect of fibres addition into the oxygen electrode system.