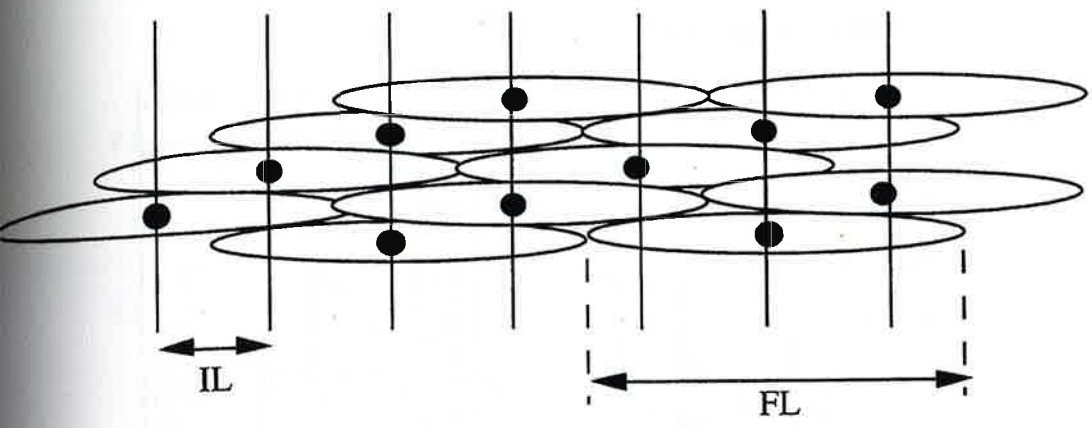


Fig. 1. The staggered overlap arrangement of discontinuous fibres in series fibred muscles. The degree of longitudinal overlap between adjacent fibres (OD) is given by the relationship OD= 1-(IL/FL), where IL is the spacing between motor end plates (black dots) and FL is the fibre length (Trotter, 1993).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

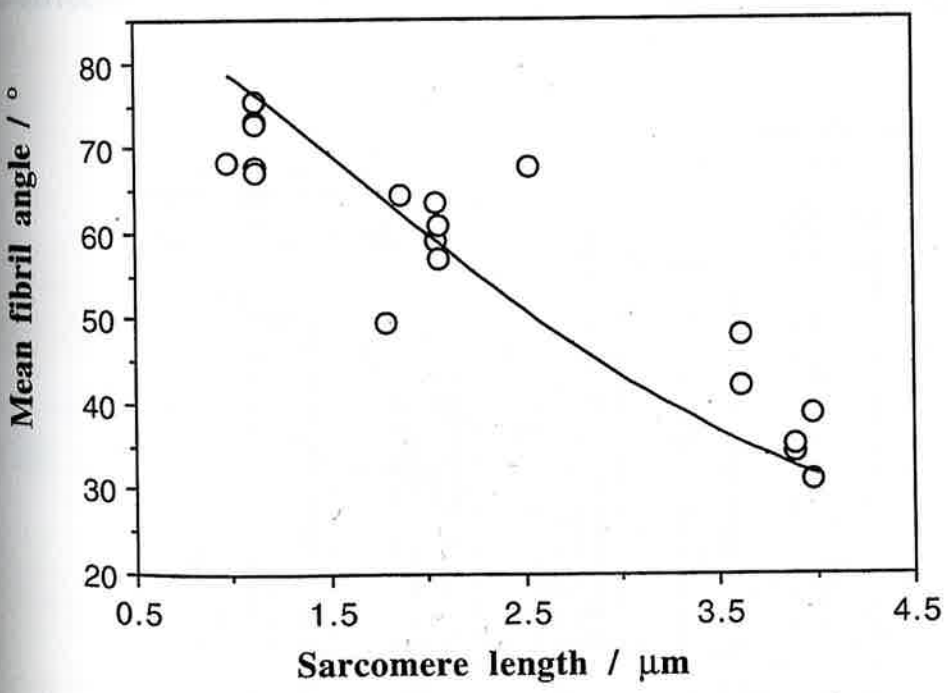


Fig.2. Mean of collagen fibril orientation in endomysium v. muscle sarcomere length. Data points shown are numerically-weighted means from analysed orientation distributions (from Purslow & Trotter, 1994). The line shown is the predicted mean orientation v sarcomere length from the model fitted to perimysial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

Table 1: Two-way analyses of variance on MFI values and osmolalities of the LTL and GM as influenced by the factors muscle and treatment

Parameter	Muscle (A)		Treatment (B)			AxB
Significance levels						
MFI value		NS		**		NS
$Osmol_{ex}$		NS		**		NS
$Osmol_{fl}$		NS		**		**
Mean values	LTL	GM	48 hpm	OH	VP	
MFI value	146	153	119^a	169^b	161^b	
$Osmol_{ex}$ mOsm	532	534	506^a	561^b	532^c	
$Osmol_{fl}$ mOsm	570	561	552^a	583^b	564^a	

^{abc} Mean values with different superscripts in each main factor column (muscle or treatment) differ $P \leq 0.05$

NS = $P > 0.05$; * = $P \leq 0.05$; ** = $P \leq 0.01$

Table 2: One-way analyses of variance on MFI values and osmolalities of the PM as influenced by treatment

Parameter	Significance	Treatment		
		48 hpm	OH	VP
MFI value	NS	80	83	89
$Osmol_{ex}$ mOsm	NS	468	455	489
$Osmol_{fl}$ mOsm	NS	493	500	514

^{abc} Mean values with different superscripts differ $P \leq 0.05$

NS = $P > 0.05$

Fig. 1: Influence of ageing treatment (OH and VP) on sensory tenderness and shear force of the LTL, GM and PM

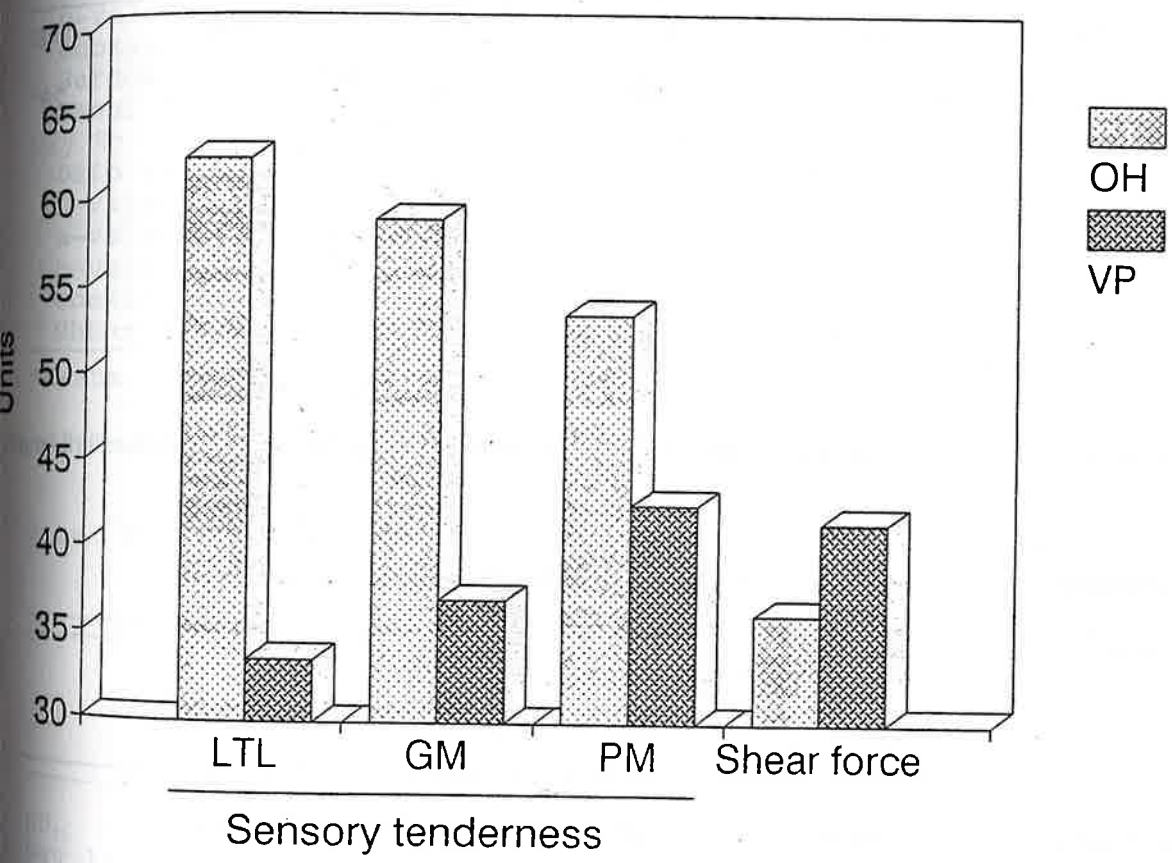


Table 1: Influence of ageing period on MFI value and myofibril length

Parameter	Ageing period (days post mortem)				
	1	4	7	14	21
MFI value	103[a]	124[b]	151[c]	146[c]	148[c]
Myofibre length (μm)	45[a]	40[b]	35[c]	35[c]	29[d]

Table 2: Influence of homogenisation blade speed on MFI value and myofibril length

Parameter	Blade speed (rpm)			
	5000	10000	20000	30000
MFI value	107[a]	128[b]	143[c]	161[d]
Myofibre length (μm)	39[ab]	40[a]	36[b]	32[c]

Tabel 1: The influence of rate of glycolysis (pH_{3h}) on veal quality characteristics in plant A (no electrical stimulation, mild chilling).

	Rate of glycolysis		
	slow (n=8) (pH_{3h}>6.7)	normal (n=8) (pH_{3h}=6.3)	fast (n=9) (pH_{3h}<6.0)
Day 1:			
pH	5.8±0.1[b]*	5.7±0.1[b]	5.5±0.1[a]
L-value	48.5±2.5[b]	51.5±4.4[b]	53.8±4.6[a]
a-value	17.5±1.4	16.7±1.7	17.8±1.4
b-value	8.1±1.3	8.3±1.1	9.9±1.0
Cooking loss (%)	12.9±2.2[b]	12.6±3.0[b]	17.1±4.1[a]
Sarcomere length (μm)	1.42±0.16[b]	1.54±0.15[b]	1.77±0.13[a]
Shear force (kg/cm^2)	6.16±1.58	6.90±2.32	6.07±2.24
Day 8:			
Drip (%)	1.5±0.4	2.0±0.5	2.0±0.8
L-value	52.1±3.9	53.9±5.4	54.2±5.4
a-value	16.7±0.9	16.1±2.3	16.9±1.6
b-value	9.6±0.6	9.8±0.9	10.5±0.7
Cooking loss (%)	20.3±1.9	20.7±2.8	22.2±4.1
Shear force (kg/cm^2)	8.97±2.54[b]	7.35±2.03[b]	4.69±1.36[a]

*Means with different superscript differ significantly ($p<0.05$)

Tabel 2: The influence of rate of glycolysis (pH_{45min}) on veal quality characteristics in plant B (electrical stimulation, rapid chilling).

	Rate of glycolysis		
	slow (n=8) (pH_{45min}>6.7)	normal (n=8) (pH_{45min}=6.3)	fast (n=8) (pH_{45min}<6.0)
pH_{3h}	5.8±0.1[b]	5.6±0.2[b]	5.3±0.1[a]
Day 1:			
pH	5.5±0.1	5.4±0.0	5.5±0.0
L-value	52.6±2.7	55.0±2.8	54.3±1.8
a-value	18.6±1.0	17.5±1.7	18.2±1.0
b-value	10.2±0.8	9.6±0.8	9.6±1.0
Cooking loss (%)	18.7±1.4	19.5±2.5	19.3±4.0
Sarcomere length (μm)	1.80±0.18	1.79±0.17	1.73±0.17
Shear force (kg/cm^2)	5.09±1.81	4.50±1.48	4.85±1.05
Day 8:			
Drip (%)	2.3±0.5	2.9±0.6	2.4±1.0
L-value	52.5±1.9[a]	55.7±2.4[a]	55.1±2.7[b]
a-value	19.1±0.8	18.7±1.5	19.0±1.0
b-value	10.9±0.6	11.0±0.7	10.8±0.7
Cooking loss (%)	21.9±4.7	21.0±1.8	26.9±2.7
Shear force (kg/cm^2)	4.33±2.16	4.25±1.27	3.92±1.13

*Means with different superscript differ significantly ($p<0.05$)

Table 1. The effect of method of suspension on sarcomere length (μm) of SM, GM, LO, GB and ST muscles, assessed at 12, 13, 14, 15 and 16 d p.m., respectively.

	SM	GM	LO	GB	ST
Pelvic supension	2.83 ± 0.12^{b}	2.59 ± 0.19^{b}	2.27 ± 0.21^{b}	3.06 ± 0.12^{b}	2.77 ± 2.06^{b}
Achilles tendon	1.66 ± 0.02^{a}	1.75 ± 0.13^{a}	1.69 ± 0.08^{a}	1.75 ± 0.08^{a}	2.06 ± 0.18^{a}

^{a,b} within columns, means with superscripts not containing a common letter differ significantly ($p < 0.05$).

Table 2. The effect of method of suspension on shear force (kg/cm^2) of SM, GM, LO, GB and ST muscles, assessed at 12, 13, 14, 15 and 16 d p.m., respectively.

	SM	GM	LO	GB	ST
Pelvic supension	4.87 ± 0.95	3.41 ± 0.35	3.00 ± 0.32^{a}	8.44 ± 2.03^{b}	4.99 ± 0.45
Achilles tendon	4.79 ± 0.68	3.39 ± 0.28	3.23 ± 0.37^{b}	7.43 ± 1.80^{a}	4.93 ± 0.42

^{a,b} within columns, means with superscripts not containing a common letter differ significantly ($p < 0.05$).

Table 3. The effect of method of suspension on cooking losses (%) of SM, GM, LO, GB and ST muscles, assessed at 12, 13, 14, 15 and 16 d p.m., respectively.

	SM	GM	LO	GB	ST
Pelvic supension	27.57 ± 0.87^{b}	26.16 ± 1.21^{b}	24.21 ± 1.38^{a}	27.14 ± 1.05	29.39 ± 0.91
Achilles tendon	26.31 ± 1.38^{a}	23.46 ± 1.58^{a}	26.37 ± 1.69^{b}	26.52 ± 0.97	30.28 ± 1.38

[a,b] within columns, means with superscripts not containing a common letter differ significantly ($p < 0.05$).

Figure 1. Relationship between sarcomere length (μm) and shear force (kg/cm^2) of the 5 muscles studied; open symbols: Achilles tendon, closed symbols: pelvic suspension.

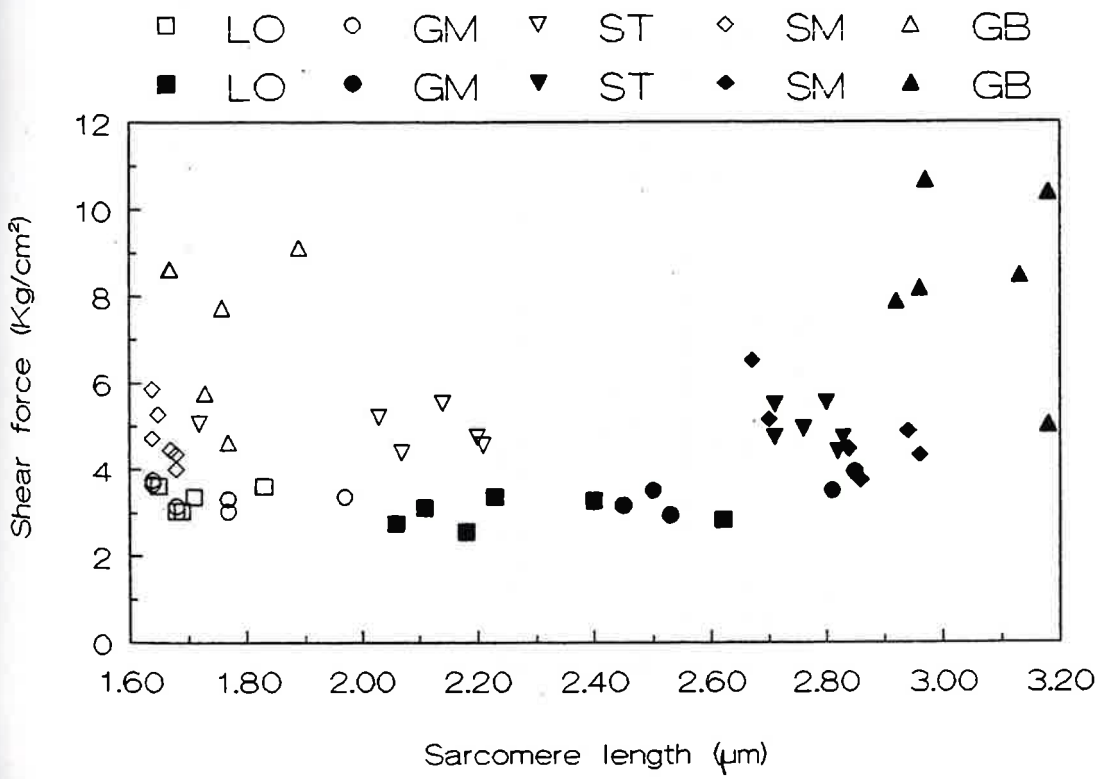
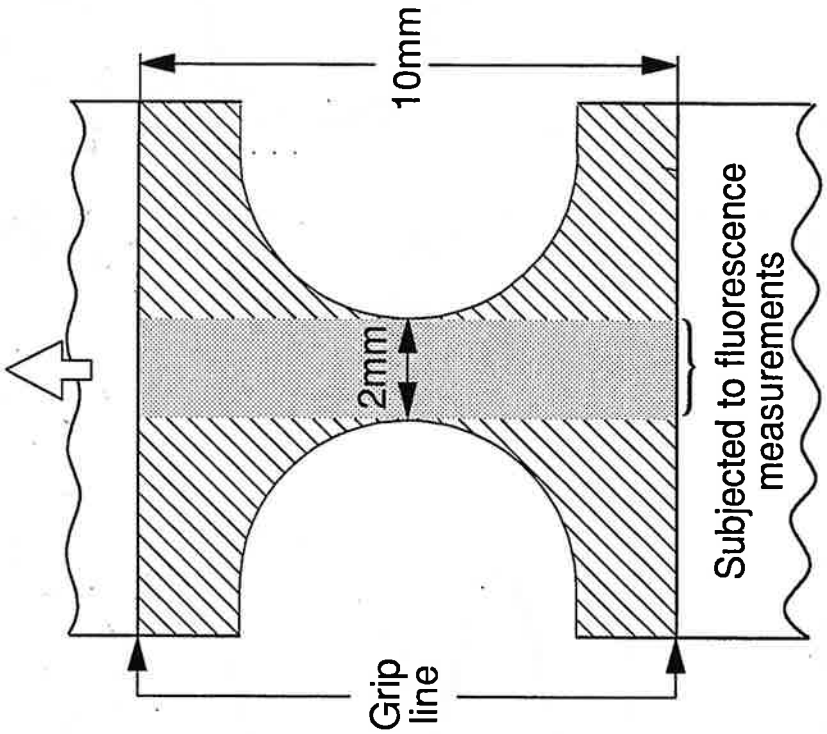
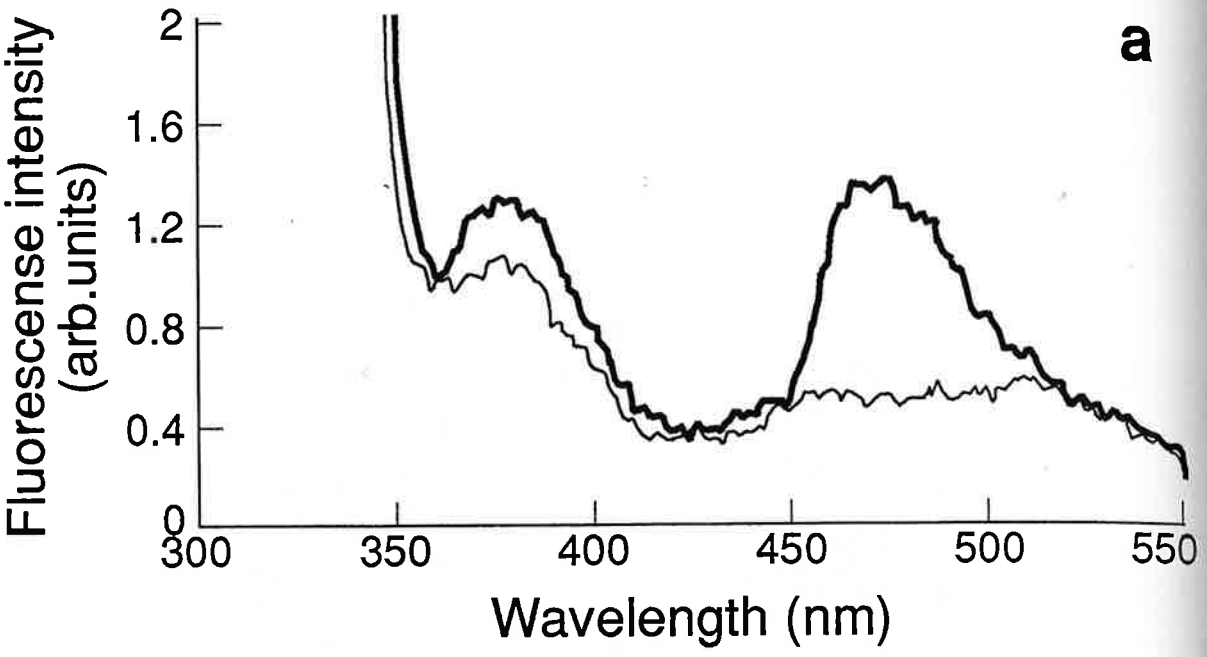


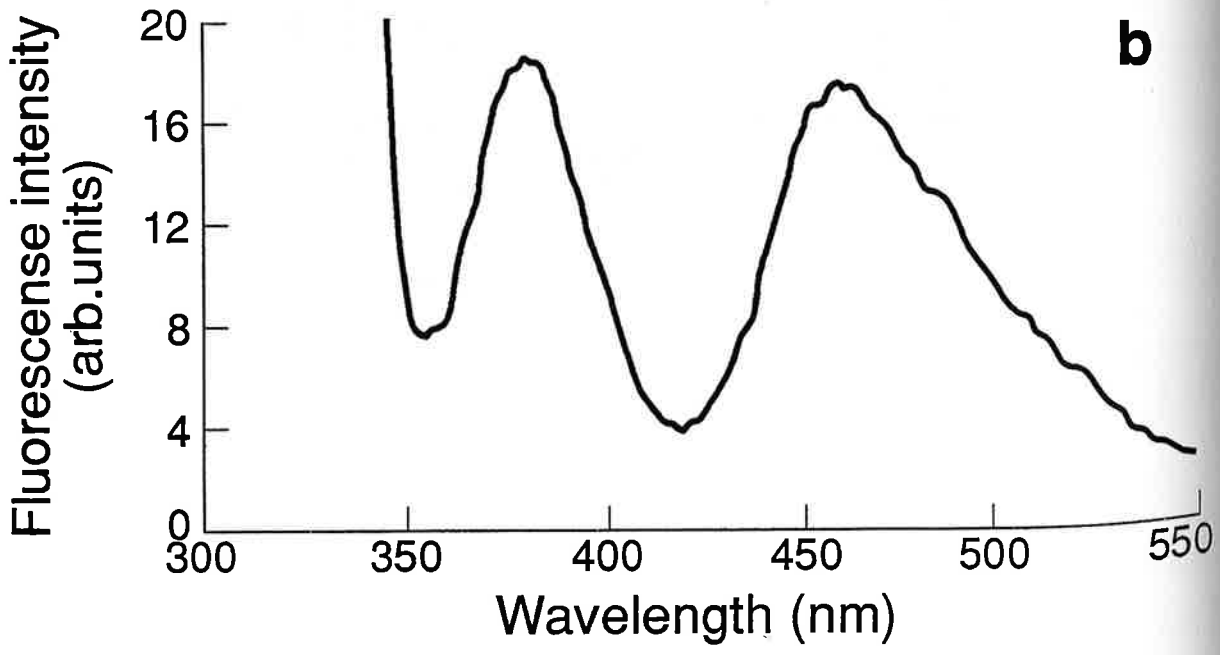
Table 1
Correlation coefficients between predicted and measured tensile parameters

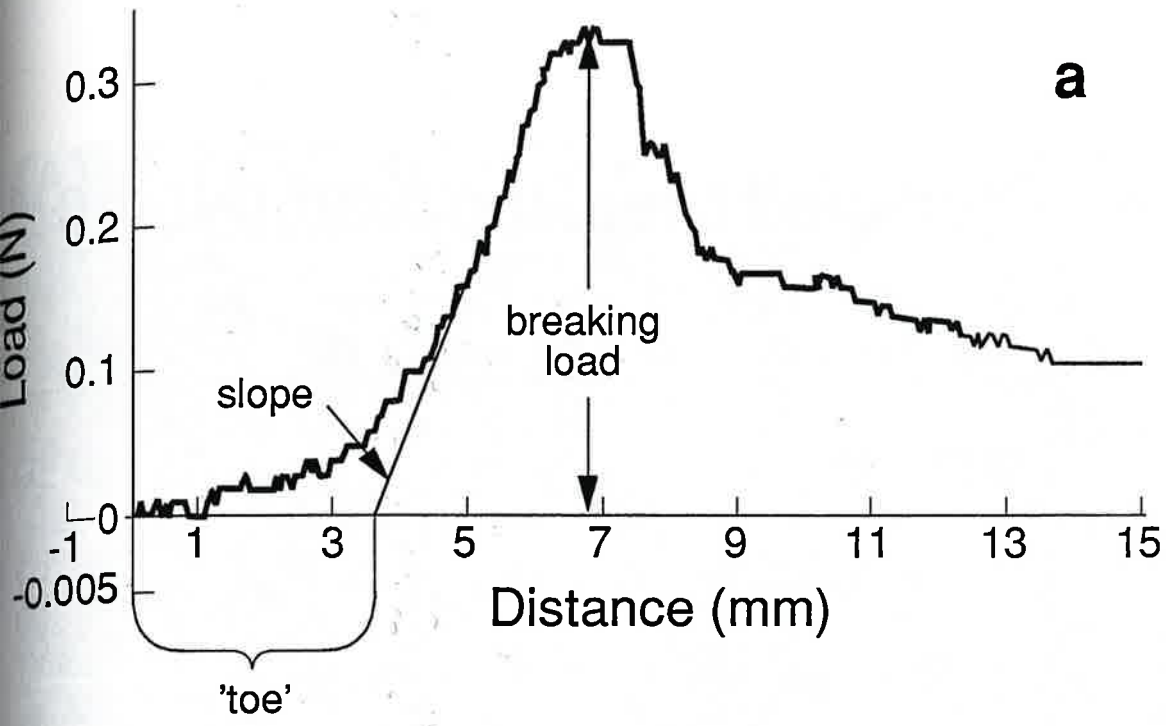
Analysis	Wavelength (nm)	Break.load Lin	Break.load Log	Slope Lin	Slope Log	'Toe' Lin	'Toe' Log
Uni-variate	$I_{f,max}$(~380)	0.89	0.85	0.85	0.82	0.62	0.61
	$I_{f,max}$(~470)	0.91	0.84	0.82	0.83	0.49	0.56
PCR	345-510	0.93[a]	0.90[b]	0.86[c]	0.92[b]	0.57[c]	0.54[a]

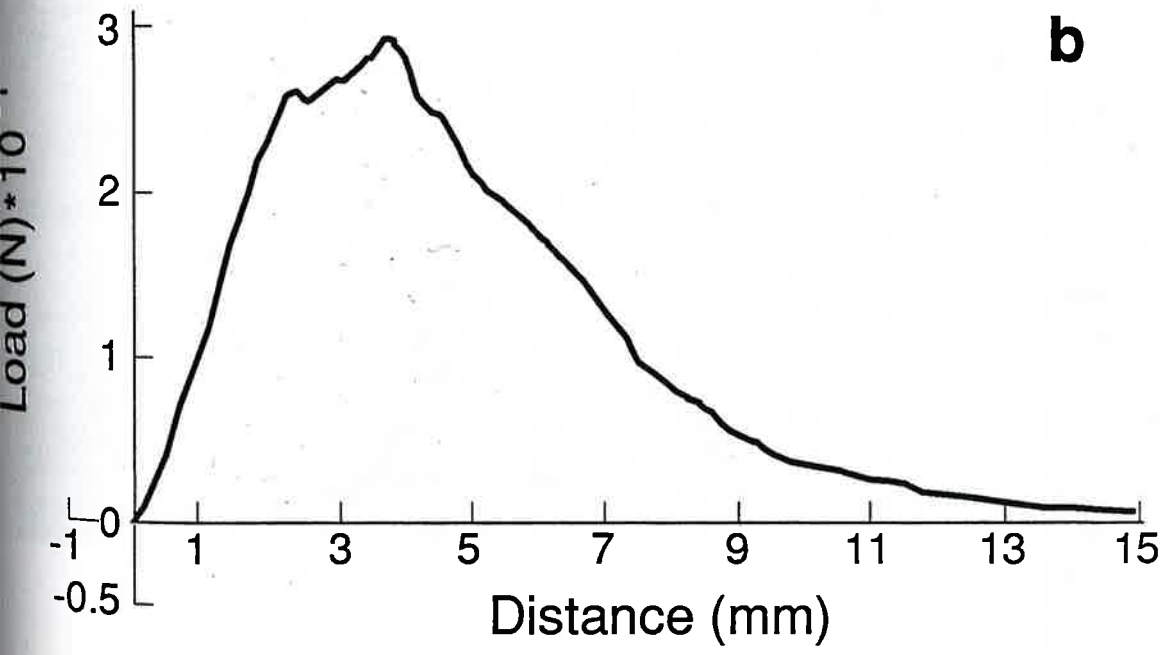
Number of components used: a=1, b=3, c=2

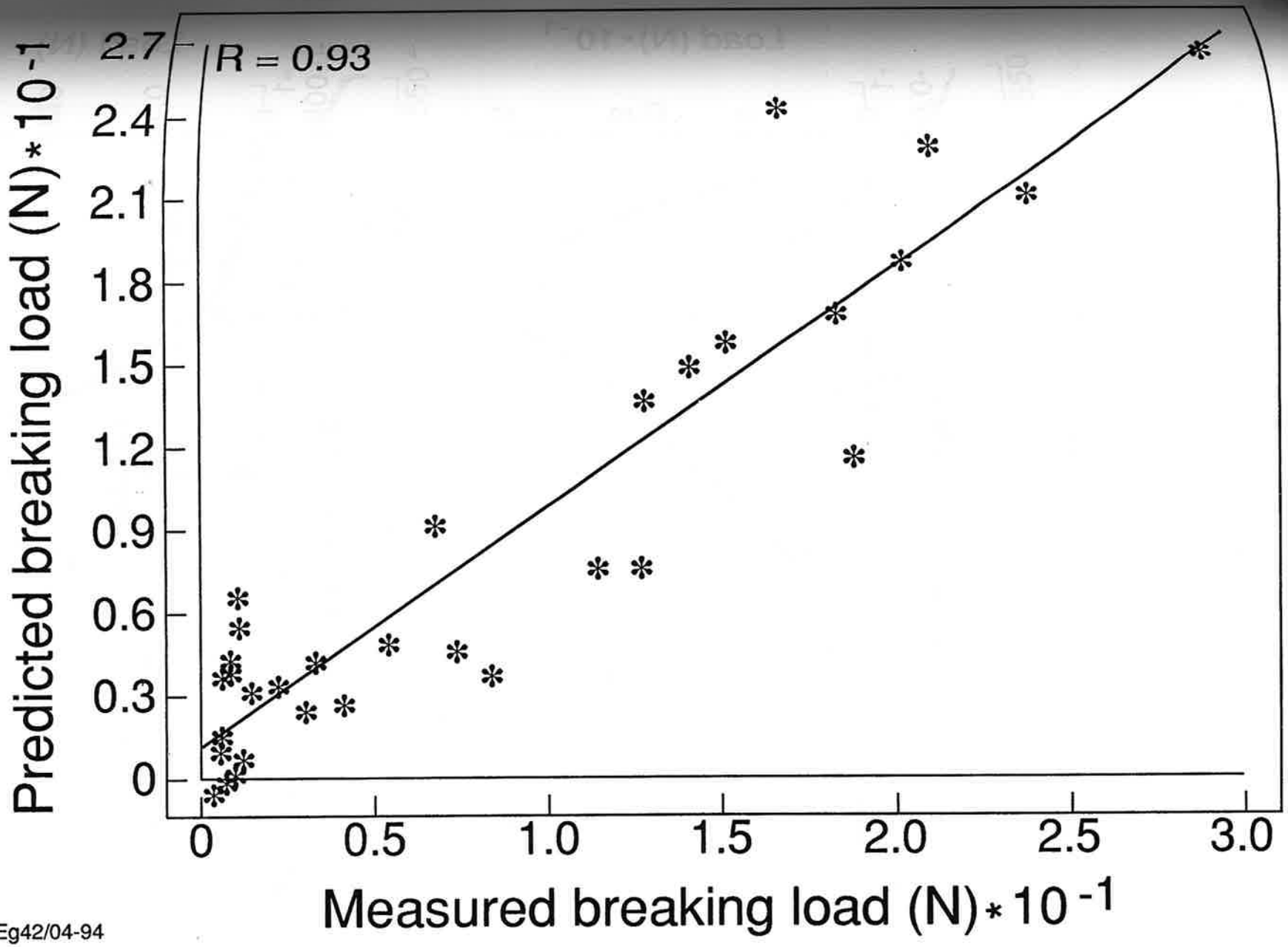

10mm
2mm
Subjected to fluorescence measurements
Grip line


a
Fluorescense intensity (arb.units)
2
1.6
1.2
0.8
0.4
0
300
350
400
450
500
550
Wavelength (nm)


b
Fluorescense intensity (arb.units)
20
16
12
8
4
0
300
350
400
450
500
550
Wavelength (nm)


a
0.3
0.2
0.1
0
-1
-0.005
Load (N)
slope
breaking load
'toe'
1
3
5
7
9
11
13
15
Distance (mm)


b
3
2
1
0
-1
-0.5
Load (N)*10
1
3
5
7
9
11
13
15
Distance (mm)


R = 0.93
Predicted breaking load (N) * 10-1
2.7
2.4
2.1
1.8
1.5
1.2
0.9
0.6
0.3
0
0
0.5
1.0
1.5
2.0
2.5
3.0
Measured breaking load (N) * 10 -1

BEg42/04-94

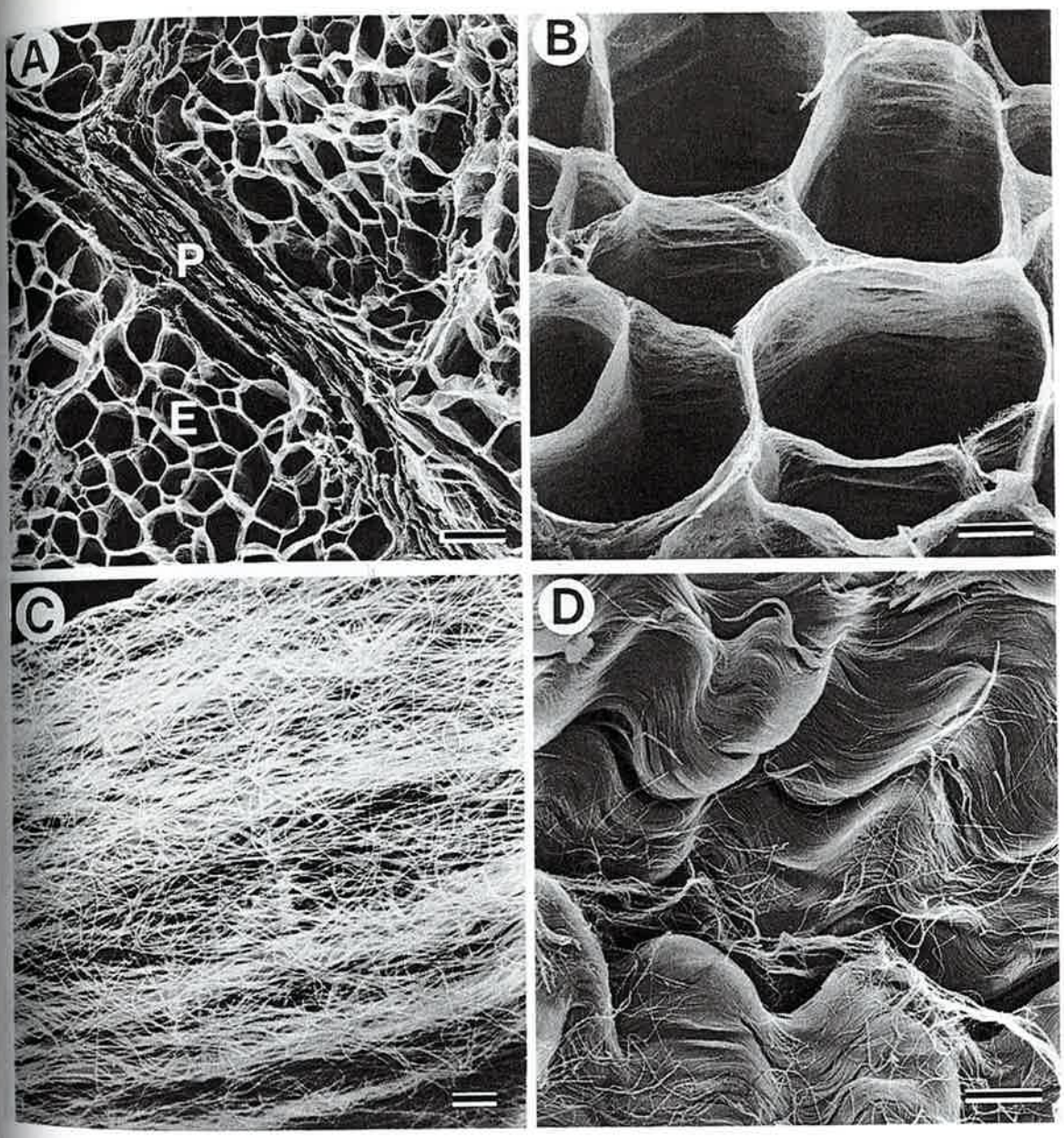


Fig. 1. Scanning electron micrographs of intramuscular connective tissue of bovine *semitendinosus* muscle immediately post-mortem. (A) Low magnification view of intramuscular connective tissue. (B) Endomysial sheaths. (C) A closer view of a part of (B). (D) A closer view of a part of the perimysium. Scale bars indicate 100 (A), 25 (B), 1.0 (C) and 5.0 μm (D). E, Endomysium; P, perimysium.

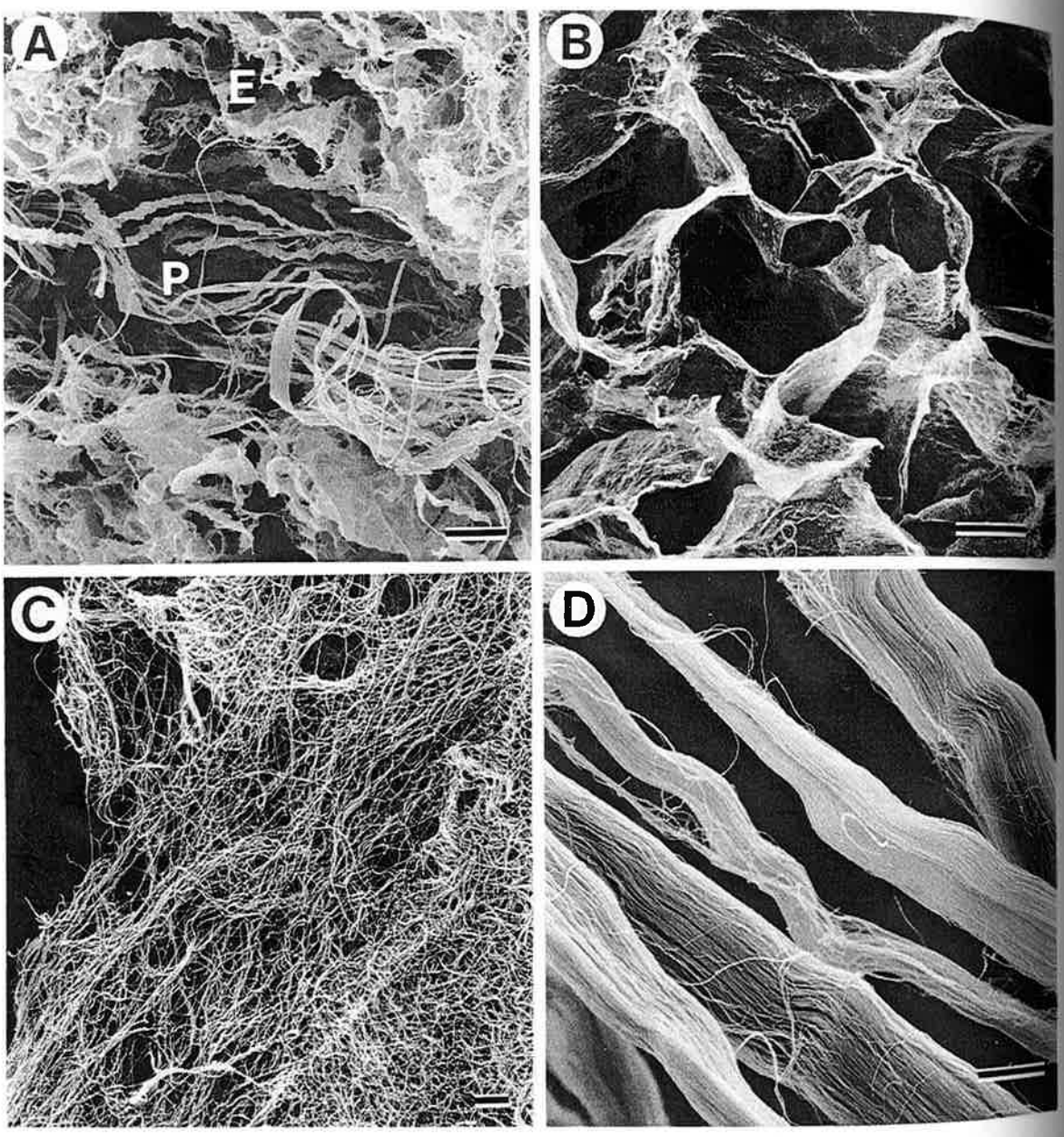


Fig. 2. Scanning electron micrographs of intramuscular connective tissue of bovine *semitendinosus* muscle conditioned for 28 days at 4°C. (A) Low magnification view of intramuscular connective tissue. (B) Endomysial sheaths. (C) A closer view of a part of (B). (D) A closer view of a part of the perimysium. Scale bars indicate 100 (A), 25 (B), 1.0 (C), 5.0 (D) μm. E, Endomysium; P, perimysium.

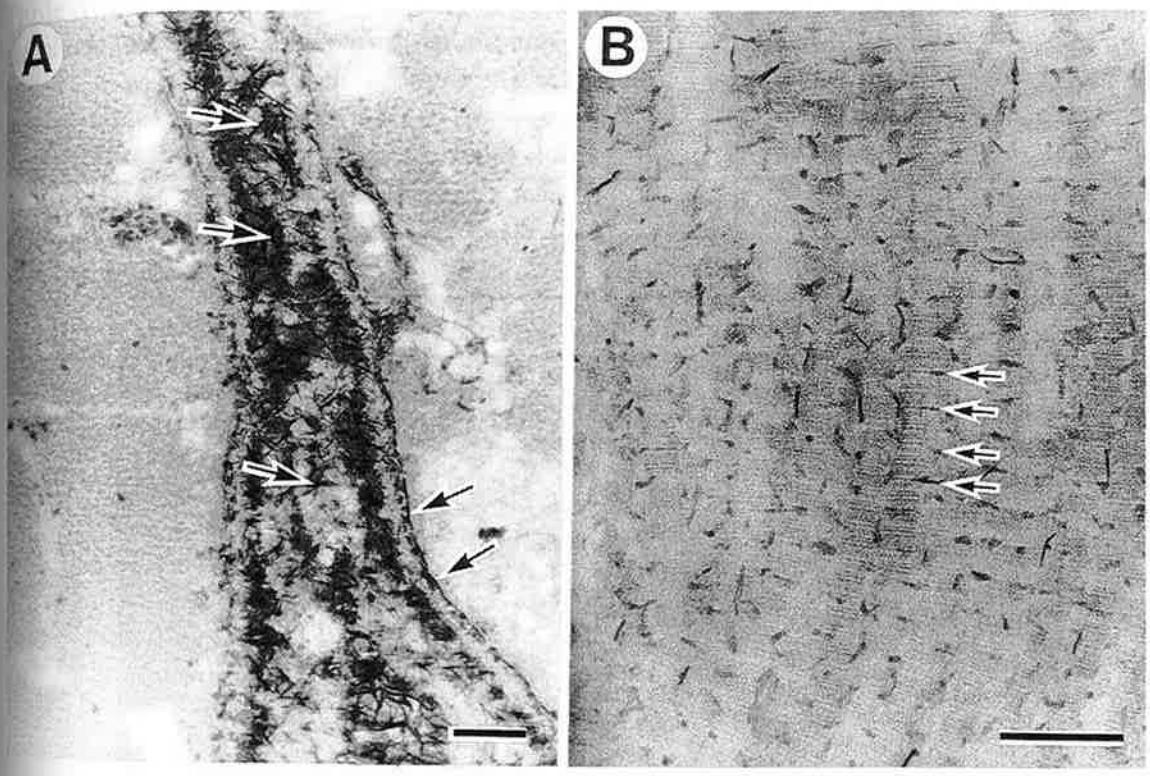


Fig. 3. Transmission electron micrographs of intramuscular connective tissue of bovine *semitendinosus* muscle immediately post-mortem. (A) The cross section along the axis of muscle fibre. (B) Longitudinal section of the bundle of collagen fibrils in the perimysium. Arrows indicate proteoglycans stained with Cuplolinic Blue. Scale bars indicate 200 nm (A) and 200 nm (B).

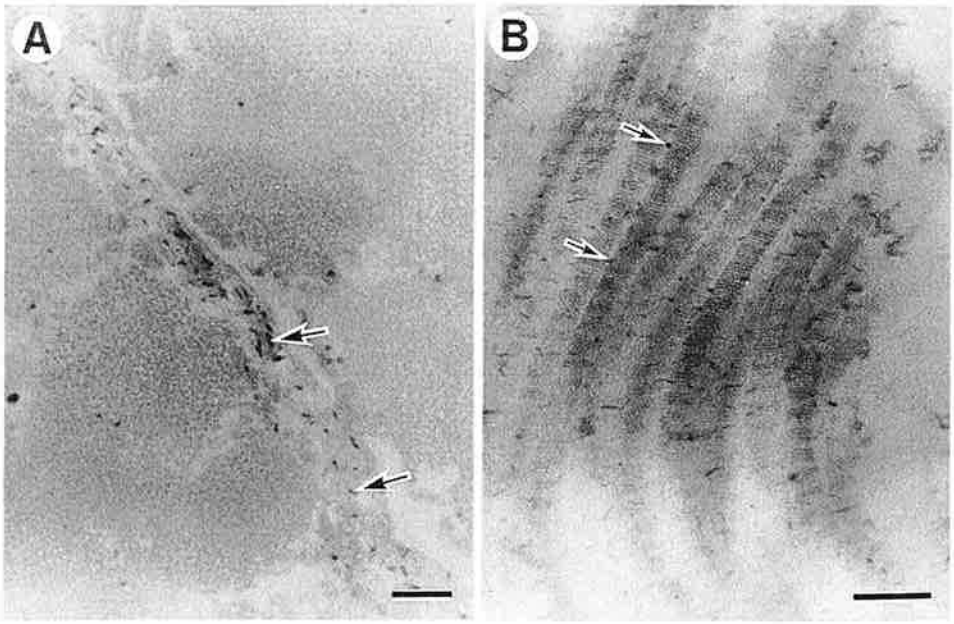


Fig. 4. Transmission electron micrographs of intramuscular connective tissue of bovine *semitendinosus* muscle conditioned for 28 days at 4°C. (A) The cross section along the axis of muscle fibre. (B) Longitudinal section of the bundle of collagen fibrils in the perimysium. Arrows indicate proteoglycans stained with Cuplolinic Blue. Scale bars indicate 200 nm (A) and 200 nm (B).

Table 1. Mean values and standard deviations of 24 longissimus thoracis muscle samples for shear force (WBS), myofibrillar protein solubility (MPS) at pH 5.5 and 7 (mg/g muscle) and TCA-soluble tryptophan (Try as µg/g muscle).

	mean value	standard deviation
WBS (N)	50.9	13.8
MPS at pH 7	27.75	6.93
MPS at pH 5.5	25.38	3.99
Try	17.44	3.21

Table 2. Mean concentrations (mg BSA-equivalents/g muscle) of total muscle myofibrillar protein and soluble myofibrillar proteins at pH 5.5 and 7.

protein	total concentration	soluble at pH 5.5	soluble at pH 7	% soluble at pH 5.5	% soluble at pH 7
Titin	6.56	0.66	2.28 ***	10.0	34.8
Nebulin	-	0.14	1.03 ***	-	-
Filamin	0.28	0.00	0.13 ***	0.0	46.4
Myosin HC	42.44	0.52	1.82 ***	1.2	4.3
M-protein	2.40	0.91	0.87	37.9	36.3
C-protein	1.25	1.28	1.14 **	102.6	91.2
α-actinin	2.87	1.43	1.14 ***	51.3	41.0
Tropomyosin	0.99	0.96	0.30 ***	96.9	30.3
Actin	25.38	1.17	1.35	4.6	5.3
Creatine phospho kinase (CPK)	1.98	0.36	0.49 ***	18.2	24.7
Troponin- T	1.54	0.75	0.22 ***	48.7	14.3
34 kDa	0.89	0.29	0.27	32.2	30.3
30 kDa	1.28	0.41	0.17 ***	32.0	13.3
Myosin LC1	1.34	0.24	0.15 **	18.1	11.2
Troponin I	3.22	1.11	0.29 ***	34.5	9.0
Troponin C	0.90	0.54	0.18 ***	60.4	20.0
Myosin LC2	4.59	0.37	0.39	8.1	8.5

** and ***: significant differences (paired t-test) between concentrations of proteins soluble at pH 5.5 and pH 7 for $p<0.01$ and $p<0.001$ respectively.

Table 3. Correlations between concentrations of total muscle individual myofibrillar proteins, shear force (WBS), myofibrillar protein solubility (MPS) at pH 5.5 and 7 and TCA soluble tryptophan (Try) on 24 longissimus thoracis samples at 3 days post mortem.

	WBS	MPS 5.5	MPS 7	titin	Troponin-T	30 kDa	CPK	34 kDa
MPS 5.5	-.61*	1						
MPS 7	-.64*	.77*	1					
Titin	.57*	-.57*	-.64*	1				
Troponin-T	.72*	-.72*	-.70*	.89*	1			
30 kDa	-.75*	.80*	.73*	-.65*	-.78*	1		
CPK	-.09	.02	-.28	.08	-.11	.04	1	
34 kDa	-.18	-.10	-.28	-.20	-.17	.11	.18	1
Try	-.55*	.76*	.51*	-.68*	-.74*	.73*	.23	.37

*: significant correlations ($p<0.01$).

Table 4. Correlations between concentrations of individual myofibrillar proteins soluble at pH 5.5 and pH 7 (mg/g muscle) and myofibrillar protein solubility (MPS) at pH 5.5 and 7, shear force (WBS) and TCA soluble tryptophan (Try) on 24 longissimus thoracis samples at 3 days post mortem.

pH 5.5	*Titin*	*Nebulin*	*Myosin HC*	*M-protein*	*C-protein*	*α-actinin*	*Tropo-myosin*	*Actin*
MPS	.74*	.56*	.66*	.61*	.29	.90*	.44*	.67*
WBS	-.67*	-.50*	-.18	-.19	-.00	-.54*	-.12	-.32
Try	.55*	.29	.47*	.68*	.17	.70*	.31	.41
	CPK	*Troponin-T*	*34 kDa*	*30 kDa*	*Myosin LC1*	*Troponin I*	*Troponin C*	*Myosin LC2*
MPS	.23	-.21	.30	.70*	-.24	.56*	.64*	.75*
WBS	.24	.53*	-.01	-.65*	.40*	.16	-.35	-.37
Try	-.15	-.32	.26	.67*	-.24	.39	.53*	.65*
pH 7.0	*Titin*	*Nebulin*	*Myosin HC*	*M-protein*	*C-protein*	*α-actinin*	*Tropo-myosin*	*Actin*
MPS	.85*	.67*	.88*	.49*	-.20	.84*	.68*	.90*
WBS	-.58*	-.28	-.59*	-.25	.33	-.58*	-.36	-.54*
Try	.55*	.22	.36	.32	-.34	.72*	.45*	.36
	CPK	*Troponin-T*	*34 kDa*	*30 kDa*	*Myosin LC1*	*Troponin I*	*Troponin C*	*Myosin LC2*
MPS	.46*	.39	.73*	.72*	.52*	.62*	.45*	.82*
WBS	-.07	-.07	-.48*	-.47*	-.23	-.30	-.31	-.52*
Try	.00	-.02	.56*	.55*	.48*	.40*	.53*	.45*

*: significant correlations ($p<0.05$).

FIGURE 1. Assay of μ-and m-calpains using four substrates

Values are the relative amounts of product using the substrates: casein (triangles), FITC-casein (diamonds), azo-casein (squares) and suc-leu-tyr-NHMec (circles).
Open symbols are for μ- and filled symbols for m-calpain.

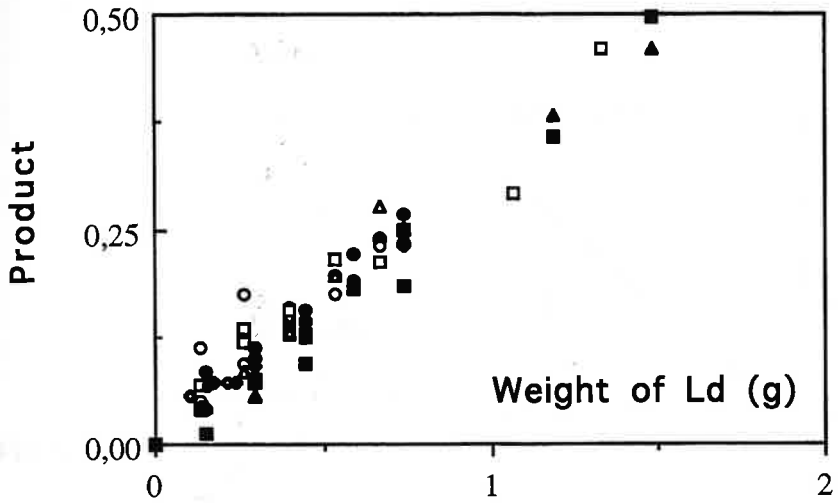


FIGURE 2. Effect of temperature on the activity of μ-calpain

The reactions were conducted at pH 7.5 using 250μM suc-leu-tyr-NHMec as substrate at the temperatures shown.

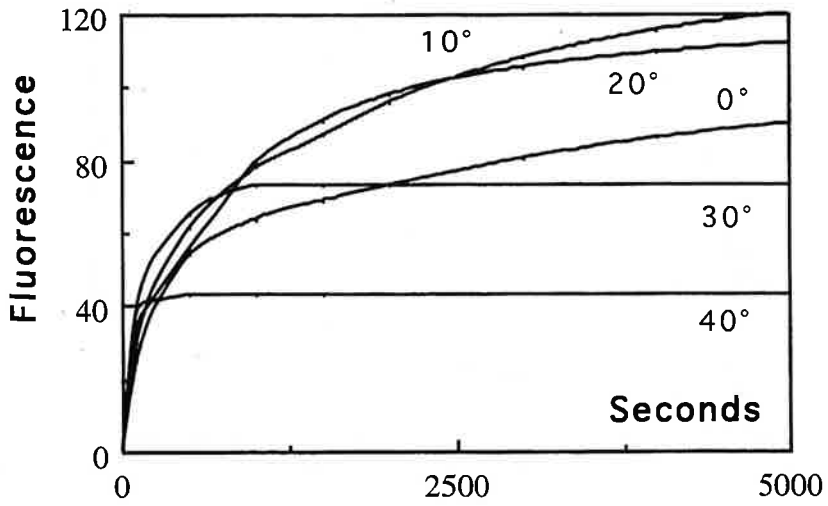


FIGURE 3. Effect of salt concentration on activity of m-calpain

Assays were conducted at 20°C using 35μg m-calpain/ml and 250μM suc-leu-tyr-NHMec as substrate. The concentration of KCl is shown.

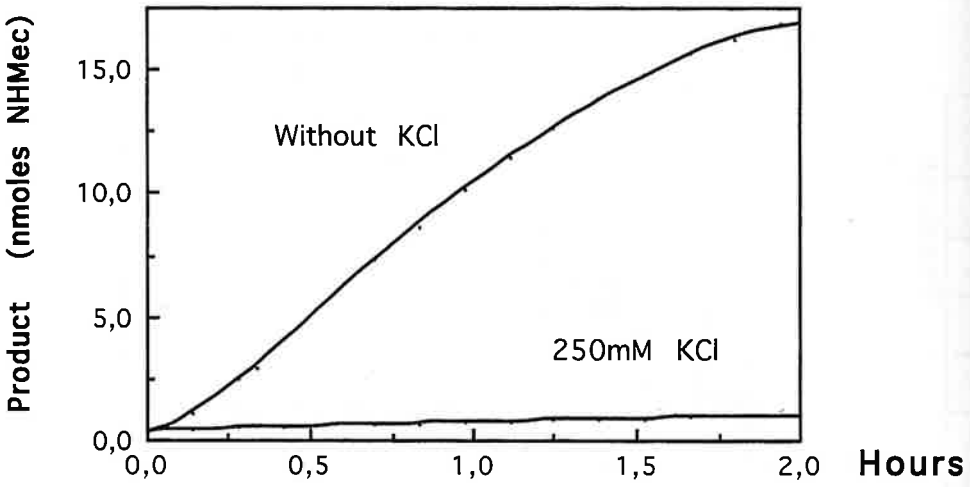


FIGURE 4. Effect of calpastatin on the activity of m-calpain

The reactions were conducted at 30°C at pH 7.5 with 250μM suc-leu-tyr-NHMec as substrate using 32μg calpain/ml and the levels (μg/ml) of calpastatin shown.

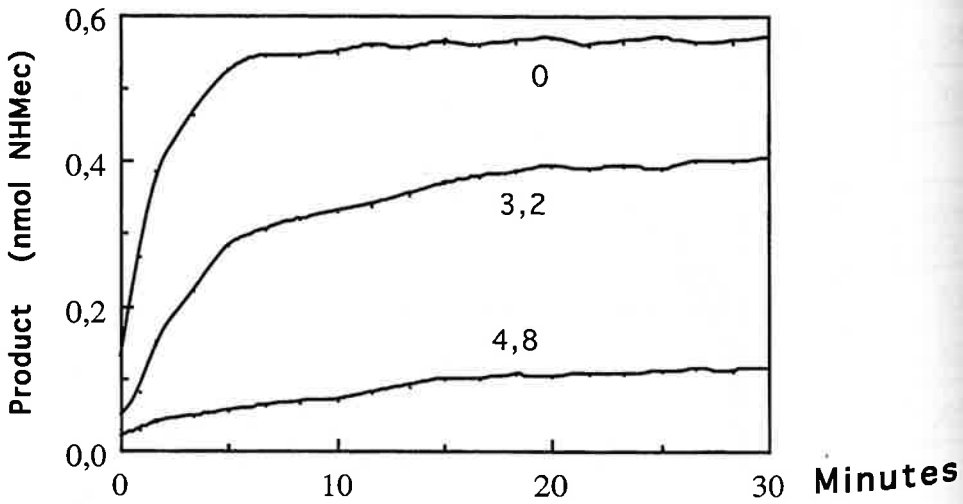


Table 1. The effect of ageing on calpain I and II activities[1]

Days	Calpain I	Calpain II
0	94.3	78.2
1	93.8	59.6
2	89.1	38.4
3	87.6	29.7
4	82.3	13.6
5	74.8	7.8
7	71.3	N.D.[2]
9	54.0	N.D.[2]
12	45.2	N.D.[2]

[1] expressed as units / g meat

[2] not determined

Table 2. The effect of ageing on myofibrillar proteins[1]

Days	0	1	2	3	4	5	7	9	12
Titin	100	101.4	96.1	79.4	80.8	72.9	55.1	46.0	32.3
Nebulin	100	76.4	74.2	61.9	50.8	53.6	42.6	35.5	21.3
C-protein	100	89.4	78.7	63.9	57.0	41.7	36.5	30.7	26.0
Troponin T	100	91.3	80.9	76.5	63.3	55.4	36.7	28.8	18.4
Tropomyosin	100	97.6	94.7	86.3	63.4	65.7	60.0	57.6	53.7
Troponin I	100	102.1	98.3	92.4	86.9	71.7	63.8	50.4	39.6
Troponin C	100	97.4	94.7	91.0	81.7	73.8	65.1	53.6	37.0

[1]expressed as retention in %

(1) *Pre-rigor* treatments	control	Ca 0.3M pH = 6.9	Ca 0.1M pH = 6.9	Ca 0.3M pH = 6.3	Ca 0.3M pH = 5.9	Na 0.6M pH = 6.9	Na0.15M pH = 6.9	Water pH = 6.9
Sarcomere length (µM)	1.95 a	1.12 b	1.15 b	1.18 b	1.06 b	1.88 a	1.93 a	1.99 a
SD (µm)	0.07	0.05	0.02	-	-	0.07	0.07	0.03

(2) *Post-rigor* treatments	control	Ca 0.3M pH = 5.4	Ca 0.1M pH = 5.4	Na 0.6M pH = 5.4	Na0.15M pH = 5.4	Water pH = 5.4
Sarcomere length (µM)	1.95 a	1.93 a	1.93 a	1.97 a	1.97 a	2.03 a
SD (µm)	0.07	0.03	0.03	0.06	0.02	0.05

Table 1 : Sarcomere lengths. (1) : *pre-rigor* treatments (at pH = 6.9, 6.3 or 5.9) ; (2) *post-rigor* treatments (at pH = 5.4). Means with the same letters (a,b) are not significantly different (p>.05).

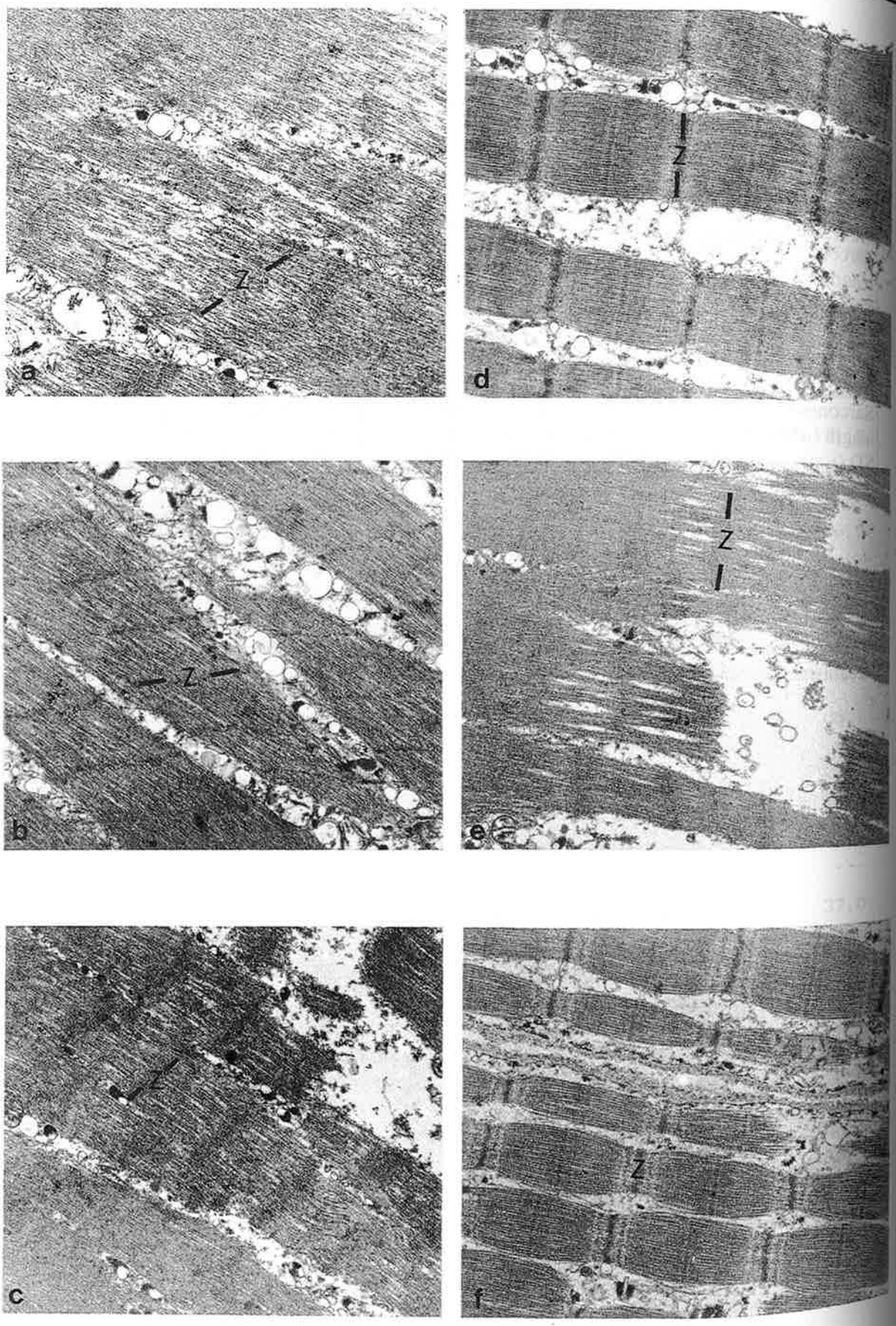


Figure 1 : Effect of *pre-rigor* calcium injections on muscle ultrastructure (x 15500).
a - b - c : Injection of 0.3 M $CaCl_2$ at pH = 6.9 and fixation at d 0 (a), d 2 (b), d 7 (c).
d - e : Injection of 0.1 M $CaCl_2$ at pH = 6.9 and fixation at d 0 (d), d 2 (e).
f : Control fixed at d 0.

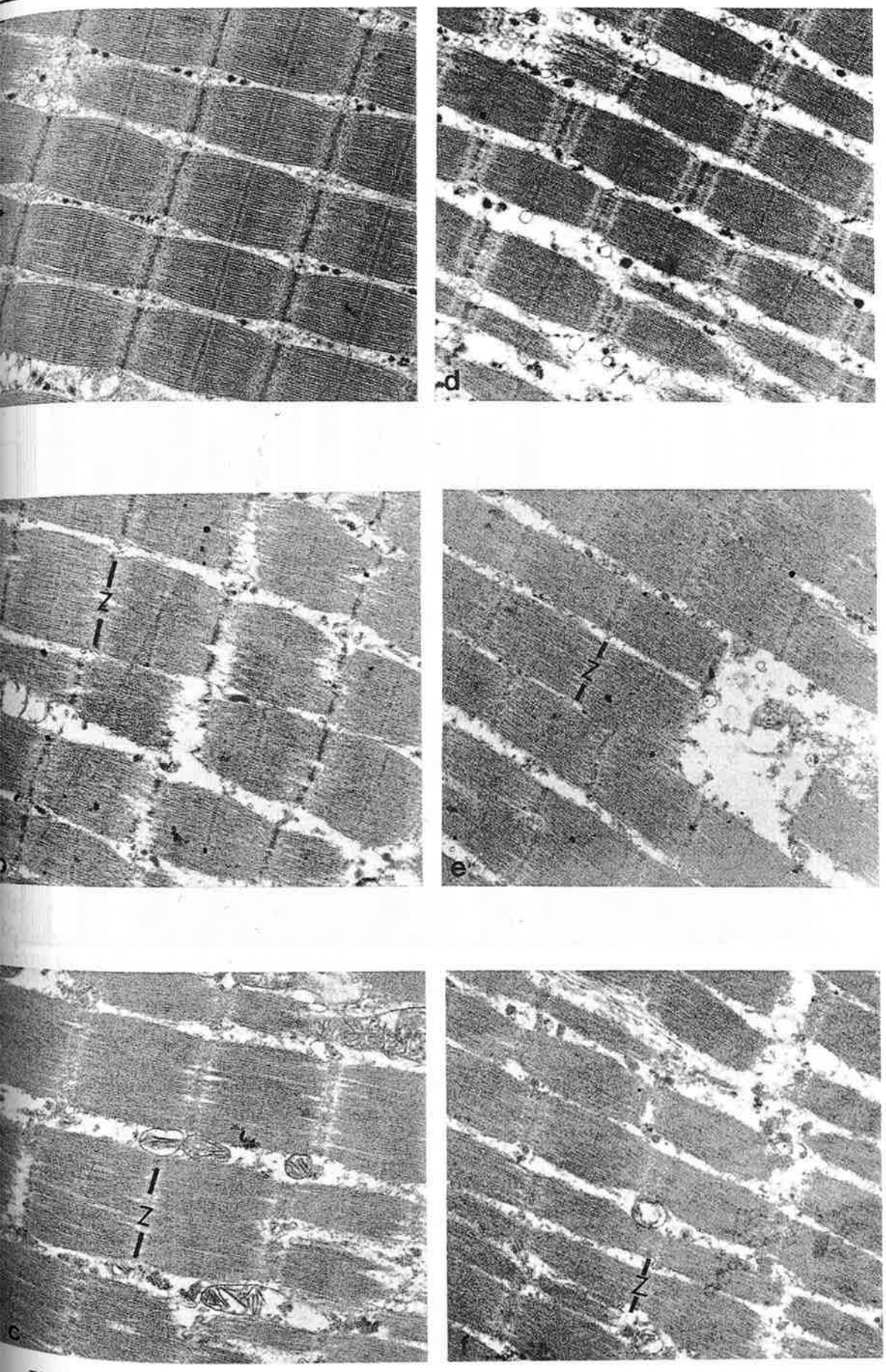


Figure 2 : Effect of *post-rigor* calcium injections and of sodium injections on muscle ultrastructure (x 15500).

a - b : Control fixed at d 1 (a) and d 7 (b).

d - e : Injections of 0.3 M $CaCl_2$ at pH = 5.4 and fixation at d 1 (d) and d 7 (e).

c - f : Injections of 0.6 M NaCl at pH = 6.9 (c) and pH = 5.4 (f) and fixation at d 14.

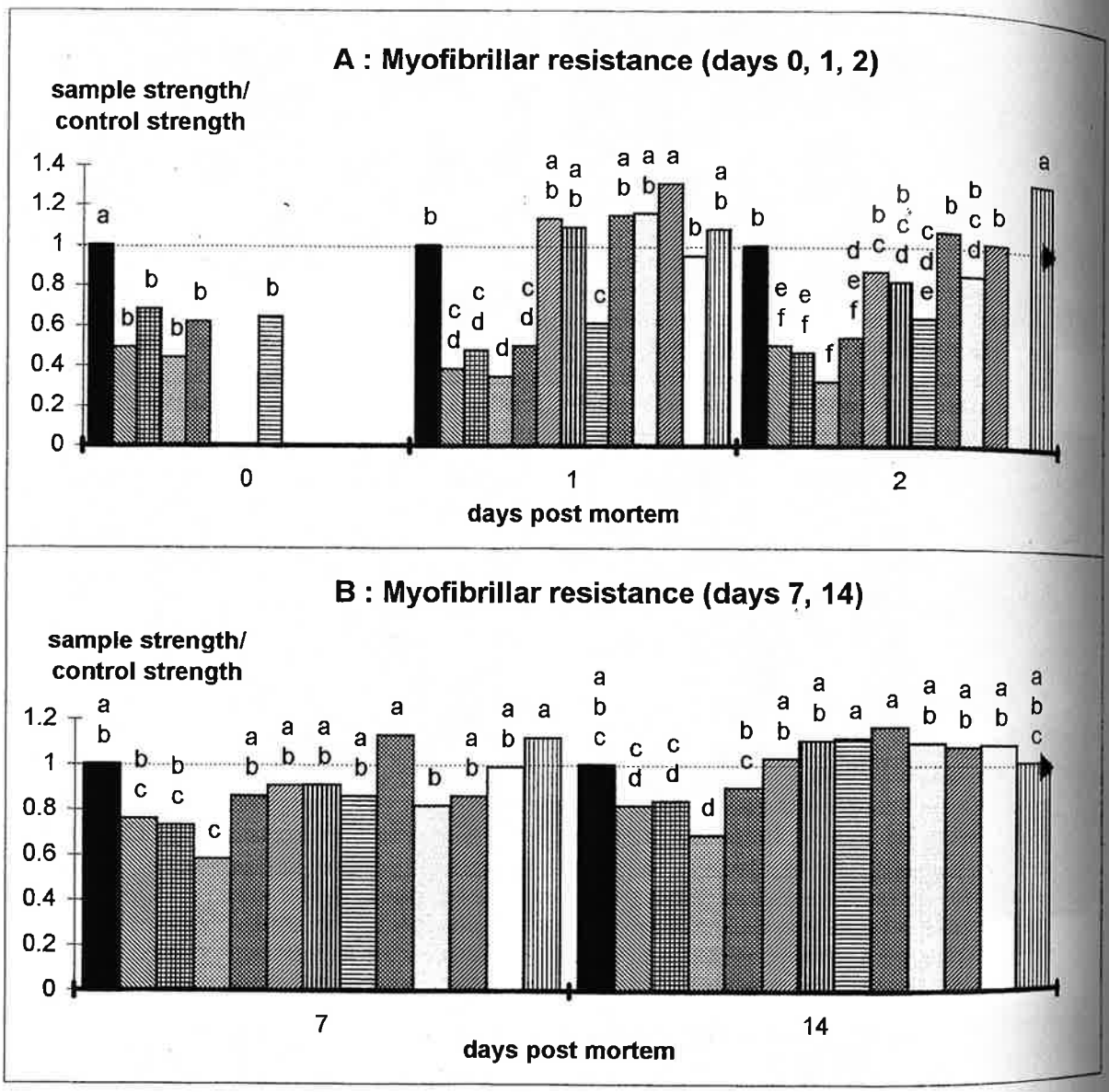


Figure 3 : Kinetics of myofibrillar resistance decrease on raw meat. Results are expressed as the ratio : maximum sample strength / maximum control strength.

- Control
- Ca 0.3 M ; pH = 6.9
- Ca 0.3 M ; pH = 6.3
- Ca 0.3 M ; pH = 5.9
- Ca 0.1 M ; pH = 6.9
- Ca 0.3 M ; pH = 5.4
- Ca 0.1 M ; pH = 5.4
- Na 0.6 M ; pH = 6.9
- Na 0.15 M ; pH = 6.9
- Na 0.6 M ; pH = 5.4
- Na 0.15 M ; pH = 5.4
- Water ; pH = 6.9
- Water ; pH = 5.4

Means with the same letters (a,b,c,d,e,f) are not significantly different (p>.05).

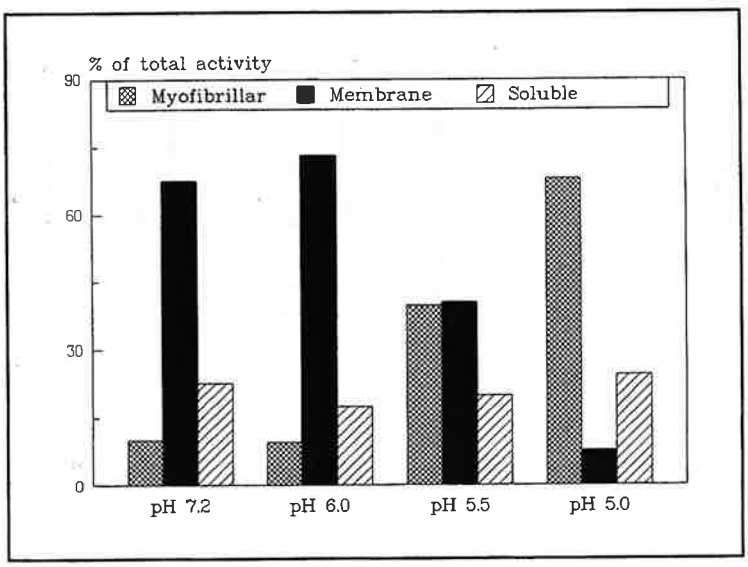
Table 1. Effect of temperature, time of incubation and pH in marinade on the distribution of cathepsin B + L activity in finely cut meat. Four different treatments are shown. Results are shown as percentage of total activity and are means of doublicate determinations.

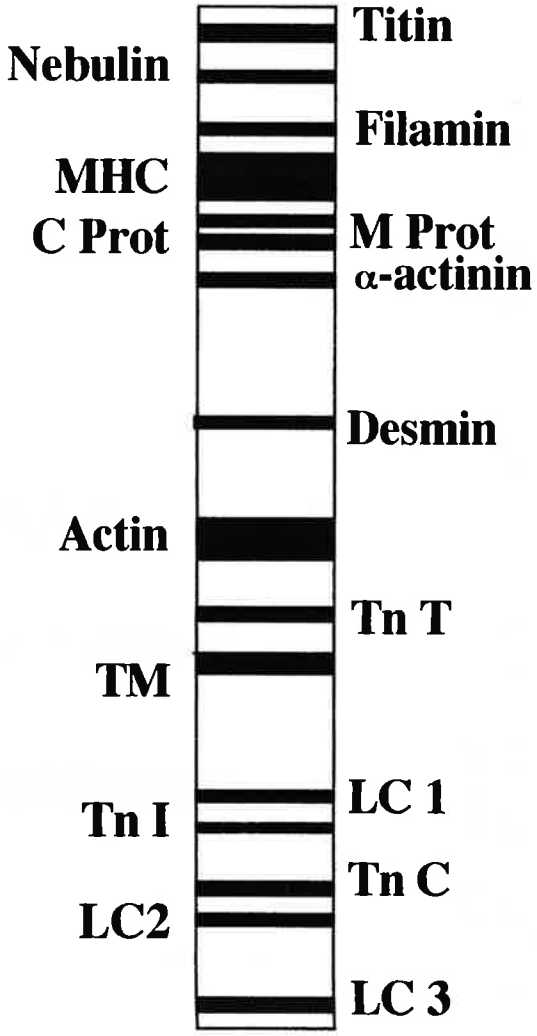
time	Fraction	pH 7.2 15 °C	pH 5.5 15 °C	pH 7.2 30 °C	pH 5.5 30 °C
1 h	Soluble	16.7	22.2	24.9	32.8
	Membrane	66.5	62.7	59.8	55.5
24 h	Soluble	31.9	33.9	49.6	54.8
	Membrane	54.9	52.8	38.1	33.5

Table 2. Distribution of cathepsin B + L in bovine *M. pectoralis profundus* during ageing in (a) control and (b) lactic acid injected samples. Results are shown as percentage of total activity and are means of doublicate determinations.

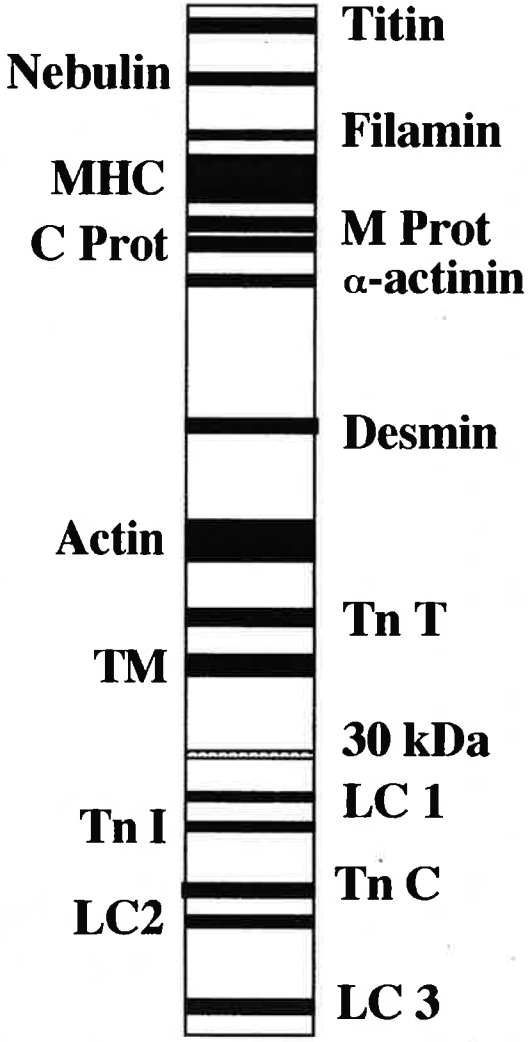
	Fraction	2 h	24 h	4 days	12 days
a	Soluble	22.7	31.6	37.3	44.7
	Membrane	60.0	48.3	40.6	38.5
b	Soluble	29.4	60.9	58.8	60.3
	Membrane	50.2	24.1	26.9	24.9

Fig. 1. Cathepsin B + L distribution after lactic acid addition to a meat homogenate. Results are for each subcellular fraction shown as percentage of total activity and are means of doublicate determinations.

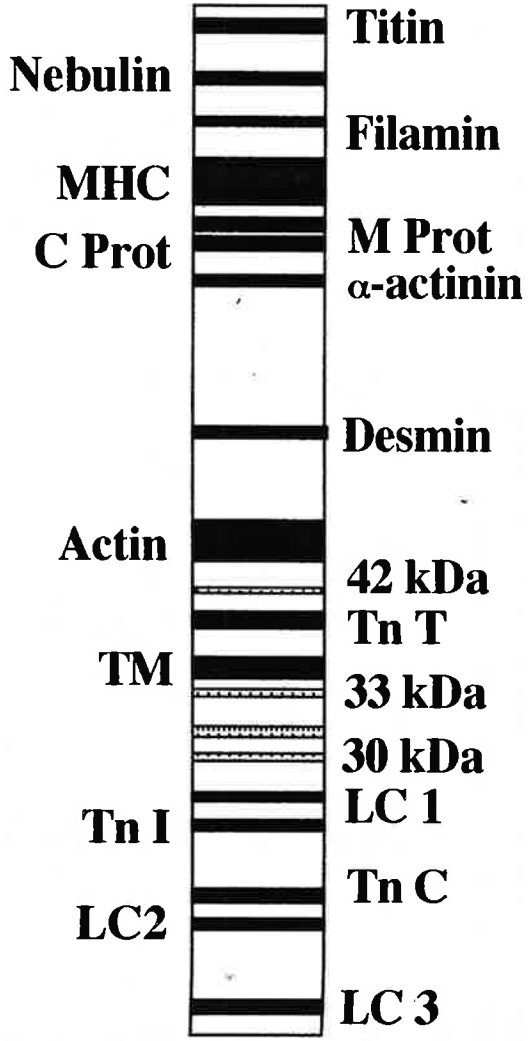




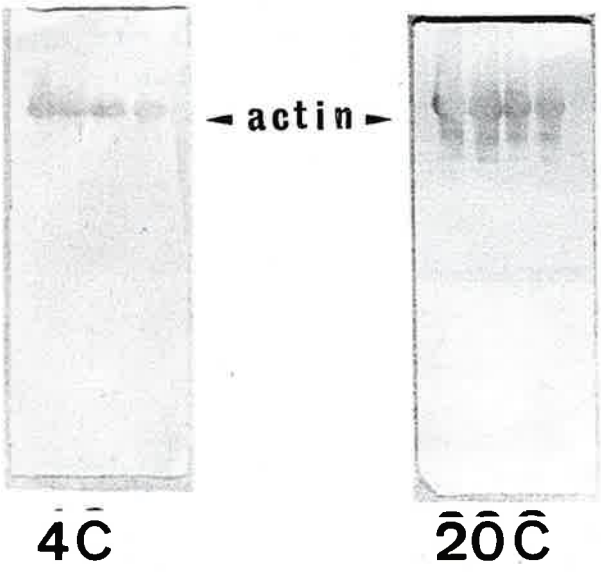
Myofibrillar proteins



48 h ageing at 4 C



48 h ageing at 20 C


actin
4C
20C

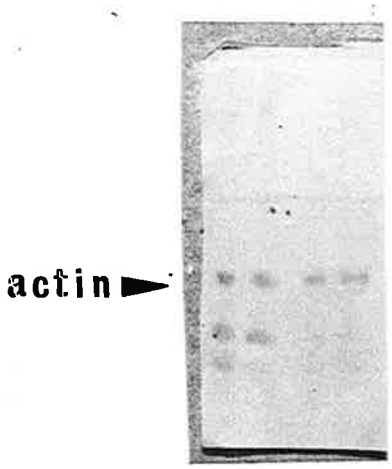
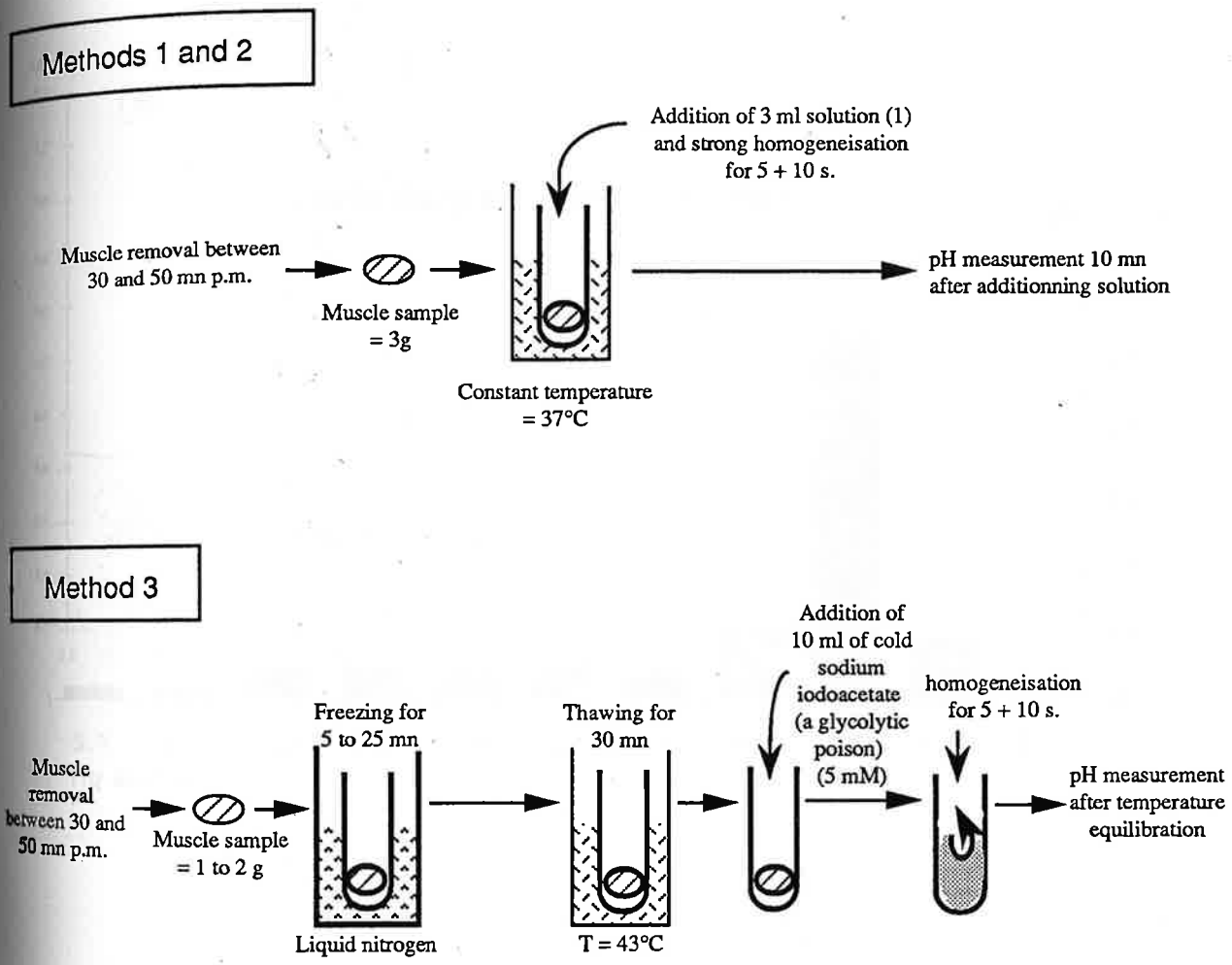

actin

FIGURE 1 : Experimental conditions description



(1) Solutions compositions :

method 1 : 20 mM $CaCl_2$ + 20 mM $MgCl_2$ + 100 mM KCl
method 2 : 1,5 % Triton X - 100

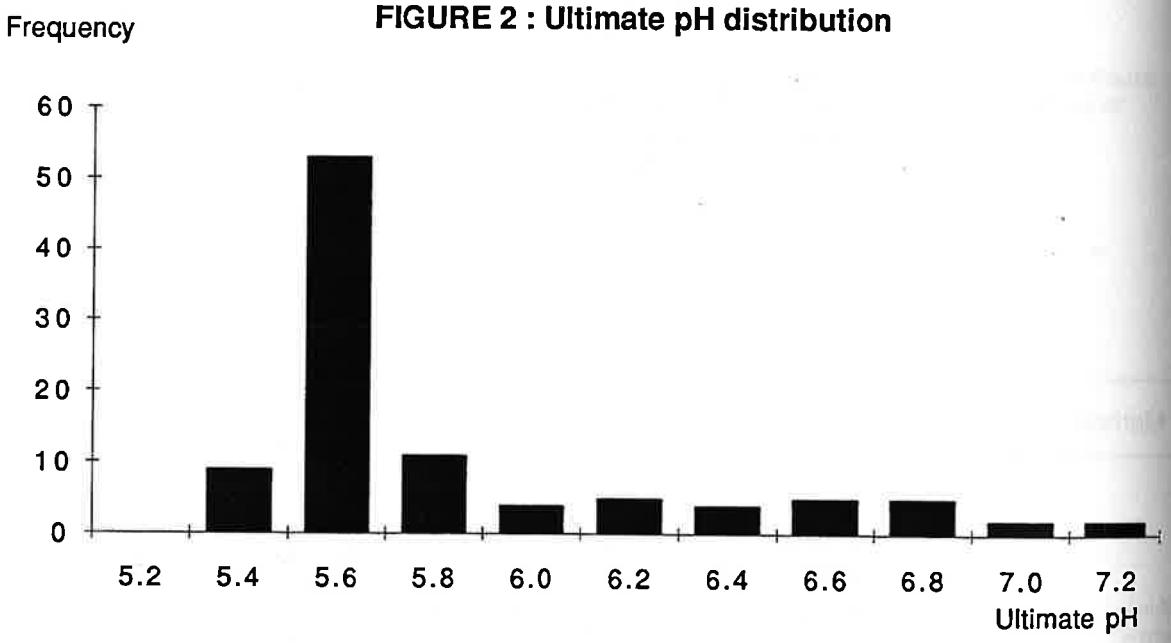


FIGURE 2 : Ultimate pH distribution

FIGURE 3 : Relationship between experimental and ultimate pH

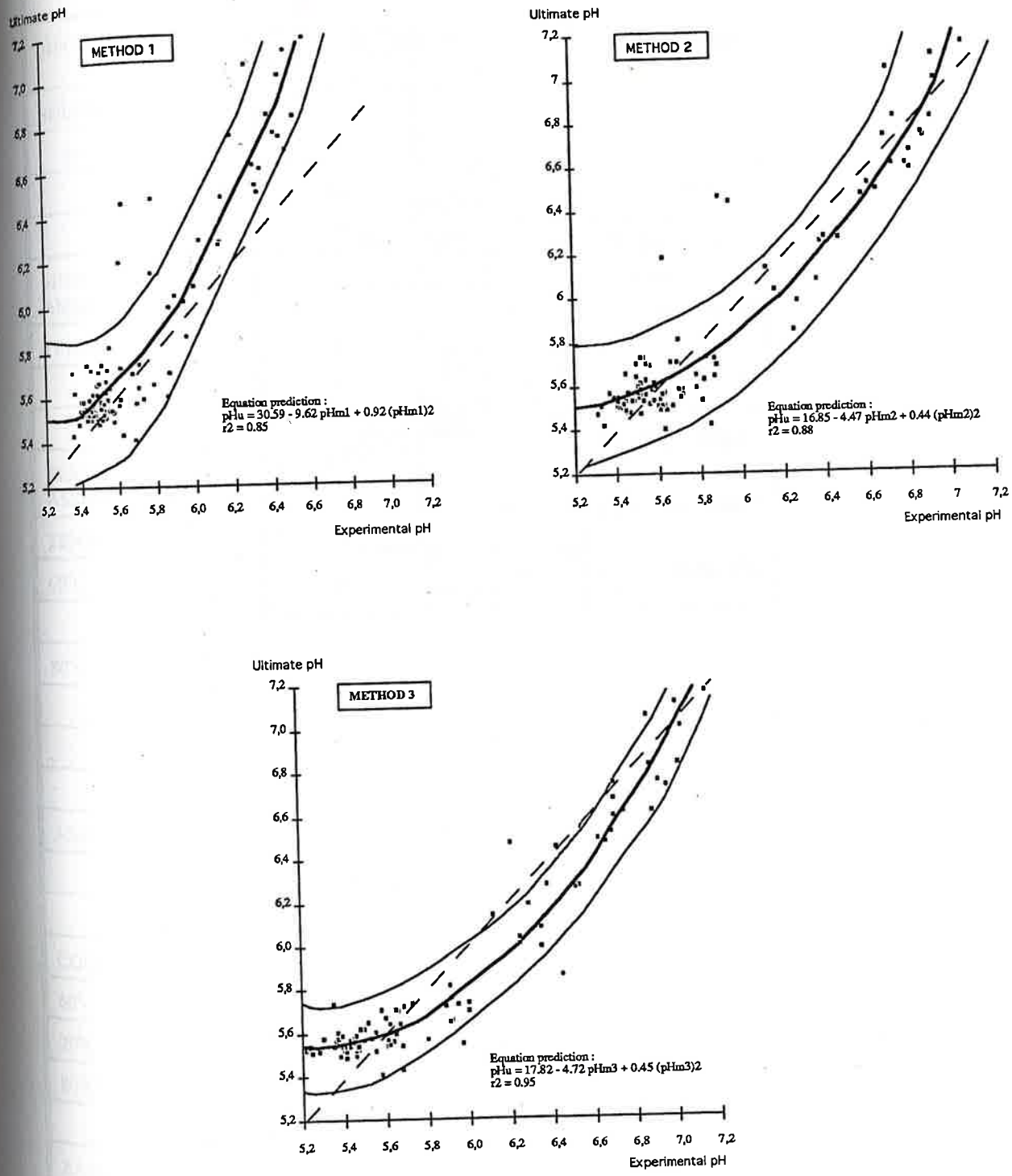


TABLE 1 : Carcasses distribution by ultimate and predicted pH values

Method 1	ultimate pH	
	< 5.8	≥ 5.8
Predicted < 5.8	69	5
pH value ≥ 5.8	2	24

Method 2	ultimate pH	
	< 5.8	≥ 5.8
Predicted < 5.8	71	3
pH value ≥ 5.8	0	26

Method 3	ultimate pH	
	< 5,8	≥ 5.8
Predicted < 5.8	60	1
pH value ≥ 5.8	0	28

TABLE 1 : *m.longissimus dorsi*

	DAY	NORMAL	INTER-MEDIATE	HIGH	SED	SIG.
pHu (48H)		5.50	6.18	6.53	0.051	***
SHEAR FORCE						
(kg)	2	7.88	8.08	4.36	1.80	N/S
	7	6.26	7.14	3.35	1.52	N/S
	14	4.20	4.26	2.98	0.74	N/S
SENSORY ANALYSIS						
TENDERNESS	2	3.5	3.8	6.0	0.697	**
	7	4.3	4.6	6.6	0.498	**
	14	5.5	5.3	6.9	0.418	**
TEXTURE ASSESSMENT						
TENDERNESS	2	6.42	6.01	6.67	0.958	N/S
60°C	7	6.32	6.89	7.84	0.842	N/S
	14	7.56	6.77	7.84	0.743	N/S
80°C	2	3.71	4.19	7.61	1.048	N/S
	7	4.92	4.97	8.27	1.278	*
	14	6.17	6.43	8.35	1.118	N/S
30kDa	2			++		
	7	++	++	+++		
	14	++	++	+++		
COOK LOSS						
60°C	2	9.16	7.63	2.95	1.313	**
70°C	2	21.18	18.11	12.73	2.319	*
80°C	2	27.55	23.43	18.86	1.871	***
SARCOMERE LENGTH (um)	2	1.80	1.61	1.55	0.098	*

SED : Standard error of difference.
SIG : Significance *** : p<0.001, ** : p<0.01, * : p<0.05, N/S : Not significant.
30kDa : Arbitrary assessment of bands +++ : very dense, ++ : dense, + : faint

TABLE 2 : *m.semimembranosus*

	DAY	NORMAL	INTERMEDIATE	HIGH	SED	SIG.
pHu (48H)		5.45	5.99	6.55	0.038	***
SHEAR FORCE						
(kg)	2	7.26	9.28	7.29	2.19	N/S
	7	5.17	7.01	6.45	1.64	N/S
	14	5.20	5.56	5.43	1.38	N/S
SENSORY ANALYSIS						
TENDERNESS	2	3.2	2.8	4.7	0.942	N/S
	7	3.4	3.3	5.5	0.647	*
	14	4.0	4.2	4.9	0.619	N/S
TEXTURE ASSESSMENT						
TENDERNESS	2	5.68	5.49	7.36	0.962	N/S
60°C	7	6.06	6.01	7.08	0.941	N/S
	14	6.24	5.96	5.33	0.802	N/S
80°C	2	3.85	4.01	6.02	1.322	N/S
	7	3.71	3.06	5.84	1.007	N/S
	14	5.07	4.15	6.14	0.854	N/S
30kDa	2	+		++		
	7	++		+++		
	14	+++	+	+++		
COOK LOSS						
60°C	2	10.91	7.30	4.03	1.713	**
70°C	2	24.30	22.71	18.82	2.91	*
80°C	2	32.33	28.61	22.69	2.67	***
SARCOMERE LENGTH (um)	2	1.84	1.67	1.51	0.11	*

SED : Standard error of difference.
SIG : Significance *** : p<0.001, ** : p<0.01, * : p<0.05, N/S : Not significant.
30kDa : Arbitrary assessment of bands +++ : very dense, ++ : dense, + : faint.

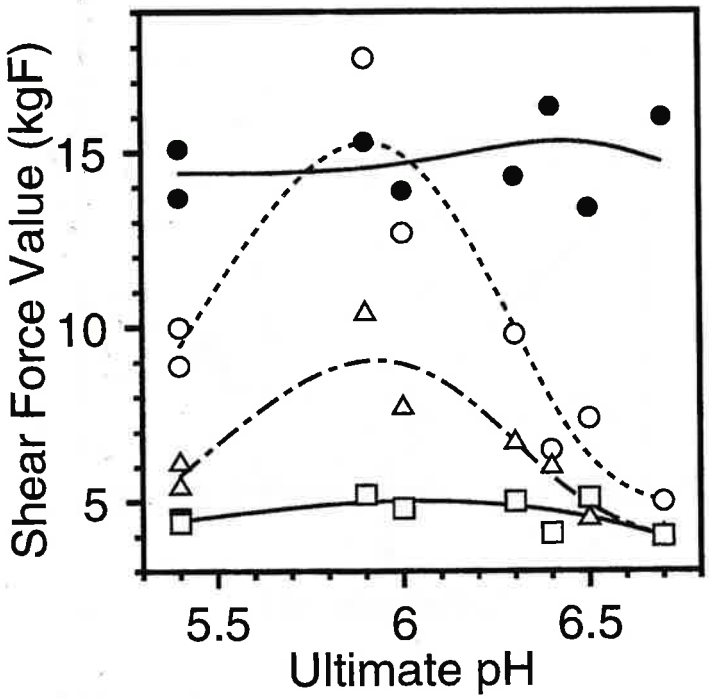


Figure 1. Post-mortem changes in shear force with respect to different ultimate pH vlaues. The loin muscles were stored for 1 day (○) 3 days (△) and 6 days (□) at 10°C. For $ZnCl_2$ treated meat, only the shear force values after 6 days holding post mortem (●) are shown.

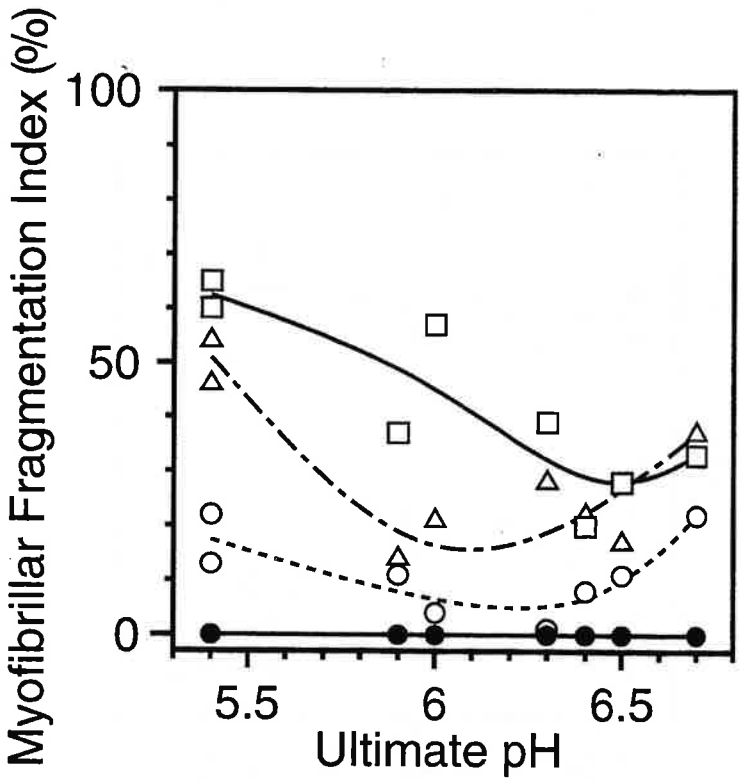


Figure 2. Post-mortem changes in myofibrillar fragmentation index. (Symbols are the same as in Figure 1.)

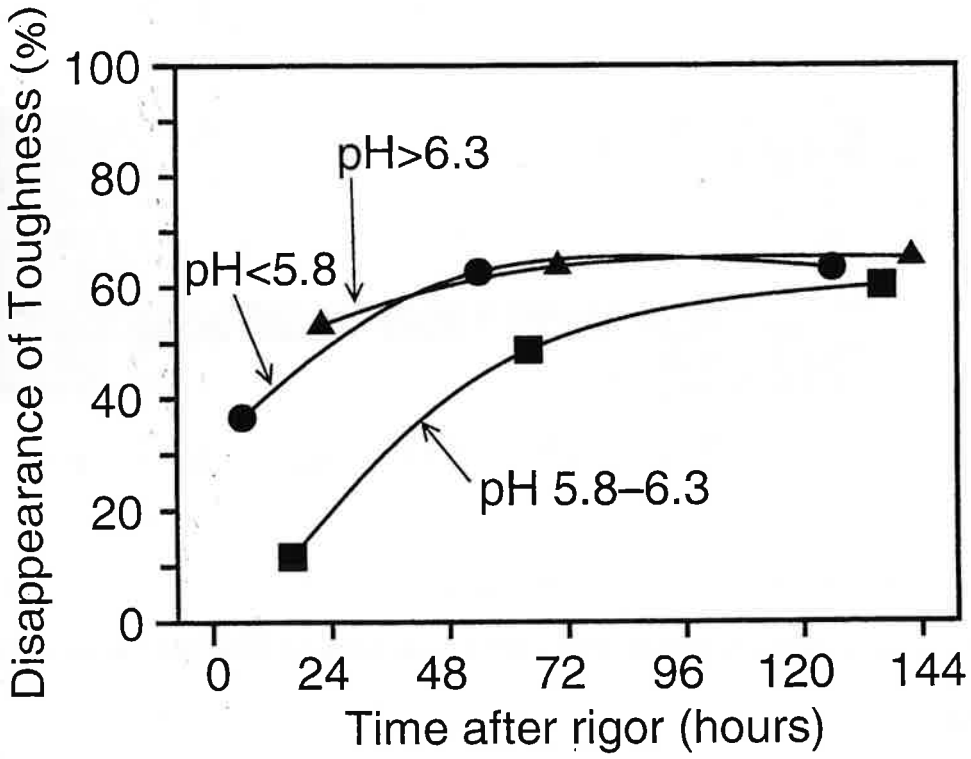


Figure 3. Toughness disappearance for three different pH_u groups stored at 10°C for 24, 72 and 144 hours after slaughter. The disappearance of toughness was expressed as a ratio (%) of the shear force values measured at each aging period with the shear force values obtained from the meat treated with $ZnCl_2$ at the first day (initial toughness – no aging). Zero time is the time of rigor onset.

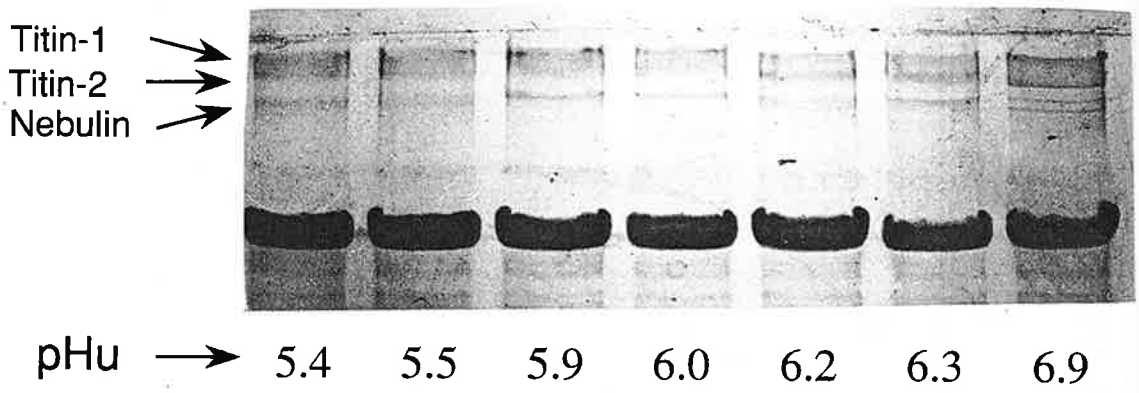


Figure 4. Changes of titin and nebulin with respect to different ultimate pH values at 2 days post-mortem.

Table 1 Fluid absorbed (mg) from meat surface by filter paper at 7 days post mortem of muscles exposed to different transport times (0, 2.5 and 5 h)

Animals		0	2.5	5
Bulls, non-stimulated,	n=6	15.9 ± 9.9	18.2 ± 9.3	18.1 ± 7.5
Bulls, stimulated,	n=6	23.0 ± 5.0[a]	30.3 ± 2.5[b]	41.8 ± 9.7[b]
Cows, non-stimulated,	n=12	31.4 ± 5.9[a]	38.0 ± 8.5[b]	38.2 ± 7.0[b]

[ab]Within rows means not containing a common superscript differ significantly ($p < 0.05$)

Table 2 Correlation coefficients of filter paper fluid absorption and drip loss of beef after 1 week of refrigerated storage

	Bulls (n=48)		Cows (n=48)	
Trait	D_{Ho}	D_{Lu}	D_{Ho}	D_{Lu}
K_{Fr} 1 day p.m.	0.492	0.695	0.310	0.479
K_{Fr} 7 days p.m.	0.371	0.437	0.438	0.733
K_{Su} 7 days p.m.	0.611	0.708	0.661	0.638

All obtained correlations are significant ($p < 0.05$)

Table 3 Correlation coefficients of pH at different times (45 min, 3 and 22 h) post mortem and water-holding capacity of beef in experiment 2

Method	pH_{45}	pH_3	pH_{22}
K_{Fr} at 1 day p.m.	-0.842	-0.637	-0.694
D_{Lu} at 7 days p.m.	-0.629	-0.537	-0.555
D_{Ho} at 7 days p.m.	-0.725	-0.635	-0.635

All obtained correlations are significant ($p < 0.05$)

Table 4 Correlation coefficients of intramuscular fat content and drip loss at 7 days post mortem of non-stimulated beef muscles

	Bulls (n=48)		Cows (n=48)	
Trait	D_{Ho}	D_{Lu}	D_{Ho}	D_{Lu}
Visual score	-0.635*	-0.773*	-0.650*	-0.570
Total fat (%)	-0.738*	-0.766*		

* significant correlation ($p < 0.05$)

Table 5 Drip loss of non-stimulated beef loins calculated on the basis of total (TW) and fat free (FW) sample weight

	D_{Ho}		D_{Lu}	
time p.m.	TW	FW	TW	FW
3	1.2 ± 0.2	1.2 ± 0.2	0.6 ± 0.1	0.6 ± 0.1
7	1.8 ± 0.6	1.9 ± 0.6	1.8 ± 0.9	1.9 ± 0.9
14	2.8 ± 0.8	2.9 ± 0.8	3.2 ± 1.4	3.3 ± 1.4

None of the differences are significant

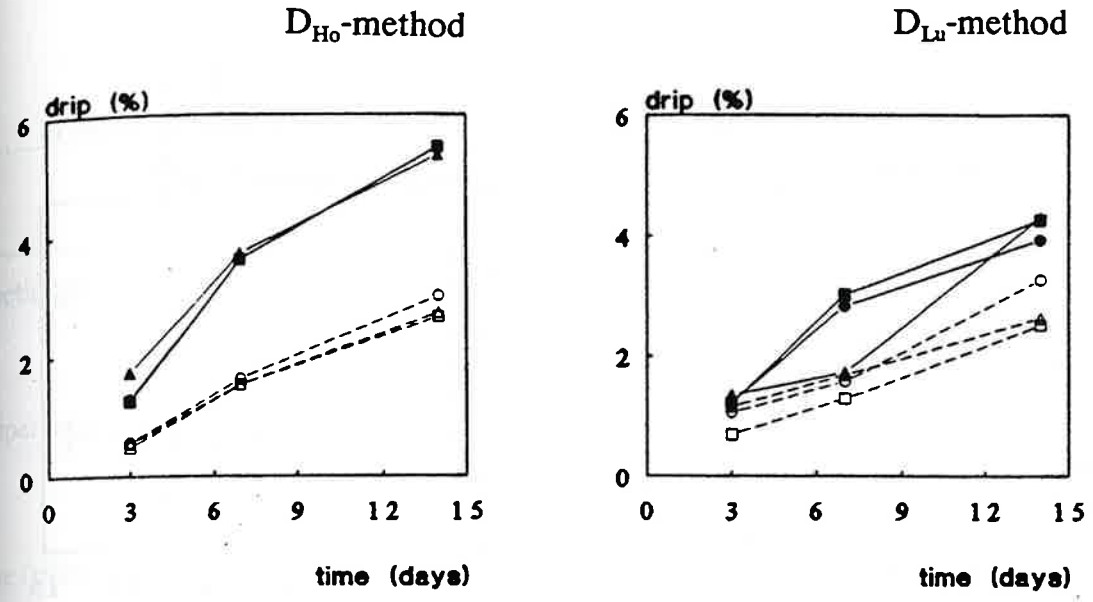


Fig. 1 Time course of D_{Ho} and D_{Lu} of non-stimulated (----) and stimulated (—) muscles exposed to various times of transport (▲ = 0 h, ● = 2.5 h, ■ = 5 h)

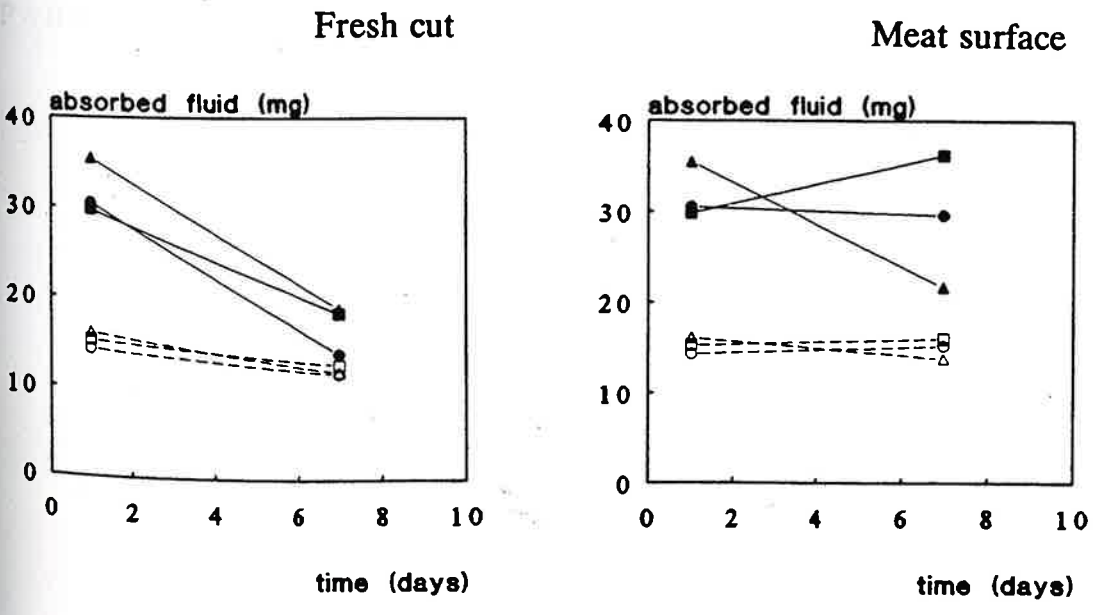


Fig. 2 Time course of K_{Fr} and K_{Su} of non-stimulated (----) and stimulated (—) muscles exposed to various times of transport (▲ = 0 h, ● = 2.5 h, ■ = 5 h)

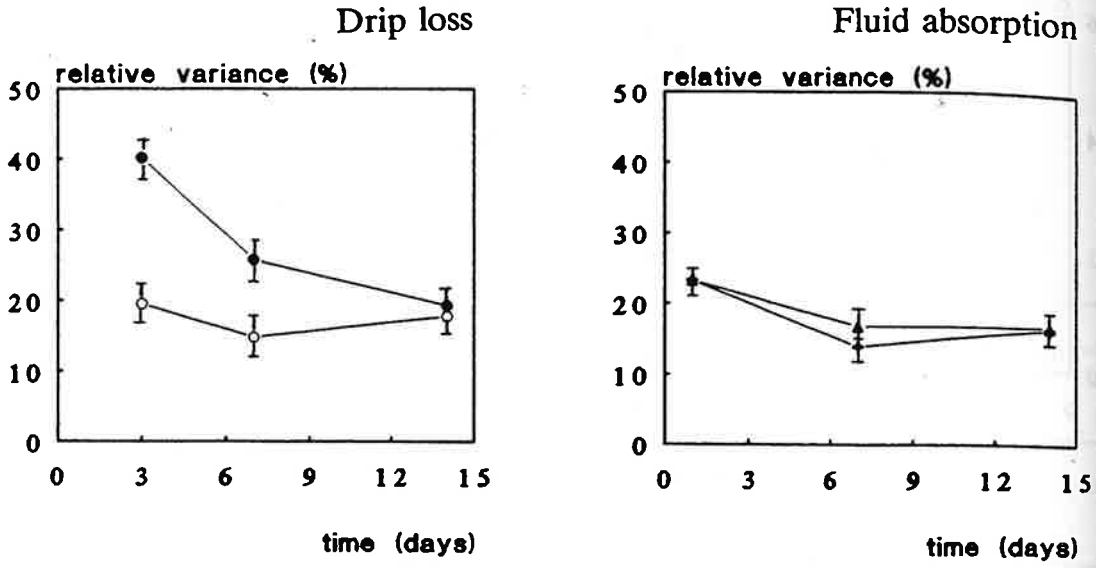


Fig. 3 Relative error and S.E.M. of drip loss and filter paper measurements. (• = D_{Ho}, o = D_{Lu}, + = K_{Fr}, ▲ = K_{Lu})

		Peak tension (kN/m^2)	CT (s) (1)	1/2 RT (s)
Genetic type (2)	HN	31.3	53	56
	HP	28.8	53	59
Temperature (°C)	35	29.1	57^A	58
	40	31.2	50^B	57
Time (min)	0	34.6^A	55	55^A
	10	33.6^A	51	53^A
	20	22.0^B	55	65^B

Table 1. Effects of genetic type, temperature and time on contraction traits in pig *tibialis cranialis*.
(1) CT: contraction time; 1/2 RT: half-relaxation time; (2) HN: halothane-negative; HP: halothane-positive.
A, B: means with different superscripts in the same source within a column are significantly at the $P < 0.01$ level.

		P T (kN/m^2)		CT (s)	
Genetic type (1)		HN	HP	HN	HP
Time (min)	0	34.3^{a}	34.9^{A}	57	53
	10	32.8^{a}	34.5^{A}	51	52
	20	$26.6^{b,C}$	$17.1^{B,D}$	50^{c}	60^{d}

Table 2. Genetic type x time interactions on peak tension (PT) and contraction time (CT).

(1) HN: halothane-negative; HP: halothane-positive.

Means with different superscripts in the same line or the same column are significantly different. Effect of time: a, b, $P < 0.05$; A, B, $P < 0.01$; effect of genetic type: c,d, $P < 0.05$; C, D, $P < 0.01$.

		PC µmol/g	ATP µmol/g	Glycogen µmol/g	G-6-P µmol/g	Lactate µmol/g	pH
Genetic type (1)	HN	20^{A}	7.9	45	0.14^{A}	11^{A}	7.05^{A}
	HP	15^{B}	6.3	40	0.69^{B}	18^{B}	6.90^{B}
Temperature (°C)	35	19	7.8	47	0.52	12	7.00
	40	16	6.5	38	0.27	16	6.95
Time (min)	0	22^{A}	8.0	50^{a}	0.44	8^{A}	7.03^{a}
	20	13^{B}	6.4	36^{b}	0.36	21^{B}	6.96^{b}

Table 3. Effects of genetic type, temperature and time on biochemical traits in pig *tibialis cranialis in situ.*

(1) HN: halothane-negative; HP: halothane-positive.

Means with different superscripts in the same source within a column are significantly different: a, b, $P < 0.05$; A, B, $P < 0.01$.

Genetic type (1)		Before HN	Before HP	After HN	After HP
In situ temperature (°C)	35	11	13^{a}	35^{C}	$47^{a,D}$
	40	11^{c}	$23^{b,d}$	32^{C}	$54^{b,D}$

Table 4. Genetic type x *in situ* temperature interactions on lactate content in *tibialis cranialis* before and after excision.

(1) HN: halothane-negative; HP: halothane-positive.

Means with different superscripts in the same line or the same column are significantly different. Effect of temperature: a, b, $P < 0.05$; A, B, $P < 0.01$; effect of genetic type: c,d, $P < 0.05$; C, D, $P < 0.01$.

		PC µmol/g	ATP µmol/g	Glycogen µmol/g	G-6-P µmol/g	Lactate µmol/g	pH
Genetic type (1)	HN	1.8^{A}	5.2^{A}	26	0.29^{A}	34^{A}	6.36^{A}
	HP	0.3^{B}	1.8^{B}	21	0.49^{B}	50^{B}	6.13^{B}
Temperature *in situ* (°C)	35	1.2	3.8	24	0.38	41	6.26
	40	0.9	3.4	23	0.41	42	6.24
Temperature post excision (°C)	35	1.5^{A}	4.3^{A}	25	0.38	37^{A}	6.32^{A}
	40	0.7^{B}	2.9^{B}	22	0.40	46^{B}	6.18^{B}
Time (min)	60	1.5^{A}	4.7^{A}	27^{a}	0.44	34^{A}	6.36^{A}
	120	0.6^{B}	2.5^{B}	19^{b}	0.34	49^{B}	6.14^{B}

Table 5. Effects of genetic type, temperature in situ and after excision, and time on biochemical traits in excised pig *tibialis cranialis*.

(1) HN: halothane-negative; HP: halothane-positive.

Means with different superscripts in the same source within a column are significantly different: a, b, $P < 0.05$; A, B, $P < 0.01$.

Table 1. The relationship of subjective quality group to objective measures of longissimus muscle quality.

Objective Quality Trait	Quality Group [z]	n	Mean	SD	Range
L*	PSE	10	58.5 a	1.9	55.3 - 61.1
	Normal	10	49.6 b	2.1	46.3 - 52.3
	DFD	10	41.3 c	2.3	37.5 - 44.3
a*	PSE	10	10.3 a	1.4	8.0 - 12.8
	Normal	10	9.2 b	1.0	7.8 - 11.1
	DFD	10	8.3 b	1.9	6.5 - 12.0
b*	PSE	10	6.5 a	1.0	5.1 - 7.9
	Normal	10	3.3 b	0.8	2.2 - 5.1
	DFD	10	1.7 c	1.5	0.2 - 4.8
Protein Solubility [y]	PSE	10	102.6 a	9.8	87.2 - 119.8
	Normal	10	182.1 b	16.4	153.8 - 199.1
	DFD	10	197.3 c	5.0	186.9 - 202.5
Ultimate pH	PSE	10	5.52 a	0.07	5.40 - 5.63
	Normal	10	5.68 a	0.07	5.57 - 5.79
	DFD	10	6.33 b	0.23	6.00 - 6.80

[z] Agriculture Canada color and structure scores ≤ 2, =3 and ≥4 for PSE, normal and DFD, respectively.

[y] g/kg - Method of Barton Gade (1984).

a,b,c - Means with different letters differ significantly ($P < 0.05$) by t-test.

Figure 1.

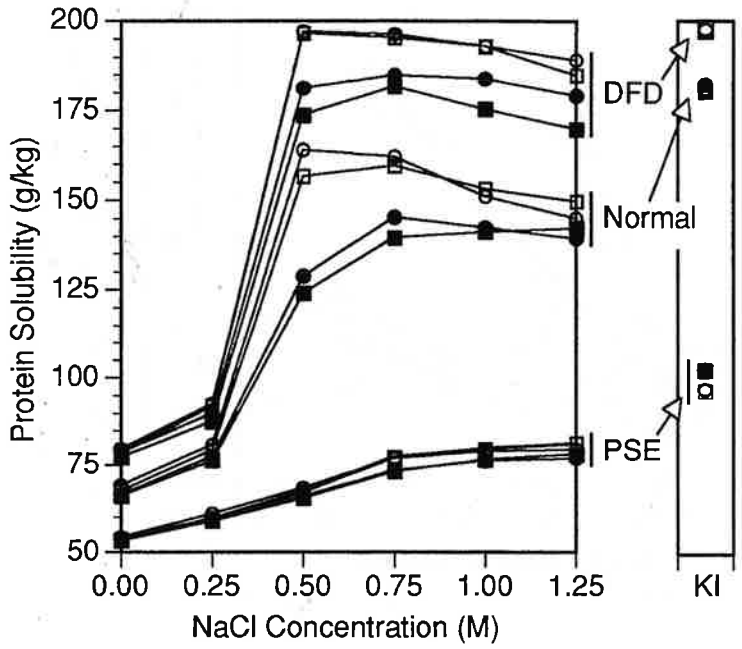


Figure 1. Effect of NaCl and KI on protein solubility of longissimus muscles of three different quality types, extracted for 1 (solid symbols) and 24 h (open symbols) at 4 (squares) and 21C (circles).

Figure 2.

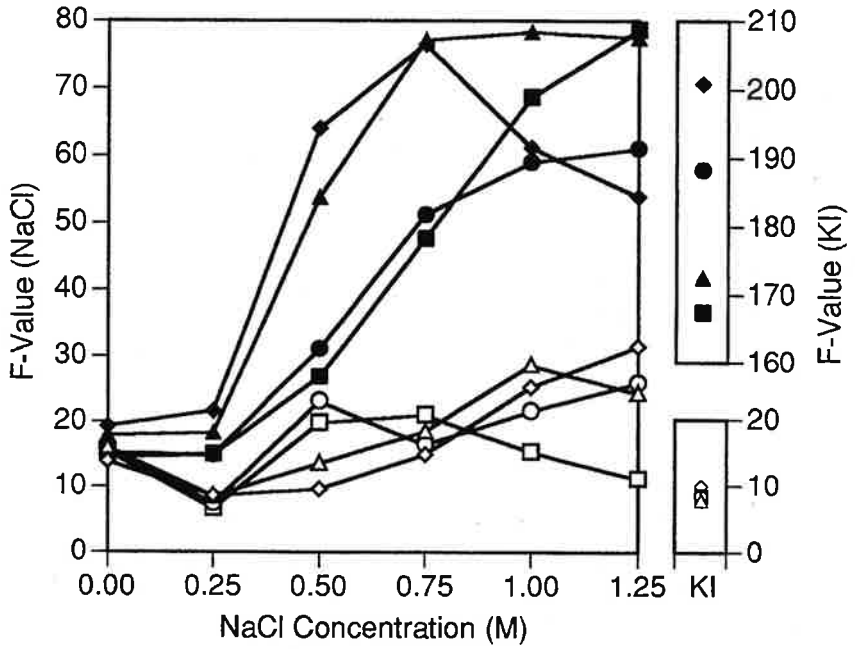


Figure 2. F-Values resulting from analysis of variance comparing protein solubility of PSE to normal muscles (solid symbols) and DFD to normal muscles (open symbols) for several NaCl concentrations and for KI. Extraction times/temperatures were: 1h/4C (squares); 1h/21C (circles); 24h/4C (triangles); 24h/21C (diamonds).

Figure 3a.

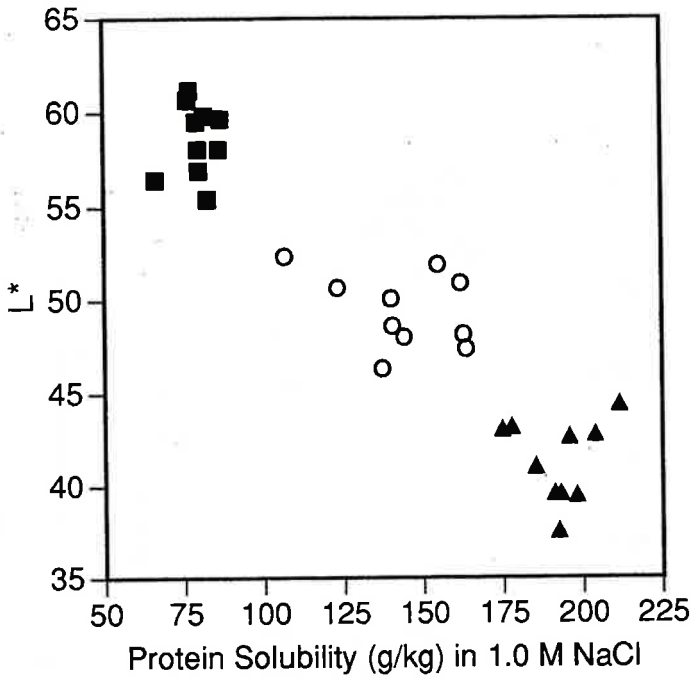

65
60
55
50
45
40
35
L*
50
75
100
125
150
175
200
225
Protein Solubility (g/kg) in 1.0 M NaCl

Figure 3b.

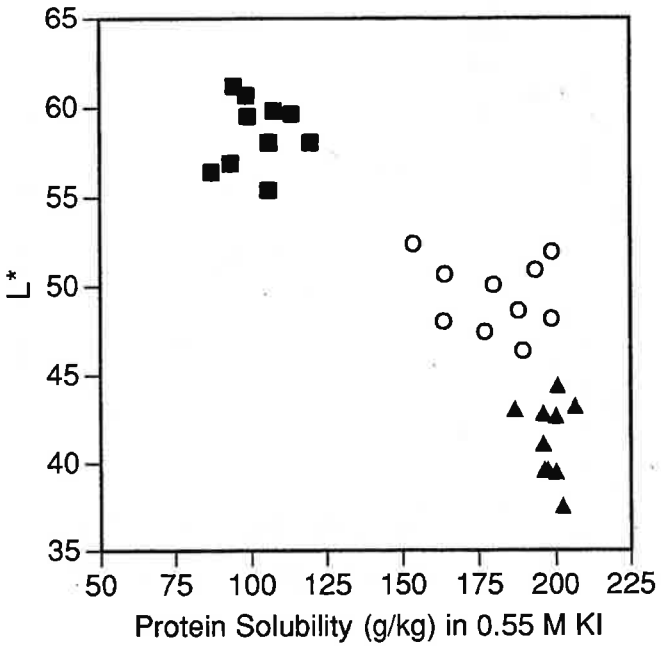


Figure 3. Relationship of L* value and protein solubility in 1.0 M NaCl (Figure 3a) and in 0.55 M KI (Figure 3b) after an extraction for 24 h at 4 C. PSE (squares), normal (circles), and DFD (triangles) quality types are indicated.

Figure 4.

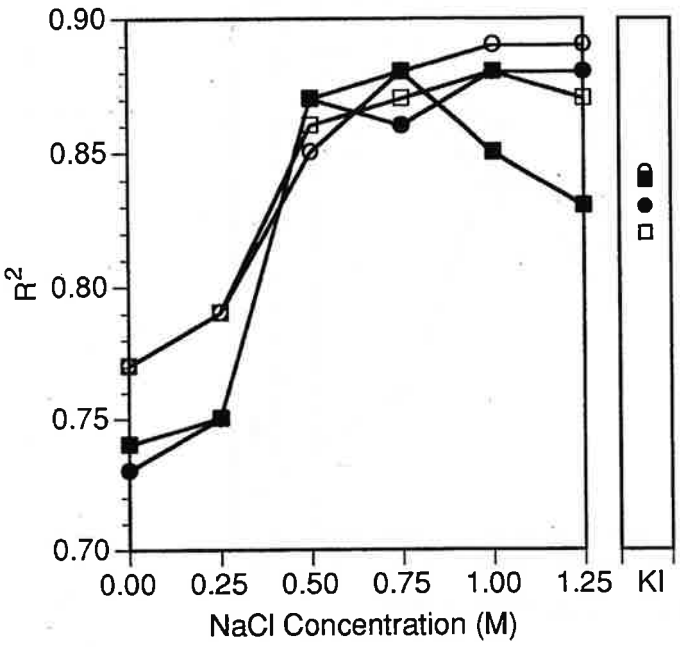


Figure 4. R^2 Values resulting from quadratic regression of L* value on protein solubility of pig muscle extracted for 1 (solid symbols) and 24 h (open symbols) at 4 (squares) and 21 C (circles).

Figure 5.

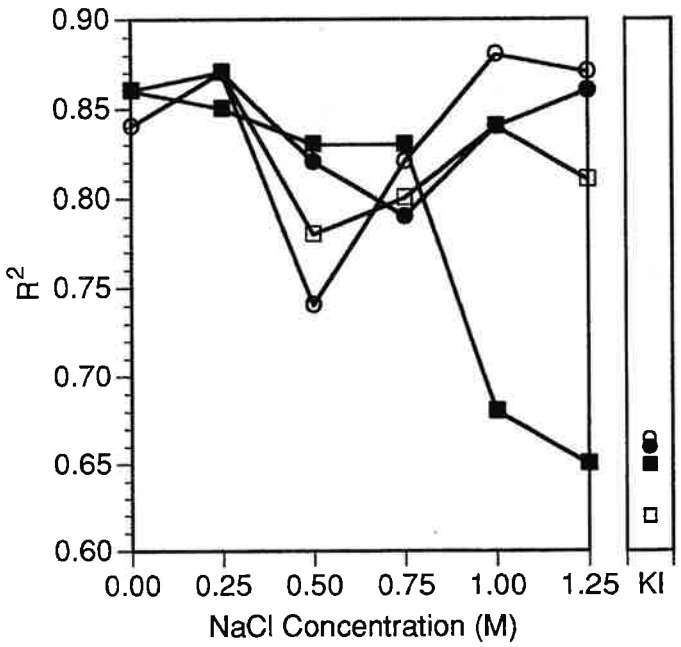


Figure 5. R^2 Values resulting from quadratic regression of pH value on protein solubility of pig muscle extracted for 1 (solid symbols) and 24 h (open symbols) at 4 (squares) and 21 C (circles).

Tabel 1 Data of different parameters obtained from M. longissimus (n=24)

M.long. code	Drip (%)	WHC (mg/cm^2)	pH	L^*	a^*	b^*	CTM(r) (v)	Elect.cond. (mS)	Glucose (mg/g)
14	0.9	1.3	6.30	43	12.2	4.7	0.65	8.4	0.30
10	1.0	1.4	6.22	49	13.4	5.2	0.48	9.0	0.34
8	1.5	0.8	5.91	n.d.	n.d.	n.d.	0.50	4.4	0.41
23	1.8	1.1	5.88	52	11.5	3.4	0.54	11.6	0.58
22	1.8	0.9	5.77	46	11.3	3.8	0.50	4.6	0.68
1	3.5	1.6	5.77	53	10.2	6.8	0.71	9.8	0.60
6	3.7	1.9	5.66	47	11.4	5.6	0.66	7.4	0.84
18	4.1	2.6	5.82	45	12.7	3.3	0.58	8.7	0.60
24	4.2	1.8	5.40	60	8.5	5.7	0.99	5.8	1.11
11	4.8	2.4	5.63	n.d.	n.d.	n.d.	0.82	8.8	0.86
9	4.8	2.5	5.81	51	12.4	3.1	0.83	15.3	0.71
20	5.0	2.2	5.54	48	13.4	6.1	0.62	8.2	0.86
16	5.4	3.2	5.58	55	10.3	5.1	0.79	8.0	1.05
2	5.6	2.8	5.49	58	8.2	6.7	0.82	9.0	1.32
17	5.7	3.3	5.61	52	11.4	5.3	0.74	8.7	1.00
21	6.0	2.0	5.48	55	10.1	5.7	0.78	6.5	1.04
19	6.8	5.2	5.47	62	10.1	6.8	1.17	13.2	1.37
5	7.2	3.6	5.53	54	10.0	6.7	0.78	10.1	0.93
3	7.8	4.5	5.45	70	6.0	9.8	1.24	13.2	1.48
15	7.9	4.5	5.45	60	9.2	5.9	1.17	10.1	1.61
13	8.5	6.4	5.49	71	5.8	7.4	1.25	15.1	1.13
4	10.7	5.2	5.41	65	6.6	8.9	1.30	13.2	1.63
12	10.8	5.0	5.56	n.d.	n.d.	n.d.	0.92	13.0	1.13
7	11.7	4.4	5.44	n.d.	n.d.	n.d.	1.15	13.0	1.50

n.d.: not available

Table 2 Correlation coëfficients (r) between drip formation and water holding capacity (WHC) and other parameters obtained for M. longissimus

Parameter	Drip formation	WHC (Kauffmann)
WHC (Kauffmann)	0.88	1
pH	0.77	0.64
L^*	0.78	0.81
a^*	0.73	0.70
b^*	0.70	0.64
CTM (refl)	0.82	0.87
CTM (abs)	0.74	0.78
Elect. conductivity	0.62	0.73
Redox potentiel	0.46	0.29
'Extracellular' potassium	0.39	0.51
Glucose-6-phosphate	0.56	0.46
Glucose	0.85	0.78

	Minolta–L	pH	Driploss	IMF	Quality score
MQM	0.89 (2.46)	0.91 (0.17)	0.88 (1.83)	0.79 (0.91)	0.88 (0.51)
Minolta–L		–0.76	0.78	0.23	–0.83
pH			–0.81	0.03	0.84
Driploss				–0.20	–0.92
IMF					0.10

Table 1.: N = 157

Minolta–L	Drip loss*	pH	Marbling score**
0.81 (2.54)	0.58	0.67 (0.25)	0.56

Table 2. * Reference method is filter paper test. ** Reference method is subjective scores, and only RFN and DFD muscles are included in this number.

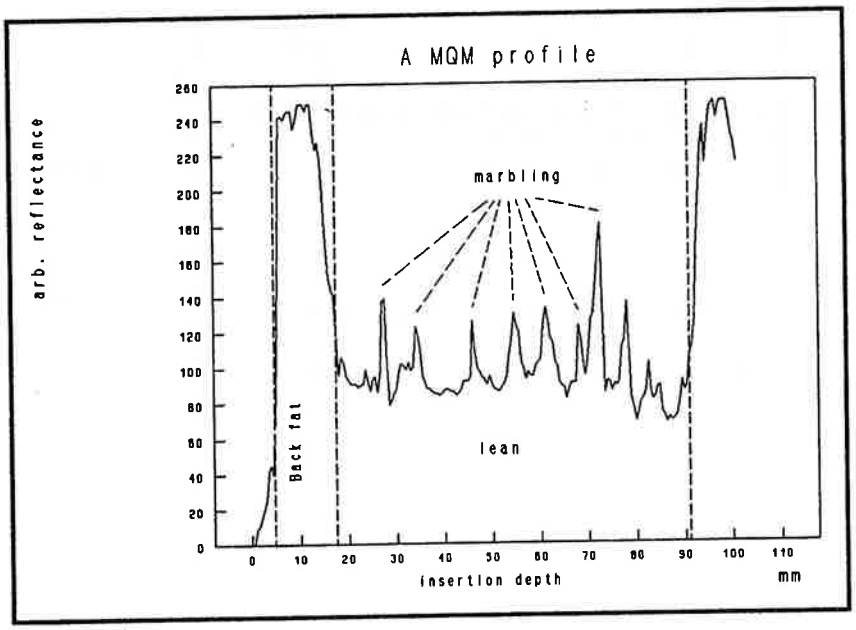


Figure 1

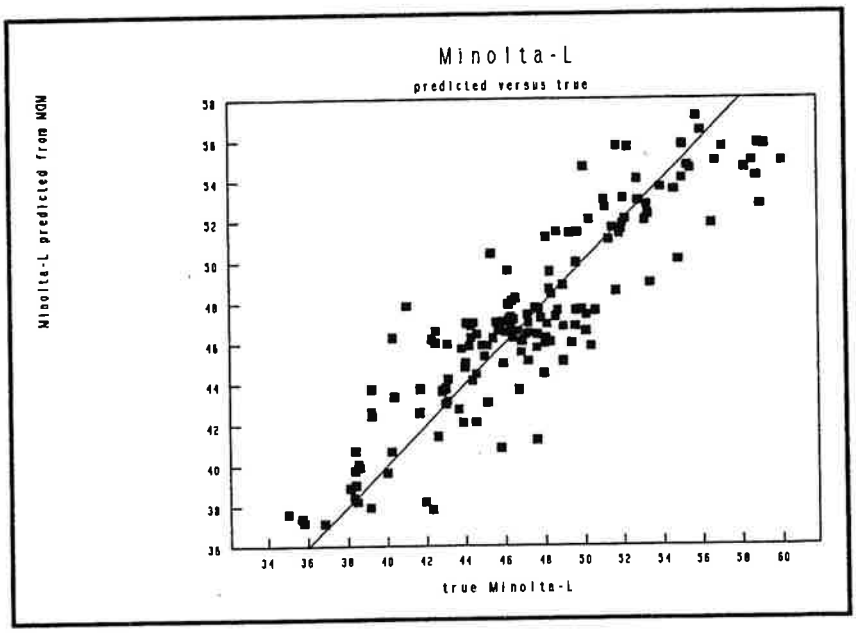


Figure 2

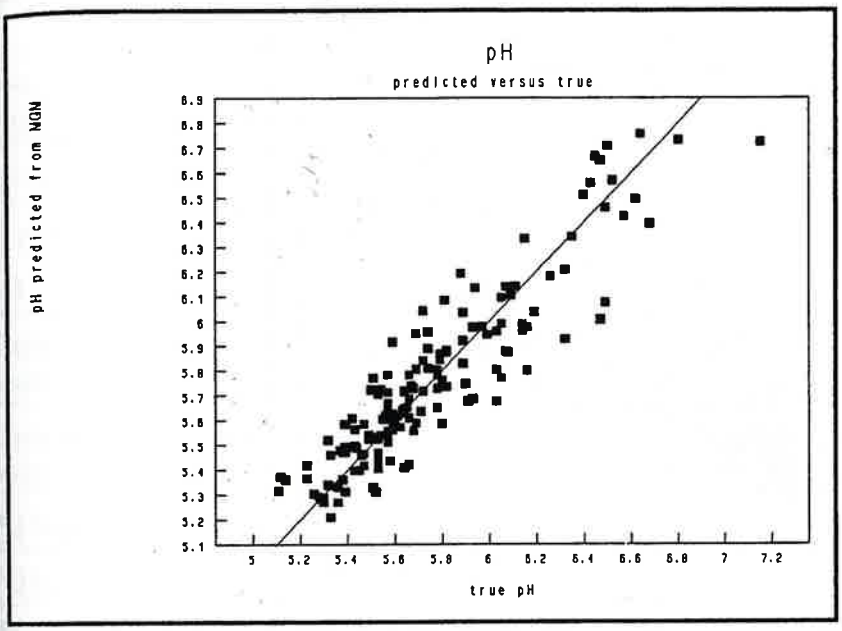


Figure 3

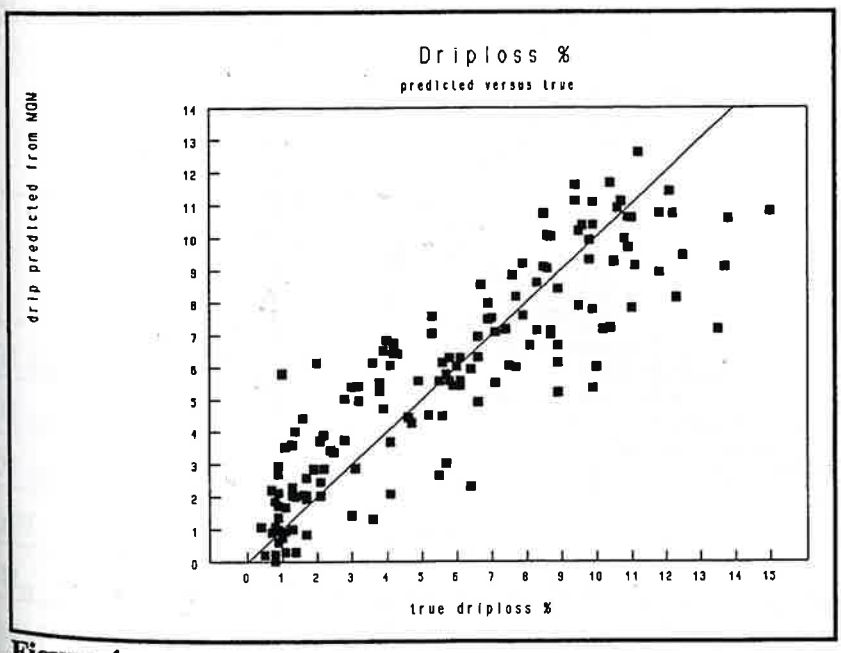


Figure 4

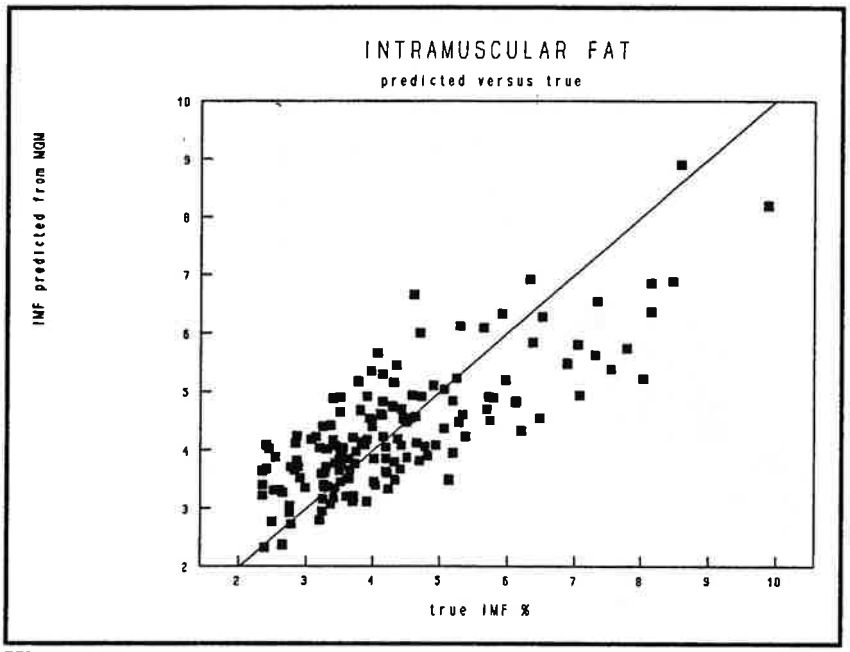


Figure 5

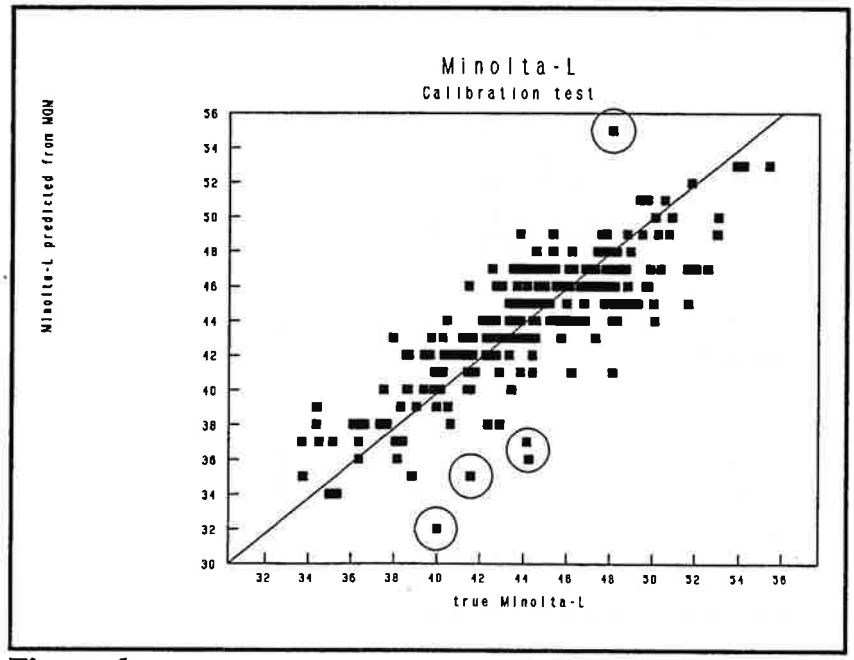


Figure 6

Table 1. Correlations Between Ultimate Meat Quality and Early Postmortem Measurements

	Filter Paper Press	L	a	b	marbling score
R_{90}	0.388^{d}	-0.036	0.620^{a}	0.249	-0.646^{a}
pH_{90}	-0.498^{c}	0.038	-0.579^{a}	-0.204	0.666^{a}
Δ pH	0.420^{c}	-0.079	0.610^{a}	0.112	-0.550^{b}
pH_u	-0.372^{d}	-0.361^{d}	-0.028	-0.305	0.077
Time of rigor onset	-0.403^{c}	-0.088	-0.526^{b}	-0.135	0.434^{c}
Time of rigor completion	-0.327	-0.114	-0.534^{b}	-0.252	0.523^{b}
PQM_{90}	0.570^{c}	-0.112	0.698^{a}	0.286	-0.529^{c}
PQM_u	0.691^{a}	-0.008	0.710^{a}	0.378	-0.486^{c}

superscripts denote significance: a: $p < 0.005$, b: $p < 0.01$, c: $p < 0.05$, d: $p < 0.1$
subscripts denote time postmortem
R: ATP/IMP absorbance ratio
PQM: Tecpro PQM conductivity probe measurements

Table 2. Correlations of Postmortem pH, R , and PQM Probe Values

	R 15 min	R 45 min	R 90 min	R 24 hr	PQM 15min	PQM 45min	PQM 90min	PQM 24hr
pH_{15}	-0.811^{a}	-0.747^{a}	-0.771^{a}	-0.288	0.214	-0.377	-0.821^{a}	-0.763^{a}
pH_{45}	-0.847^{a}	-0.792^{a}	-0.706^{b}	-0.232	0.075	-0.350	-0.734^{a}	0.778^{a}
pH_{90}	-0.828^{a}	-0.839^{a}	-0.923^{a}	-0.243	-0.114	-0.681^{a}	-0.777^{a}	-0.803^{a}
ΔpH	0.622^{a}	0.689^{a}	0.797^{a}	0.144	0.338	0.788^{a}	0.609^{b}	0.692^{a}
pH_u	-0.092	0.004	-0.167	-0.525^{b}	0.126	0.214	0.107	-0.077
PQM_{15}	-0.250	-0.146	0.112	-0.166	1.000	0.595^{b}	-0.181	-0.057
PQM_{45}	0.424^{d}	0.537^{c}	0.686^{a}	-0.323	0.595	1.000	0.522^{c}	0.586^{c}
PQM_{90}	0.937^{a}	0.897^{a}	0.761^{a}	-0.066	-0.181	0.522^{c}	1.000	0.924^{a}
PQM_u	0.876^{a}	0.829^{a}	0.759^{a}	-0.065	-0.057	0.586^{c}	0.924^{a}	1.000

superscripts denote significance: a: $p < 0.005$, b: $p < 0.01$, c: $p < 0.05$, d: $p < 0.1$
subscripts denote time postmortem
R: ATP/IMP absorbance ratio
PQM: Tecpro PQM conductivity probe measurement

Table 3. Correlations of Complex Impedance Measurements with Early Postmortem Measurements

	R 45	Ph 45	Rigor onset	Rigor Completion	Rate of Rigor
$Z_{low\ time}$	-0.741^{a}	0.713^{a}	0.417^{c}	0.576^{a}	-0.518^{b}
$\theta_{low\ time}$	-0.723^{a}	0.691^{a}	0.322	0.538^{b}	-0.427^{c}
$Z_{high\ time}$	-0.566^{a}	0.414^{c}	0.543^{a}	0.675^{a}	-0.618^{a}
$\theta_{high\ time}$	-0.622^{a}	0.542^{b}	0.562^{a}	0.685^{a}	-0.563^{a}
Z_{peak}	-0.340^{d}	0.236	0.456^{c}	0.514^{b}	-0.583^{a}
θ_{peak}	-0.465^{c}	0.387^{d}	0.584^{a}	0.628^{a}	-0.595^{a}
Z_{15}	0.634^{a}	-0.600^{a}	-0.395^{d}	-0.502^{c}	0.478^{c}
θ_{15}	0.637^{a}	-0.664^{a}	-0.403^{c}	-0.446^{c}	0.366^{d}
Z_{45}	-0.401^{c}	0.243	0.341^{d}	0.392^{d}	-0.584^{a}
θ_{45}	-0.421^{c}	0.161	0.497^{c}	0.459^{c}	-0.538^{b}
Z_{90}	-0.431^{c}	0.282	0.393^{d}	0.508^{b}	-0.680^{a}
θ_{90}	-0.766^{a}	0.634^{a}	0.554^{a}	0.741^{a}	-0.778^{a}
Z_{120}	-0.302	0.146	0.352^{d}	0.415^{c}	-0.581^{a}
θ_{120}	-0.617^{a}	0.482^{c}	0.538^{b}	0.684^{a}	-0.684^{a}
ΔZ_{45-15}	-0.621^{a}	0.477^{c}	0.462^{c}	0.553^{a}	-0.701^{a}
$\Delta\theta_{45-15}$	-0.700^{a}	0.516^{b}	0.619^{a}	0.615^{a}	-0.628^{a}
ΔZ_{90-15}	-0.560^{a}	0.416^{c}	0.463^{c}	0.596^{a}	-0.746^{a}
$\Delta\theta_{90-15}$	-0.838^{a}	0.733^{a}	0.590^{a}	0.761^{a}	-0.770^{a}
ΔZ_{90-45}	-0.306	0.214	0.296	0.416^{c}	-0.514^{b}
$\Delta\theta_{90-45}$	-0.684^{a}	0.664^{a}	0.394^{d}	0.635^{a}	-0.636^{a}

superscripts denote significance: a: $p < 0.005$, b: $p < 0.01$, c: $p < 0.05$, d: $p < 0.1$
subscripts denote time postmortem
Z: Relative Muscle Impedance
θ: Relative Muscle Phase Angle

Table 4. Comparison of Means Between Normal and Abnormal Pork Quality

	normal water holding capacity		abnormal water holding capacity	
Filter Paper Press (cm^2/cm^2)	1.77[a]	(0.02)	2.05[a]	(0.04)
Firmness Score	2.6[a]	(0.13)	1.8[a]	(0.23)
L	39.3	(0.7)	39.8	(1.2)
a	1.82[b]	(0.24)	2.68[b]	(0.41)
b	5.79	(0.16)	6.28	(0.28)
Marbling Score	2.1[b]	(0.23)	1.4[b]	(0.39)
pH_{45}	6.40[a]	(0.04)	6.15[a]	(0.05)
pH_{90}	6.17[a]	(0.07)	5.76[a]	(0.10)
Δ pH	0.232[a]	(0.040)	0.410[a]	(0.058)
pH_u	5.47	(0.03)	5.38	(0.05)
R_{45}	0.869[a]	(0.022)	0.971[a]	(0.031)
R_{90}	0.973[a]	(0.042)	1.160[a]	(0.061)
PQM_{15} (mS/m)	3.6	(0.21)	3.9	(0.32)
PQM_{45} (mS/m)	3.7	(0.17)	4.1	(0.24)
PQM_{90} (mS/m)	3.8[a]	(0.41)	5.4[a]	(0.60)
PQM_u (mS/m)	3.0[a]	(0.52)	6.0[a]	(0.77)
Rigor onset (minutes postmortem)	71.9[b]	(6.6)	50.3[b]	(9.6)
Rigor completion (minutes postmortem)	229.3[a]	(16.4)	167.7[a]	(23.9)
Total time in rigor (minutes postmortem)	157.4[b]	(11.5)	117.4[b]	(16.8)
Rate of rigor completion / weight (cm/time/g)	1.75	(0.22)	2.27	(0.32)
Time of Impedance Low (minutes postmortem)	17.3[a]	(1.3)	9.0[a]	(1.9)
Time of Impedance High (minutes postmortem)	75.1	(10.0)	50.4	(14.5)
Relative Impedance at 15 min (ohm/ohm)	0.984[b]	(0.011)	1.024[b]	(0.016)
Relative Phase Angle at 15 min (degrees)	0.979	(0.022)	1.028	(0.031)
Relative Impedance at 45 min (ohm/ohm)	1.091	(0.021)	1.073	(0.031)
Relative Phase Angle at 45 min (degrees)	1.162	(0.029)	1.126	(0.042)
Relative Impedance at 90 min (ohm/ohm)	1.121	(0.041)	1.069	(0.059)
Relative Phase Angle at 90 min (degrees)	1.291[a]	(0.060)	1.069[a]	(0.087)
Δ Relative Impedance 90-15 min	0.137	(0.044)	0.045	(0.064)
Δ Relative Phase Angle 90-15 min	0.312[a]	(0.070)	0.041[a]	(0.102)

normal quality: FPP<1.95 abnormal quality: FPP>1.95
superscripts: a, means are different $p< 0.05$ b, means are different $p<0.1$
standard deviations shown in parenthesis

Table 1. Fresh pork loin quality characteristic correlations to finished product characteristics

CookedCharacteristics	RawCharacteristics	r
Product Cooking Loss	Sensoptic invasive probe - conductivity	-0.85 to -0.87
	Warner-Bratzler Shear-Parallel	0.69 to 0.70
	Warner-Bratzler Shear-Perpendicular	0.73 to 0.81
	Minolta Chromometer "a" values	0.69
Cured/Cooked Color	pH	-0.64 to -0.71
	CTM invasive probe, absorption	0.54 to 0.69
	Hunter Labscan "L" values	0.68 to 0.71
	Minolta Chromometer "L" values	0.68 to 0.73
Cured/Cooked Texture	pH	-0.48 to -0.59
	CTM invasive probe, absorption	0.42 to 0.65
	CTM surface probe, light scattering	0.45 to 0.57
	CTM surface probe, absorption	0.42 to 0.52
	Hunter Labscan "L" values	0.50 to 0.59
	Minolta Chromometer "L" values	0.53 to 0.61
	Minolta Chromometer "b" values	0.50 to 0.54

Table 2. Prediction equation for cured/cooked pork loin quality based upon raw pork loin characteristics

Product Cooking Loss (R^2 = - 0.76) = 16.43 - 0.16 (Sensoptic probe, conductivity)

Product Cooking Loss (R^2 = 0.84) = 16.43 - 0.07 (Sensoptic probe, conductivity) + 0.85 (Warner-Bratzler Shear, parallel) + 0.22 (Warner-Bratzler Shear, perpendicular)

Cured/Cooked Color (R^2 = 0.56) = 3.19 - 1.02 (pH) + 0.73 (CTM invasive probe, absorption)

Cured/Cooked Color (R^2 = 0.57) = 3.19 - 0.79 (pH) + 0.58 (CTM invasive probe, absorption) + 0.05 (Hunter "L" value) - 0.02 (Minolta "L" value)

Cured/Cooked Texture (R^2 = 0.50) = 2.82 + 0.80 (CTM surface probe, light scattering) + 0.58 (CTM surface probe, absorption)

Cured/Cooked Texture (R^2 = 0.51) = 2.82 - 0.11 (pH) + 0.22 (CTM invasive probe, absorption) + 0.22 (CTM surface probe, light scattering) + 0.42 (CTM surface probe, absorption) - 0.01 (Hunter "L") - 0.002 (Minolta "L") - 0.03 (Minolta "b")

Table 1 - Means and standard deviations of the fresh meat characteristics for the different meat categories.

	MEAT CATEGORIES				
	PSE	Normal	DFD	F test	SL
n	22	44	14		
pH_1	5.52 ± 0.21^a	6.06 ± 0.24^b	6.41 ± 0.25^c	67.33	***
pH_{24}	5.55 ± 0.10^a	5.62 ± 0.13^a	6.32 ± 0.27^b	119.20	***
drip $loss_{24}$	3.80 ± 1.4^a	1.16 ± 0.34^b	1.22 ± 0.33^b	88.03	***
L	55.70 ± 4.49^a	53.32 ± 4.14^b	49.76 ± 3.97^c	8.53	***
a	20.38 ± 2.74^a	20.74 ± 2.42^a	21.03 ± 2.90^a	0.28	ns
b	14.57 ± 1.33^a	14.59 ± 1.34^a	13.93 ± 1.42^a	1.32	ns
Total pigment (haematin ppm)	39.40 ± 7.91^a	42.89 ± 9.74^a	43.69 ± 6.18^a	0.78	ns

ns = not significant; ***p<0.001
In the same row, means with identical letters are not significantly different (test LSD, P<0.05)
SL - significancy level

Table 2 - Brine gain for the different meat quality groups.

	WITHOUT PHOSPHATE			WITH PHOSPHATE		
	PSE	Normal	DFD	PSE	Normal	DFD
Partial Gain (%)	13.10 ± 1.35^a	12.40 ± 1.03^a	13.14 ± 1.52^a	15.26 ± 1.99^b	14.38 ± 1.21^c	14.16 ± 0.93^c
Total Gain (%)	10.56 ± 1.72^a	$11.63 \pm 1,.4^b$	12.49 ± 1.43^{bc}	12.60 ± 2.15^c	13.61 ± 1.22^d	13.52 ± 0.86^{cd}

In the same row, means with identical letters are not significantly different (test LSD, P<0.05)

Table 3 - Cooking losses for the different meat quality groups.

	WITHOUT PHOSPHATE			WITH PHOSPHATE		
	PSE	Normal	DFD	PSE	Normal	DFD
Partial loss (%)	30.30 ± 2.85^a	27.70 ± 3.12^b	18.80 ± 4.27^c	18.70 ± 3.45^c	18.90 ± 3.06^c	13.00 ± 1.71^d
Total loss (%)	22.95 ± 3.49^a	19.33 ± 3.49^b	8.59 ± 5.24^c	8.38 ± 4.30^c	7.88 ± 3.45^c	1.93 ± 1.50^d

In the same row, means with identical letters are not significantly different (test LSD, P<0.05)

Table 4 - Tenderness, color parameters (L, a, b) and salt content of the final product obtained from the three meat categories.

	WITHOUT PHOSPHATES			WITH PHOSPHATES		
	PSE	Normal	DFD	PSE	Normal	DFD
Shear force (N)	55.36 ± 10.99^{a}	49.02 ± 7.35^{b}	41.42±11.08^{cd}	43.78± 11.77^{c}	42.17± 8.47^{cd}	36.49 ± 7.33^{d}
L	63.44 ± 1.70^{a}	63.63 ± 2.41^{a}	63.09 ± 3.58^{a}	63.07 ±2 .75^{a}	63.67 ± 2.81^{a}	63.00 ± 3.90^{a}
a	11.77 ± 0.64^{a}	11.49 ± 0.96^{a}	11.50 ± 1.13^{a}	11.73 ± 0.88^{a}	11.56 ± 1.04^{a}	11.57 ± 1.30^{a}
b	7.21 ± 0.54^{a}	6.97 ± 0.49^{a}	7.00 ± 0.82^{a}	6.65 ± 0.73^{a}	6.62 ± 0.45^{a}	6.69 ± 0.83^{a}
Salt content (%)	1.90 ± 0.31^{a}	1.95 ± 0.16^{a}	2.15 ± 0.06^{a}	2.09 ± 0.28^{a}	2.14 ± 0.18^{a}	2.18 ± 0.84^{a}

In the same row, means with identical letters are not significantly different (test LSD, P<0.05)

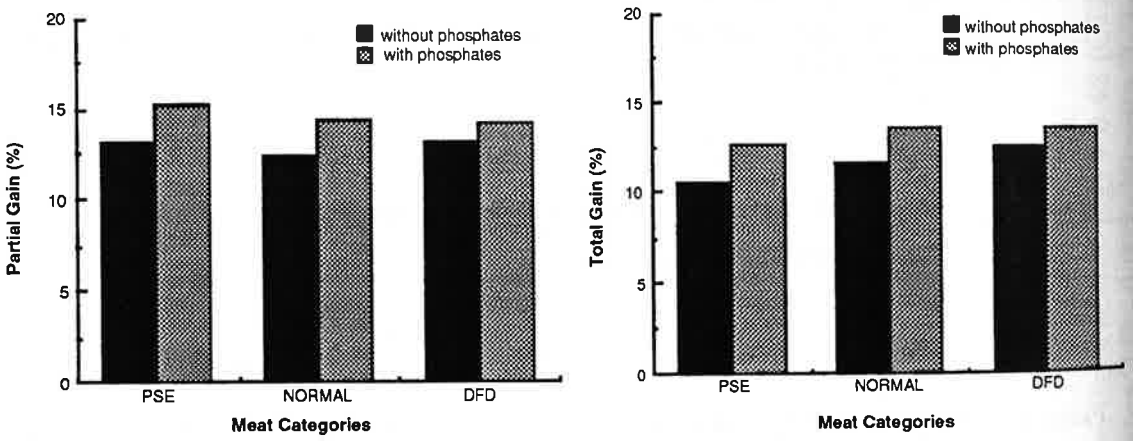


Figure 1 - Influence of the phosphates addition in the water absorption during brining (partial and total) for the three meat categories.

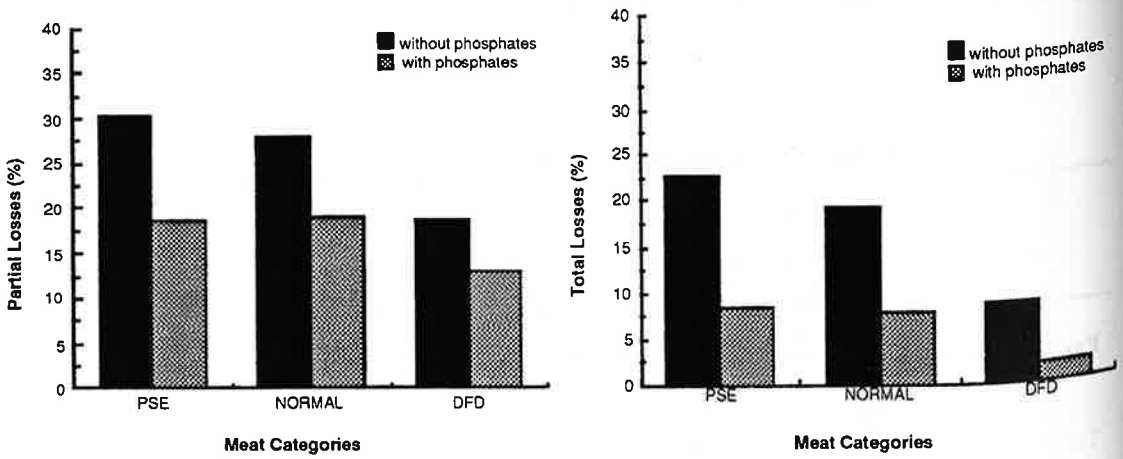


Figure 2 - Influence of the phosphates addition in the cooking loss (partial and total) for the three meat categories.

Table 1- Limiting values for meat classification.

Meat categories	pH	Color (L value)	Drip loss %
PSE	pH_1<5.9	>53	>2
Normal	-	<53	<2
DFD	pH_{24}>6.0	-	-

Table 2- Means and standard deviations of different parameters for the different meat categories.

	MEAT CATEGORIES			F test	Significancy Level
	PSE n=147	Normal n=314	DFD n=29		
pH_1	5.57 ± 0.16^a	6.07 ± 0.24^b	6.26 ± 0.20^c	281.02	***
pH_{24}	5.48 ± 0.12^a	5.58 ± 0.15^b	6.21 ± 0.19^c	317.95	***
Drip $loss_{24}$	4.67 ± 2.22^a	1.28 ± 0.80^b	0.99 ± 0.74^b	313.36	***
L_{24}	55.11 ± 3.21^a	53.17 ± 3.41^b	49.62 ± 3.48^c	37.82	***
R-value	1.26 ± 0.07^a	1.05 ± 0.13^b	1.11 ± 0.12^c	55.22	***
Total Sol. Protein[1]	125.73 ± 20.11^a	137.65 ± 11.65^b	143.6 ± 19.43^b	6.35	**

ns = not significant, * P<0.05, ** P<0.01, *** P<0.001
In the same row, means with identical letters are not significantly differents (LSD test, p<0.05).
[1] number of samples: PSE = 22; normal = 43; DFD =14.

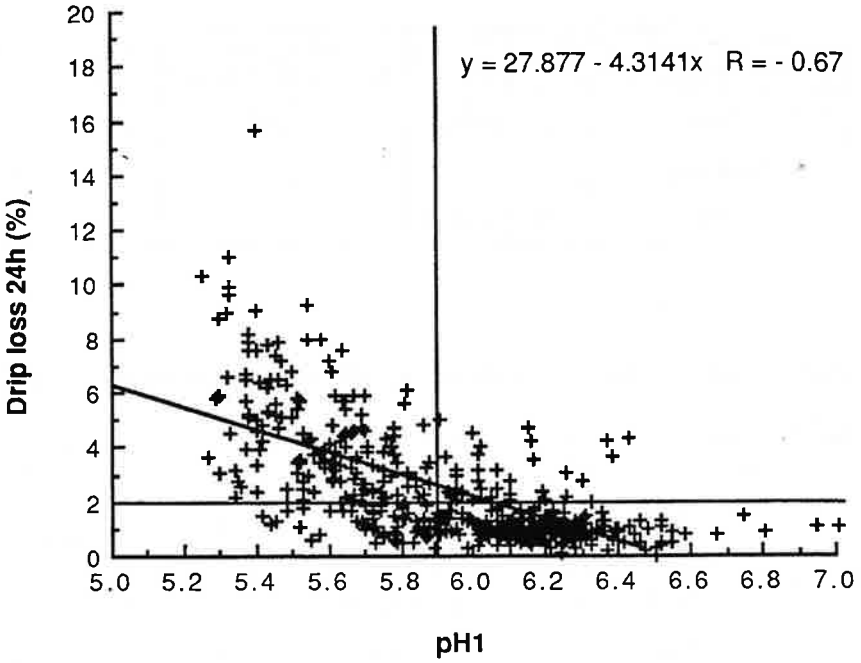


Figure 1 - pH_1 and drip loss 24h relationship.

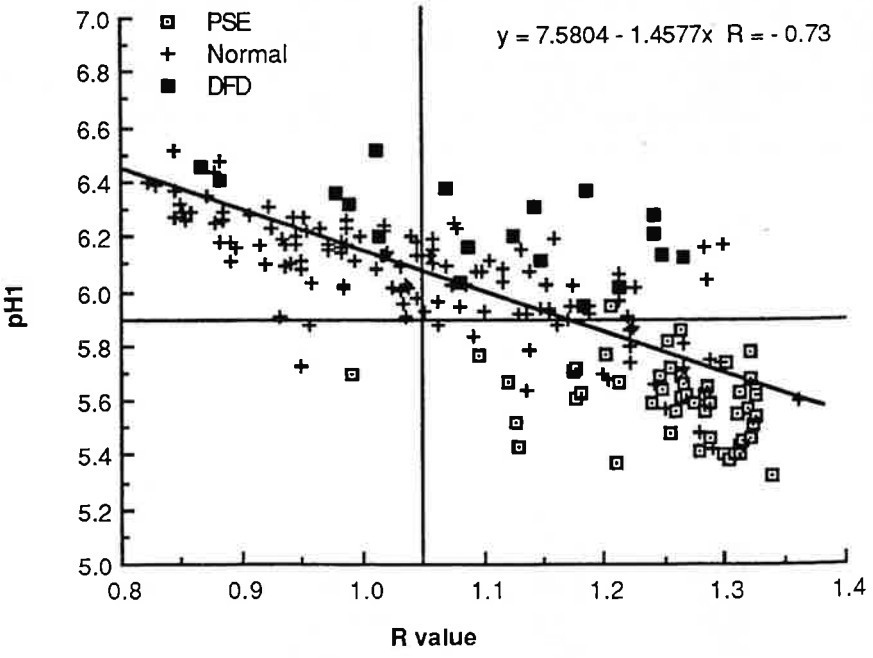


Figure 2 - R value, pH_1 and meat quality relationship.

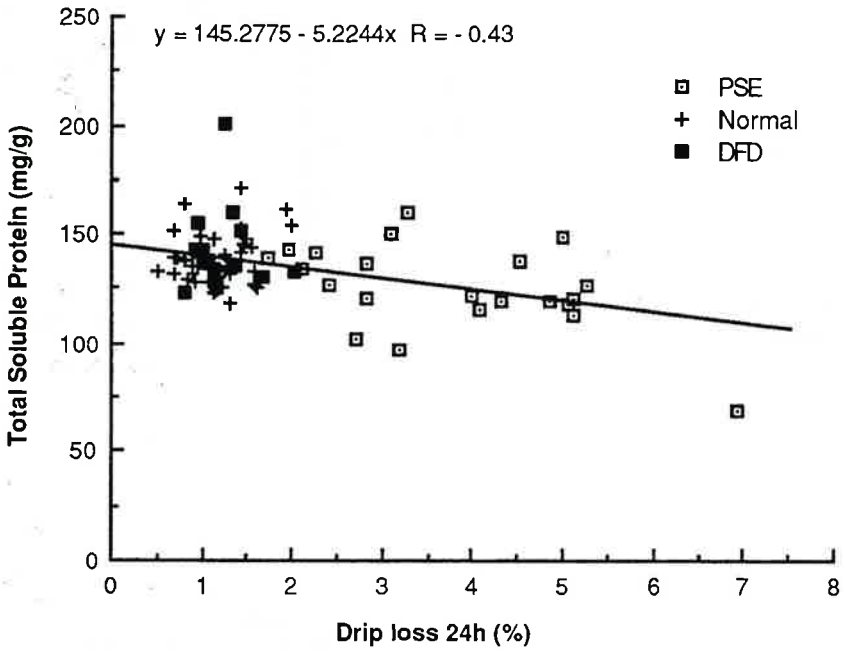


Figure 3 - Soluble protein, drip losses and meat quality relationship.

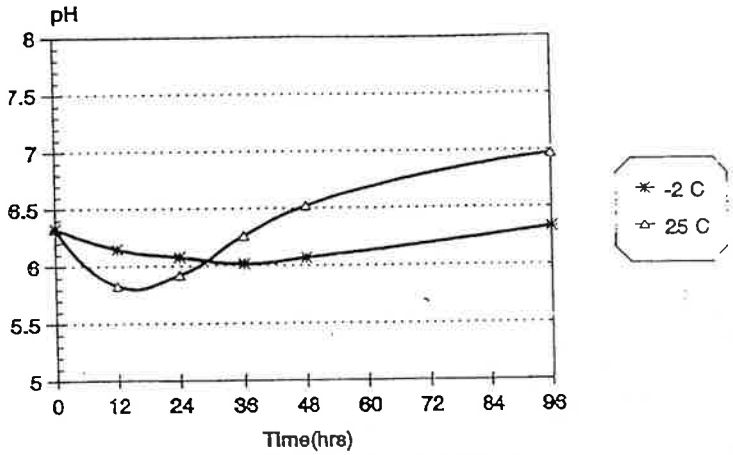


Fig. 1 Changes in pH values of pork stored at -2°C and 25°C during storage.

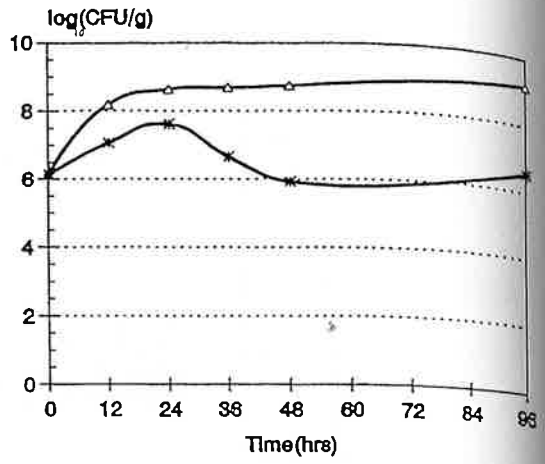


Fig. 2 Changes in bacterial counts of pork stored at -2°C and 25°C during storage.

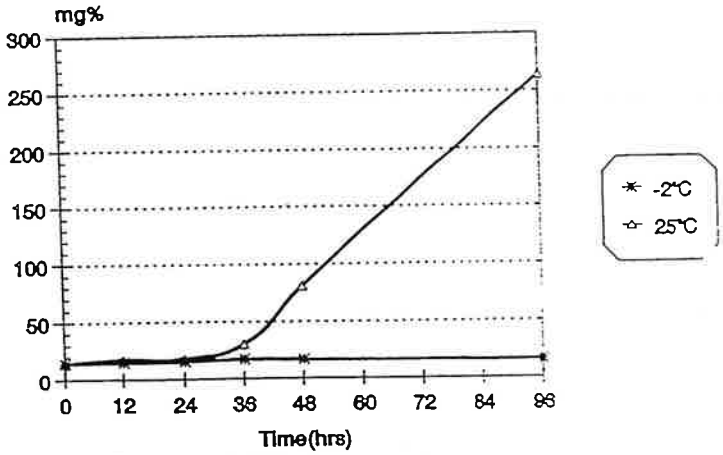


Fig. 3 Changes in VBN values of pork stored at -2°C and 25°C during storage.

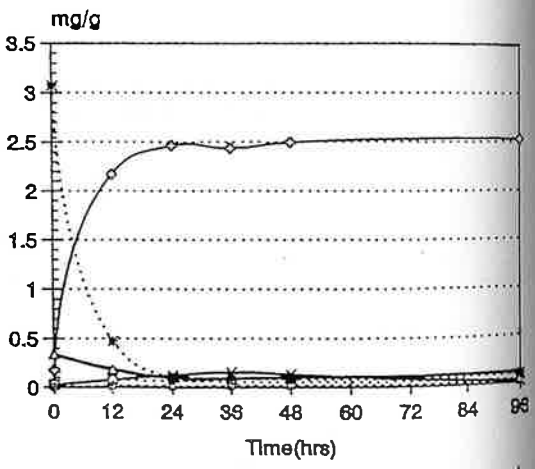
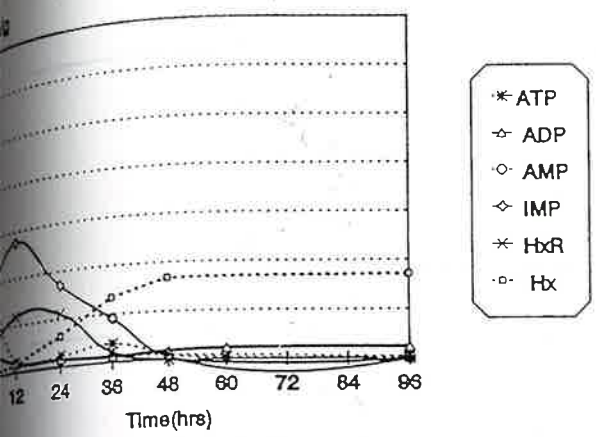
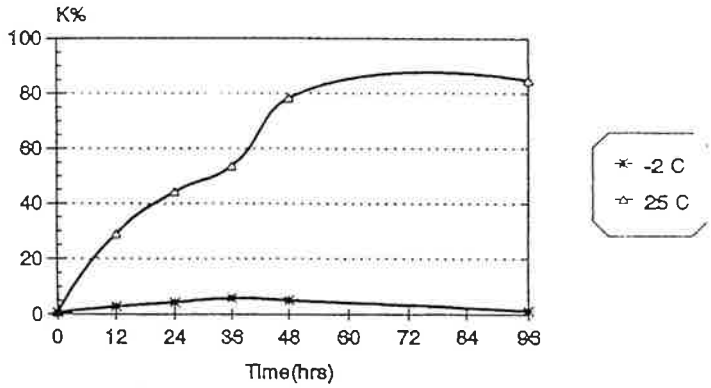


Fig. 4 Changes in ATP-related compounds of pork stored at -2°C during storage.



Changes in ATP-related compounds of pork stored at 25°C during storage.



K=(HxR+Hx)/(ATP+ADP+AMP+IMP+HxR+Hx)x100%
HxR:Inosine
Hx:hypoxanthine

Fig. 6 Thermograms of pork stored at 25°C during storage.

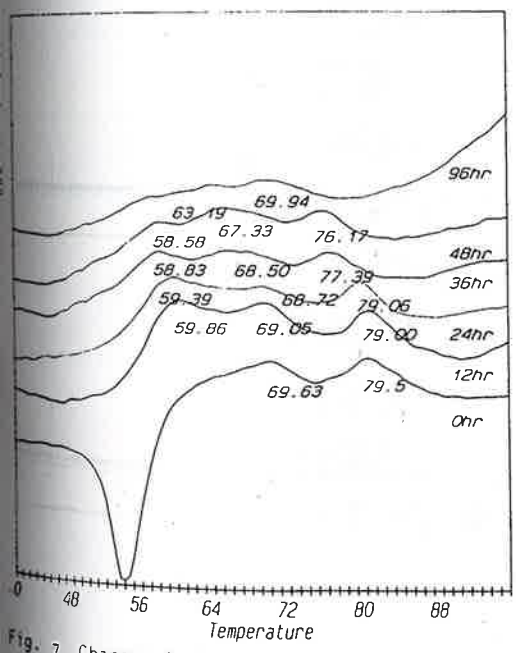


Fig. 7 Changes in K-values of pork stored at -2°C and 25°C during storage.

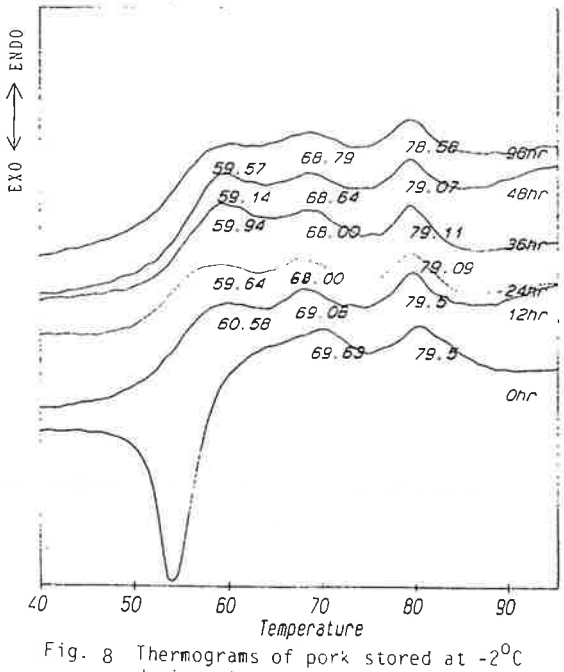


Fig. 8 Thermograms of pork stored at -2°C during storage.

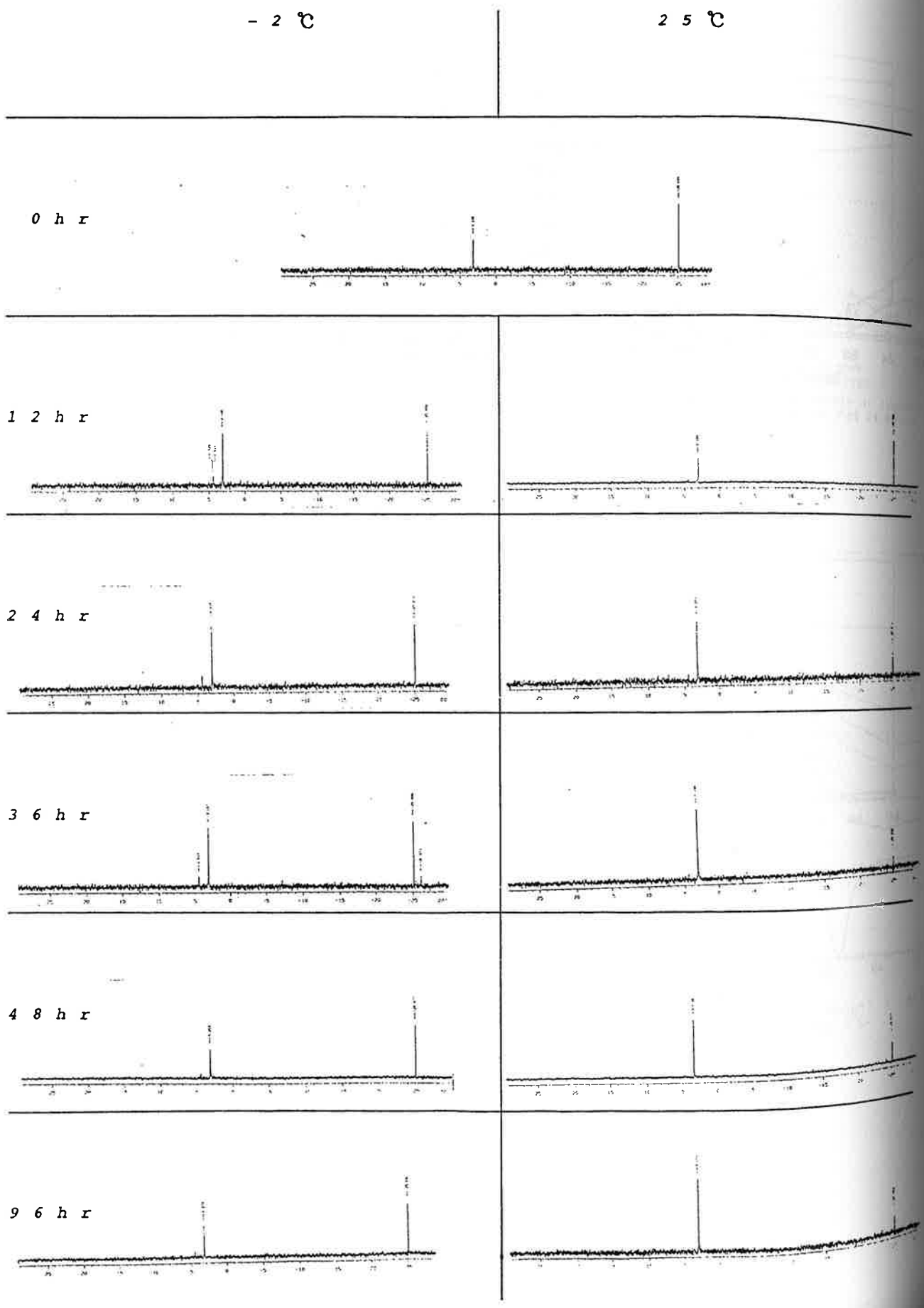
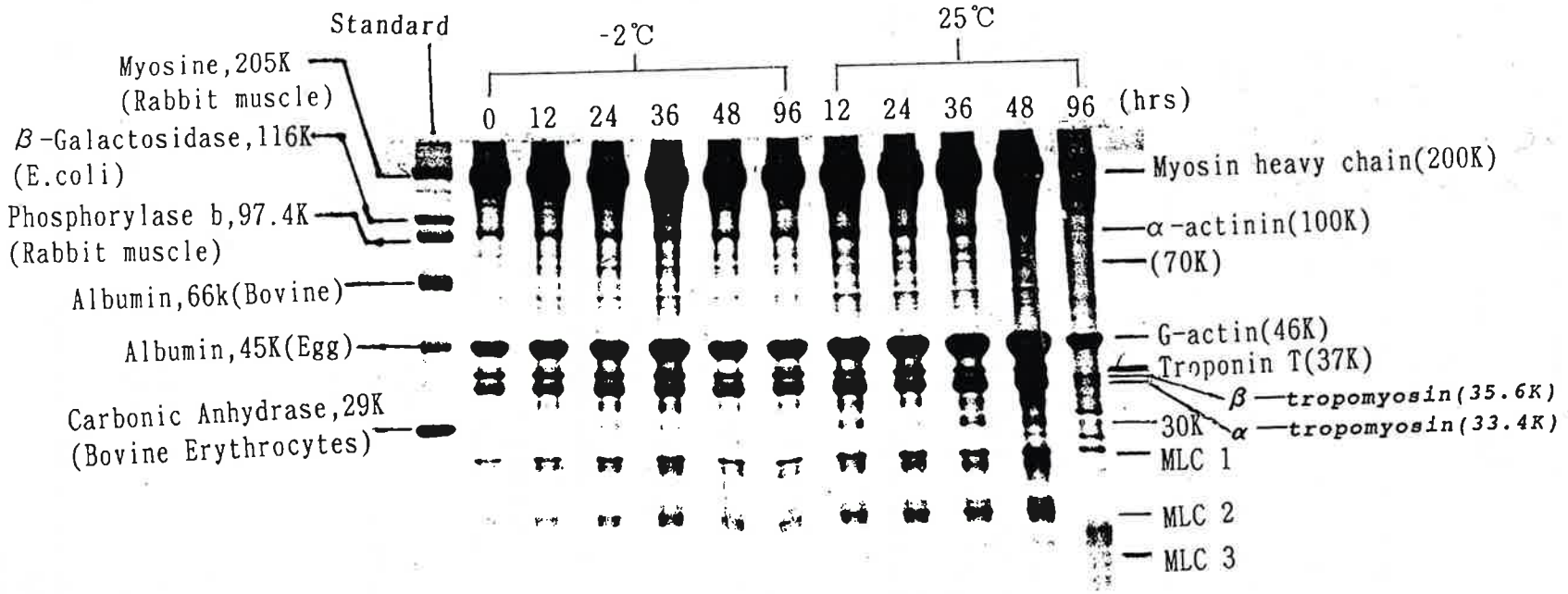


Fig. 9 Changes in NMR-spectra of ATP-related compounds of pork stored at -2^{O} and 25^{O}C during storage.



MLC 1:myosin light chain 1
MLC 2:myosin light chain 2
MLC 3:myosin light chain 3

Fig. 10 Changes in electrophoretogram of myofibrillar proteins of porcine muscle stored at -2°and 25°C during storage.

TABLE 1

Mean Values and Standard Deviation of Drip loss (%), Cooking loss (%) and Sarcomere length (μm) at different times of boning (n=12).

	Time of boning		
	1 h ps	*6 h ps*	*24 h ps*
Drip loss[1]	$15.08^{a}\pm1.93$	$12.10^{b}\pm2.49$	$12.67^{b}\pm1.74$
Cooking loss[1]	$31.68^{a}\pm2.10$	$31.44^{a}\pm2.30$	$30.74^{a}\pm1.98$
Sarcomere length[1]	$1.69^{a}\pm0.08$	$1.69^{a}\pm0.09$	$1.83^{b}\pm0.08$

[1] : Figures with different superscripts within the same row differ significantly ($p<0.05$).

TABLE 2

Mean Values and Standard Deviations of WB Shear Force (N/cm^2) at different times of boning and aged until either 1 d or 7 d post stunning with calculated Ageing Effect (%) in Tenderness (n=12).

Time of boning ps	*Warner Bratzler shear force*		*Significance*	*Ageing effect*[1]
	1 d ps	*7 d ps*		
1 h	96.4 ± 13.7	89.4 ± 11.2	ns	7.3^{a}
6 h	77.9 ± 35.3	58.8 ± 20.7	$p<0.05$	24.5^{b}
24 h	56.3 ± 12.7	49.3 ± 13.2	ns	12.5^{c}

[1] : Figures with different superscripts differ significantly ($p<0.05$).

TABLE 3

Coefficients of correlation (r) between tenderness parameters[1].

	Warner-Bratzler shear force (WB)	*Muscle shortening (MS)*	*Drip loss (DL)*	*Cooking loss (CL)*	*Sarcomér length (SL)*
WB	--				
MS	0.46^{a}	--			
DL	0.36^{a}	0.38^{a}	--		
CL	0.49^{b}	0.20	-0.12	--	
SL	-0.45^{a}	0.16	-0.12	-0.30	--

[1] : Calculated for unaged samples only (n=36 except for MS where n=24).
[a] : $|r|>$ observed value, $p<0.05$
[b] : $|r|>$ observed value, $p<0.01$

Table 1. Influence of mechanical tenderization on protease activities.

Fraction	CAF (U/g protein)[1] x 10^{-4}		cathepsins B+ L [2] x 10^{-4}		cathepsin D [3] x 10^{-4}	
	treated	untreated	treated	untreated	treated	untreated
super-natant	30.3±0.17	22.3±1.07	9.00±0.23	8.07±0.62	1.84±0.02	51.3±1.09
	6.20±0.03	6.09±0.14	2.33±0.12	2.30±0.13	8.46±0.07	15.8±0.30
	8.65±0.23	8.51±0.11	0.085±0.01	0.011±0.007	6.51±0.09	9.42±0.17
	4.02±0.10	3.72±0.11	1.28±0.002	0.92±0.04	1.30±0.19	4.64±0.24
	6.76±0.04	5.58±0.26	4.96±0.18	4.50±0.09	8.83±0.09	7.85±0.09
lysosol	4.06±0.17	6.94±0.19	4.06±0.17	6.94±0.19	1.70±0.01	3.35±0.14
	5.87±0.46	8.67±0.68	5.87±0.46	8.67±0.68	5.83±0.09	10.0±0.18
	2.84±0.17	4.61±0.39	2.84±0.17	4.61±0.39	0.41±0.02	3.93±0.32
	4.53±0.29	3.46±0.19	4.53±0.29	3.46±0.19	3.12±0.03	11.6±0.53
	4.73±0.16	6.85±0.05	4.73±0.16	6.85±0.05	4.14±0.27	8.83±0.13

1 1 unit of activity is defined as an increase of OD (278nm) of 0.001/min/g muscle

2 Activity values are given in umol substrate hydrolysed/min/g muscle

3 Specific activity (units/g protein) is defined as the number of tyrosine units per gramme of protein. One unit of enzyme activity is defined as the net extinction value of the supernatant as compared to the optical density which was given control one.

Values of pH meat were in range 5.3-5.6 and the difference between treated and untreated samples never exceeded 0.1 unit.

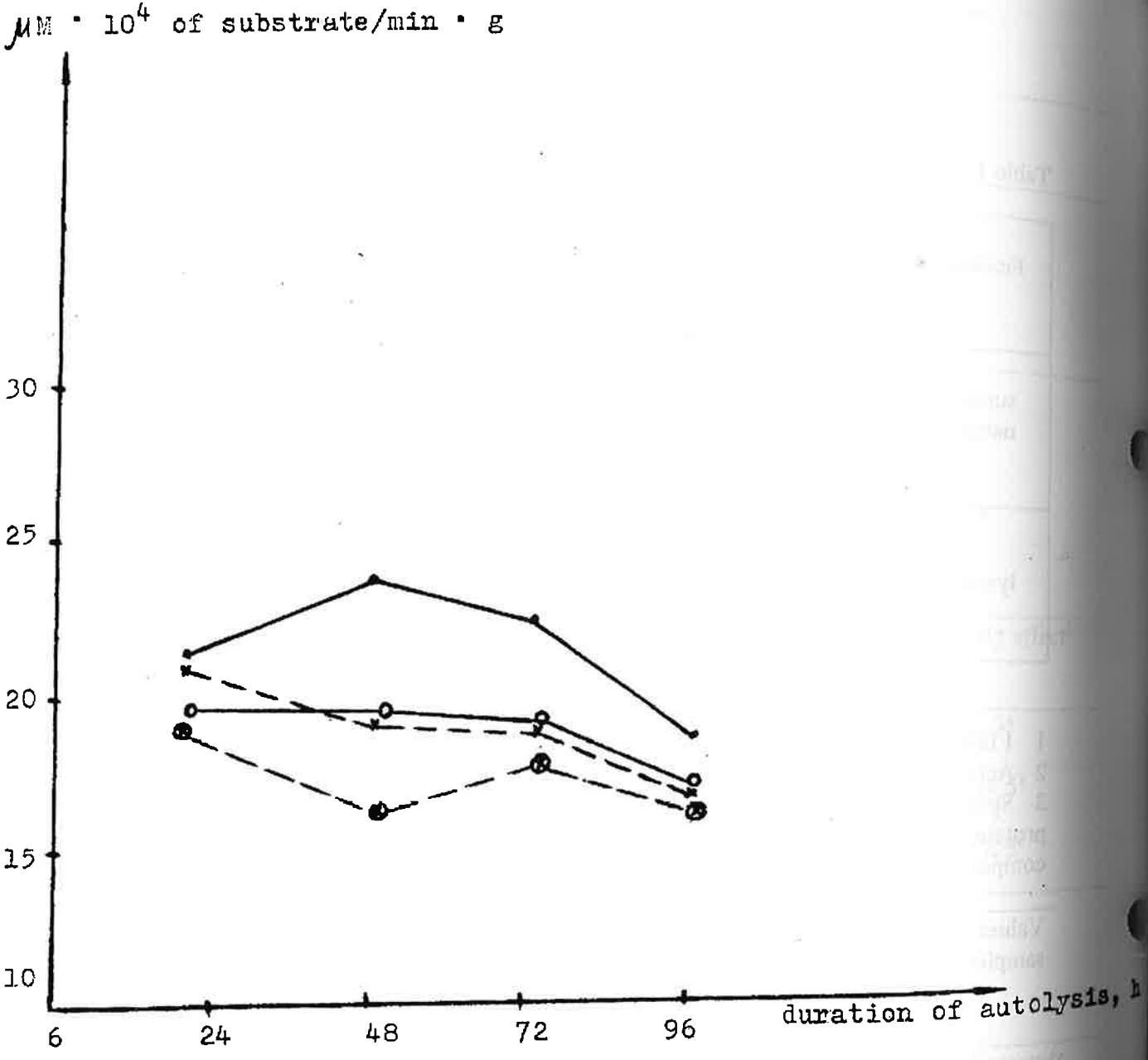


Fig. 1. Cathepsins B + L activity as plotted against duration of autolysis for different quality groups of pork (M. long. dorsi), chilled:

- pH - 5.4 PSE, untrimmed
- pH - 5.9 Nor, untrimmed
- pH - 5.4 PSE, trimmed
- pH - 5.9 Nor, trimmed

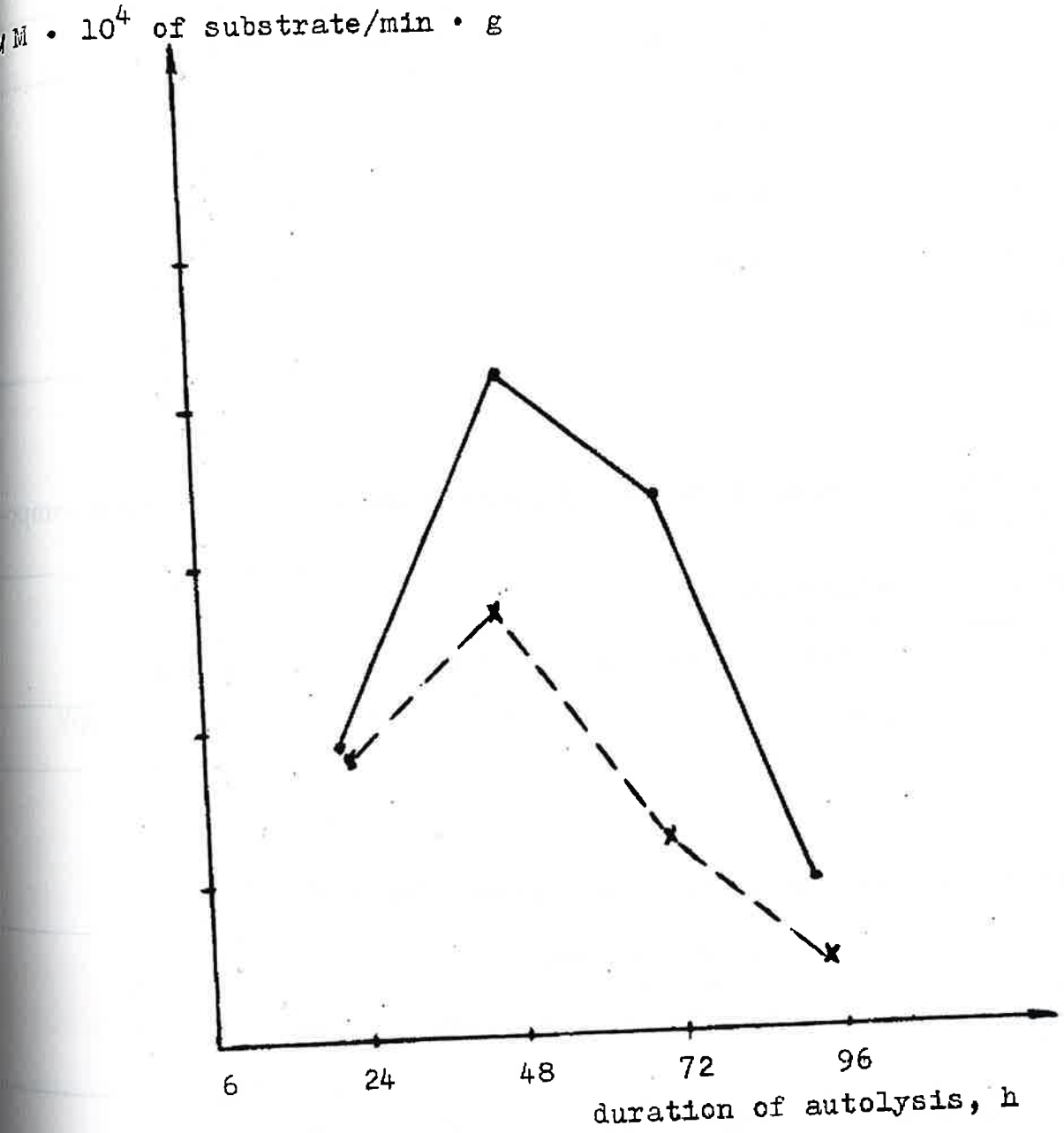


Fig. 2. Cathepsins B + L activity as plotted against duration of autolysis for different quality groups of chilled pork (M. long. dorsi, intramuscular connective tissue):

●——● - meat PSE, pH_1 - 5.4

×- - - -× - meat Nor. pH_1 - 5.9

Table 1. Overall means and standard deviation for the variables measured. Abbreviations used are: raw meat swelling ratio (RMS), cooked meat swelling ratio (CMS) and mean fibre cross-sectional area, cooked (CMFA) and raw (RMFA)

	Overall mean	Standard deviation
RMS	1.10	0.11
CMS	0.69	0.23
RMFA	5939	588
CMFA	3068	938

Table 2. Variable loadings of the first principal component from the principal component analysis

pH in incubation buffer	pH after marination		RMS	CMS	CMFA	RMFA
	In buffer	In meat				
0.42	0.43	0.43	0.42	0.41	0.32	0.13

Table 3. Linear correlations between the variables measured

		pH after marination				
	RMFA	In buffer	In meat	RMS	CMS	CMFA
pH Incubation buffer	0.92[a)]	0.88	0.92	0.90	0.79	0.97
Buffer after marination		0.98	0.94	0.88	0.85	0.99
Meat after marination			0.91	0.94	0.88	0.98
RMS				0.83	0.94	0.96
CMS					0.88	0.87
CMFA						0.91

[a)] All correlations are significant on the level $\alpha \leq 0.05$.

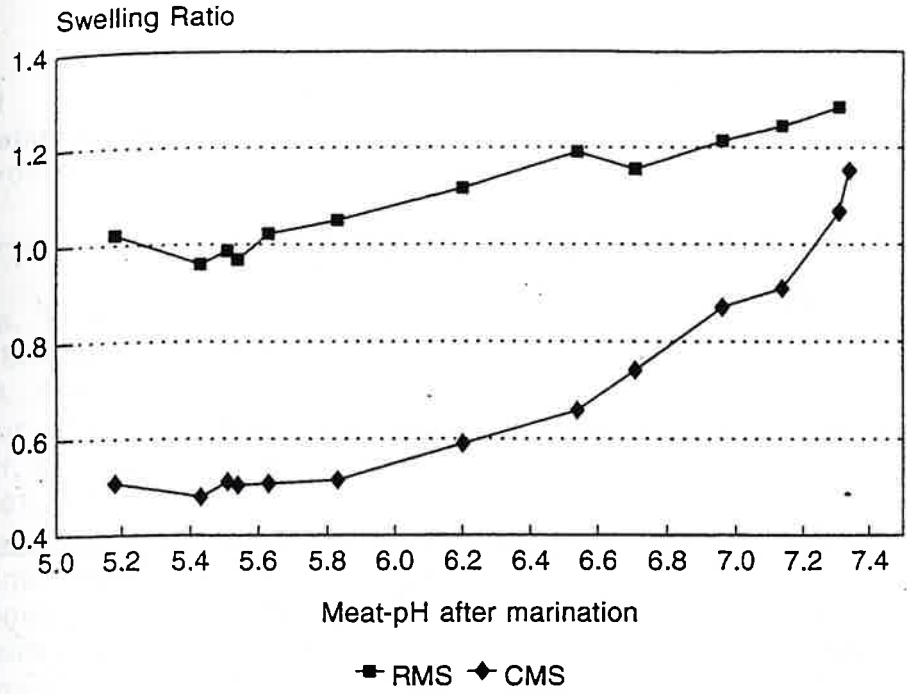


Figure 1. Relationships between raw (RMS) and cooked (CMS) meat swelling ratios, and meat-pH after incubation.

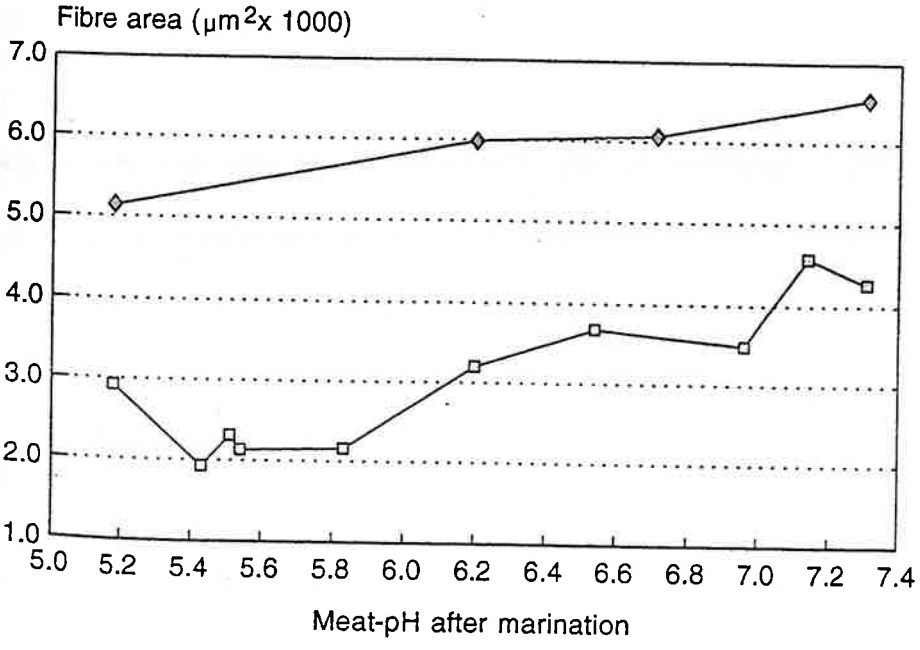


Figure 2. Relationships between raw (RMFA) and cooked (CMFA) mean fibre area and meat-pH after incubation.

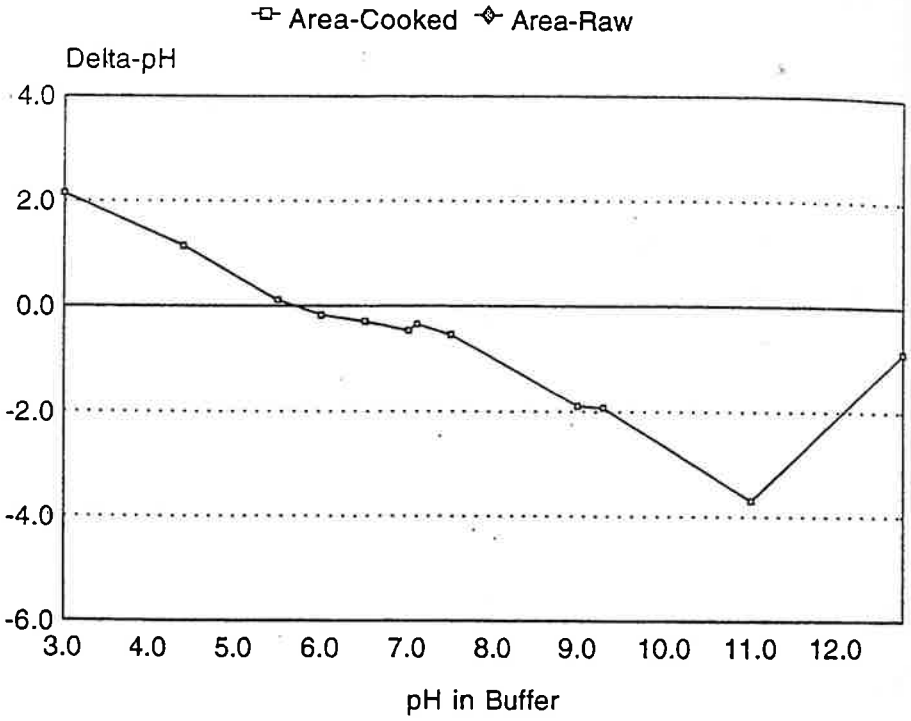


Figure 3. Relationship between the meat-pH after marination and p
buffer. The graph illustrates the buffer capacity of the muscle.

- Based on DSC-thermograms through the displacement of heat-induced denaturation peaks the effect of different cryoprotectants could be easily followed during frozen storage.

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Table 1. Analysis of variance of soluble protein content (means in %)

Cryoprotectants		Salt		Months	
control	56.73[a]	I.	63.84[a]	0	66.25[a]
sucrose-sorbitol	59.75[b]	II.	51.18[b]	2	62.93[b]
glucose-sorbitol-citric acid	56.57[a]			4	49.43[c]
glycerol	56.98[a]			6	56.12[d]
				8	52.82[e]

a,b,c,d,e - different letter within the same column means significal difference ($P<0.05$)

Table 2. TBA-values (mg malonaldehyde/kg specimen) during frozen storage.

Codes	Storage time (months)				
	0	2	4	6	8
I/1	0,19	0,19	0,27	0,34	0,17
I/2	0,28	0,33	0,47	0,43	0,36
I/3	0,20	0,24	0,37	0,38	0,13
I/4	0,20	0,22	0,34	0,27	0,14
II/1	1,38	1,22	2,14	2,92	2,15
II/2	1,83	1,15	2,04	3,01	2,23
II/3	1,16	1,19	1,39	1,37	0,91
II/4	1,16	1,18	1,97	1,86	1,99

Table 3. Analysis of variance of TBA-values (means in mg MA/kg specimen)

Cryoprotectants		Salt		Months	
control	1.09[a]	I.	0.26[a]	0	0.79[a]
sucrose-sorbitol	1.19[a]	II.	1.70[b]	2	0.70[a]
glucose-sorbitol-citric acid	0.71[b]			4	1.09[b]
glycerol	0.92[c]			6	1.30[c]
				8	1.10[b]

a,b,c - different letter within the same column means significal difference ($P < 0.05$)

Table 4. Analysis of variance of peak-temperatures related to the denaturation of actin (mean values in °C).

Cryoprotectants		Salt		Months	
control	69.14[a]	I.	74.55[a]	0	69.85[a]
sucrose-sorbitol	70.17[b]	II.	65.11[b]	2	69.92[a]
glucose-sorbitol-citric acid	70.15[b]			4	69.68[a]
glycerol	69.86[a]			6	69.87[a]

a,b - different letter within the same column means significal difference ($P < 0.05$)

Table 5. Analysis of variance of cooking loss of ham-type models (means in %)

Cryoprotectants		Salt		Months	
control	7.67[a]	I.	1.91[a]	0	2.55[a]
sucrose-sorbitol	4.51[b]	II.	10.68[b]	4	7.44[bc]
glucose-sorbitol-citric acid	6.48[c]			6	7.24[b]
glycerol	6.65[c]			8	8.11[c]

a,b,c - different letter within the same column means significal difference ($P < 0.05$)

Table 6. Sensory evaluation - colour (mean scores - 3 member's panel)

Sample	Storage time (months) 0	4	6	8
I/1	4.0	3.0	4.0	3.5
I/2	5.0	5.0	5.0	5.0
I/3	3.0	4.0	4.0	4.0
I/4	2.5	4.5	4.0	4.0
II/1	1.5	1.5	1.5	1.5
II/2	2.0	2.0	2.0	2.0
II/3	1.0	1.5	1.0	1.5
II/4	1.5	2.5	2.5	2.0

Meaning of scores:
1 = pale, greyish colour
5 = vivid pink colour

Table 7. Sensory evaluation - texture (mean scores - 3 member's panel)

Sample	Storage time (months) 0	4	6	8
I/1	3.0	4.0	3.5	3.0
I/2	4.0	3.0	4.0	4.0
I/3	4.0	3.5	3.5	3.5
I/4	2.5	3.7	3.0	3.5
II/1	3.0	1.5	1.0	1.5
II/2	4.0	2.5	2.5	2.5
II/3	3.0	2.0	2.0	2.0
II/4	2.5	2.0	2.0	2.0

Meaning of scores: 1 = soft, non-elastic
3 = no soft, no firm, elastic
5 = firm, elastic

Table 8. Sensory evaluation - flavour (mean scores - 3 member's panel)

Sample	Storage time (months) 0	4	6	8
I/1	1.0	3.0	3.0	3.0
I/2	5.0	5.0	4.0	4.0
I/3	1.0	3.5	3.5	3.5
I/4	4.0	4.5	4.5	4.5
II/1	1.0	3.0	3.0	3.0
II/2	3.0	4.0	4.0	3.5
II/3	4.0	3.5	3.5	3.5
II/4	3.5	2.0	2.0	2.0

Meaning of scores:
1 = no sweety flavour
5 = very sweety flavour

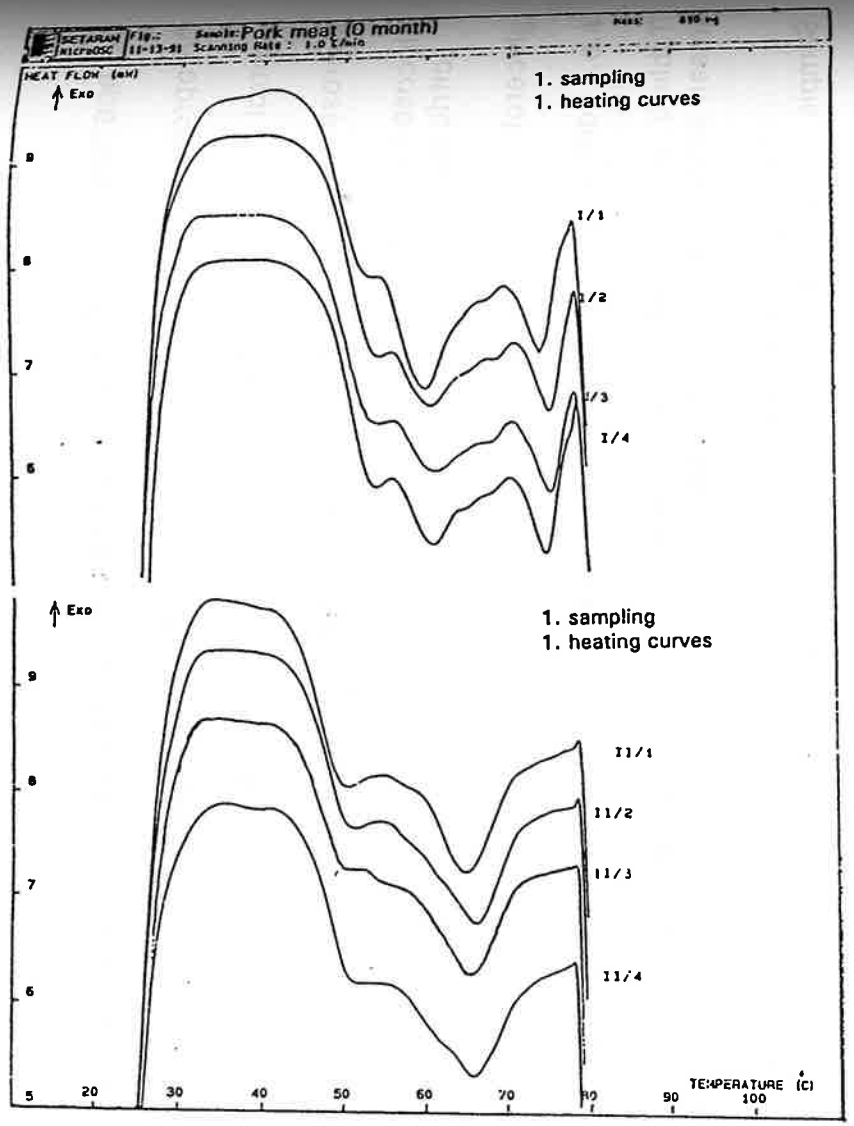


Fig. 1. Thermograms of frozen stored samples (0 month) (I- without salt, II- with added salt, 1- control, 2- sucrose-sorbitol, 3- glucose-sorbitol-citric acid, 4- glycerol)

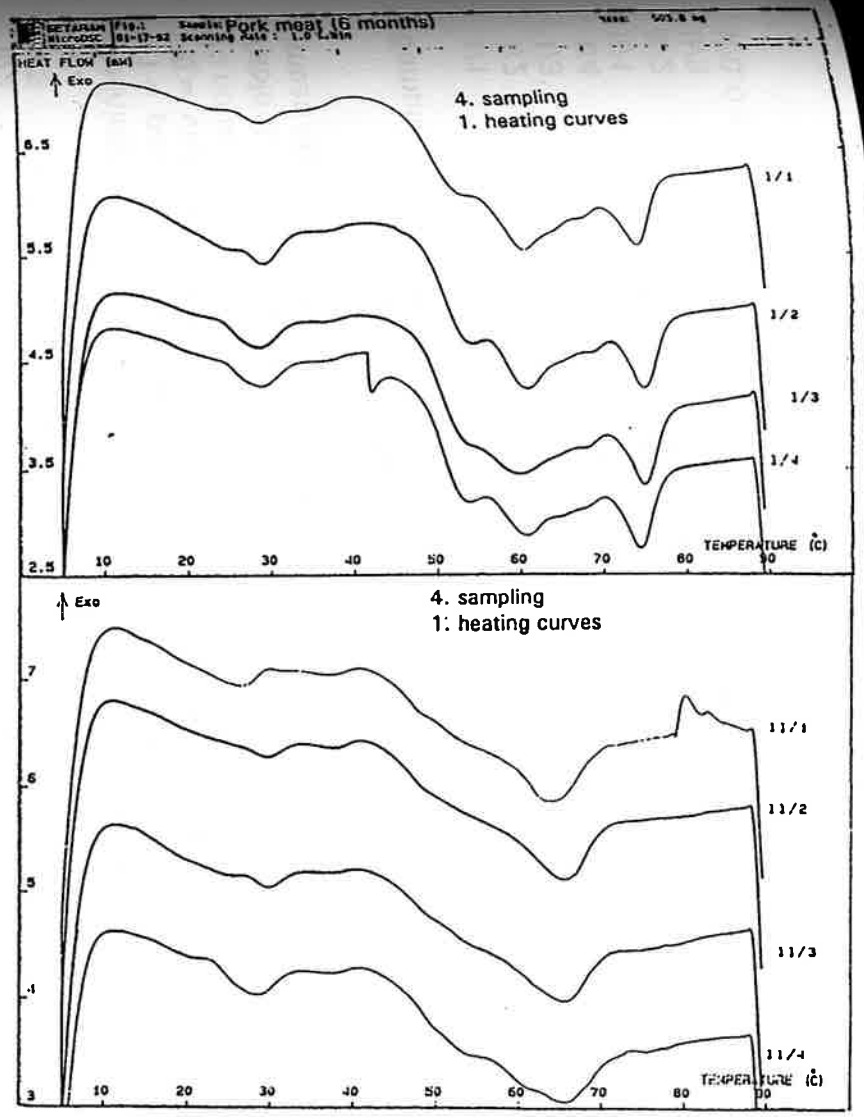


Fig. 2. Thermograms of frozen stored samples (up to 6 months) (list of codes seen at Fig. 1)

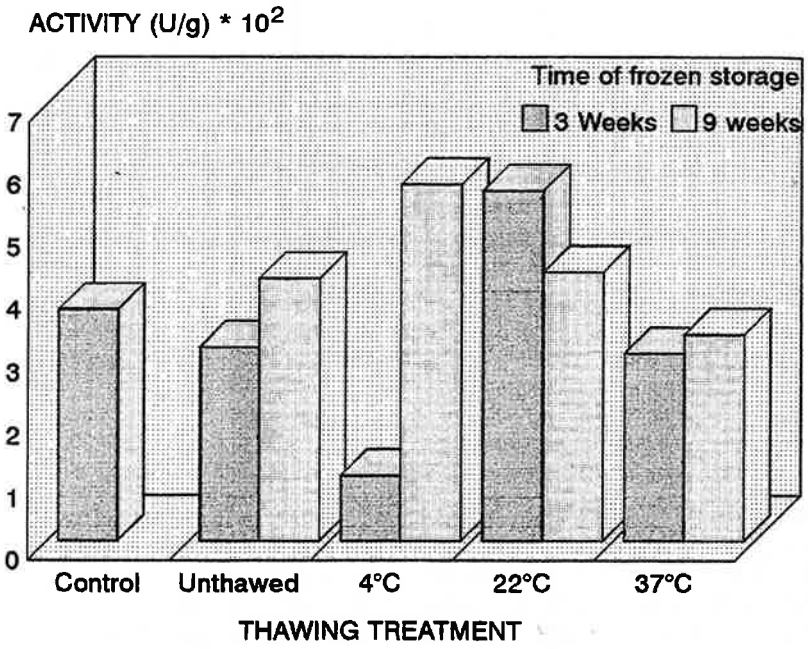


Figure 1. Effect of frozen storage and thawing treatment on Cathepsin D activity.

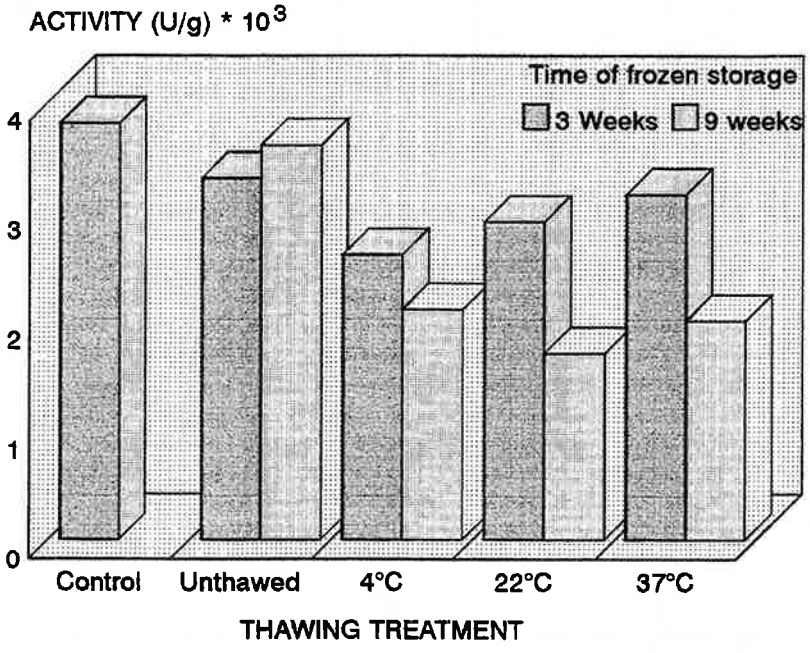


Figure 2. Effect of frozen storage and thawing treatment on Cathepsin H activity.

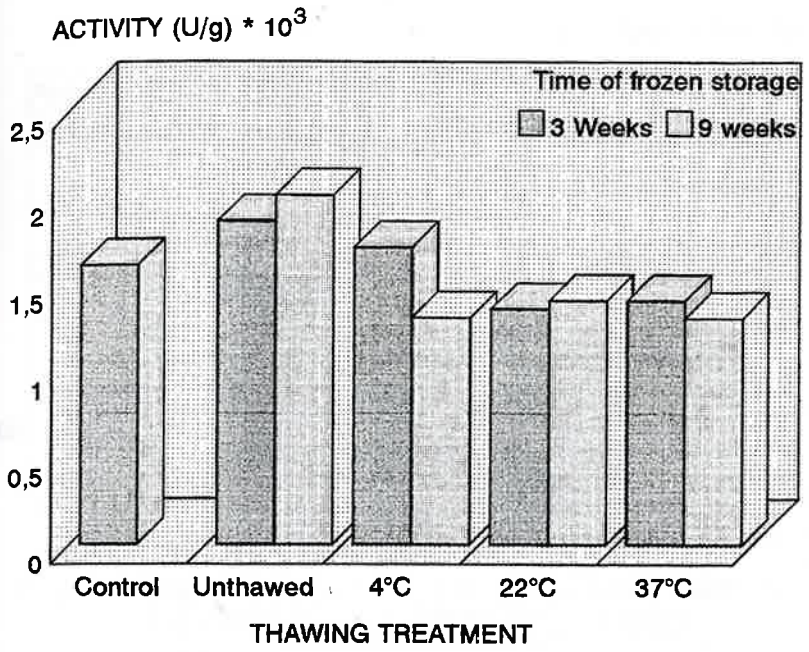


Figure 3. Effect of frozen storage and thawing treatment on Cathepsin B activity.

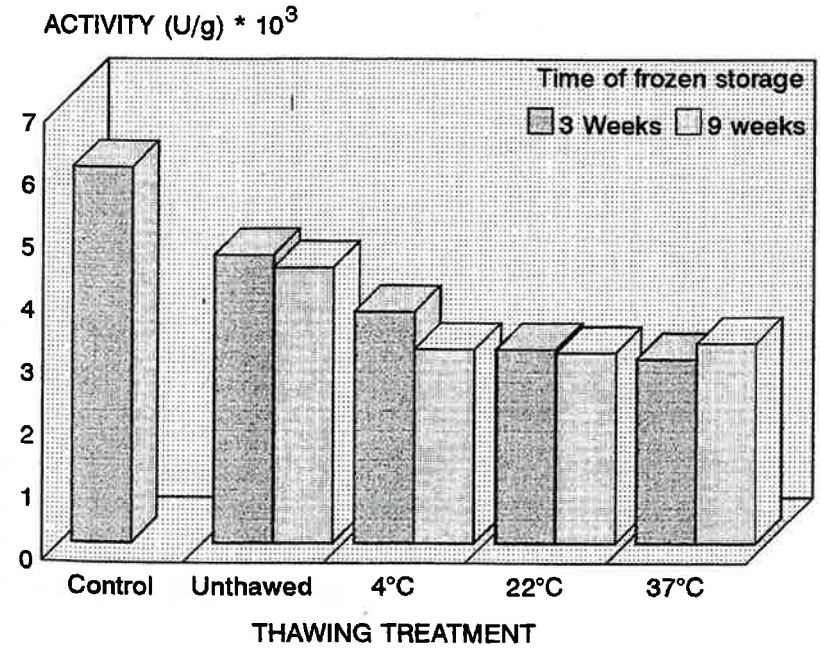


Figure 4. Effect of frozen storage and thawing treatment on Cathepsin B+L activity.

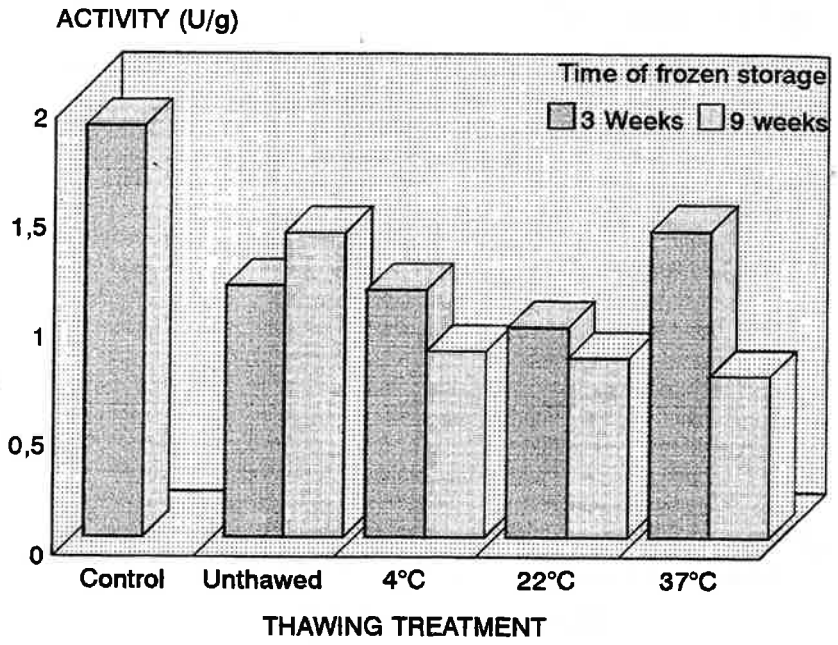


Figure 5. Effect of frozen storage and thawing treatment on alanyl hydrolyzing activity.

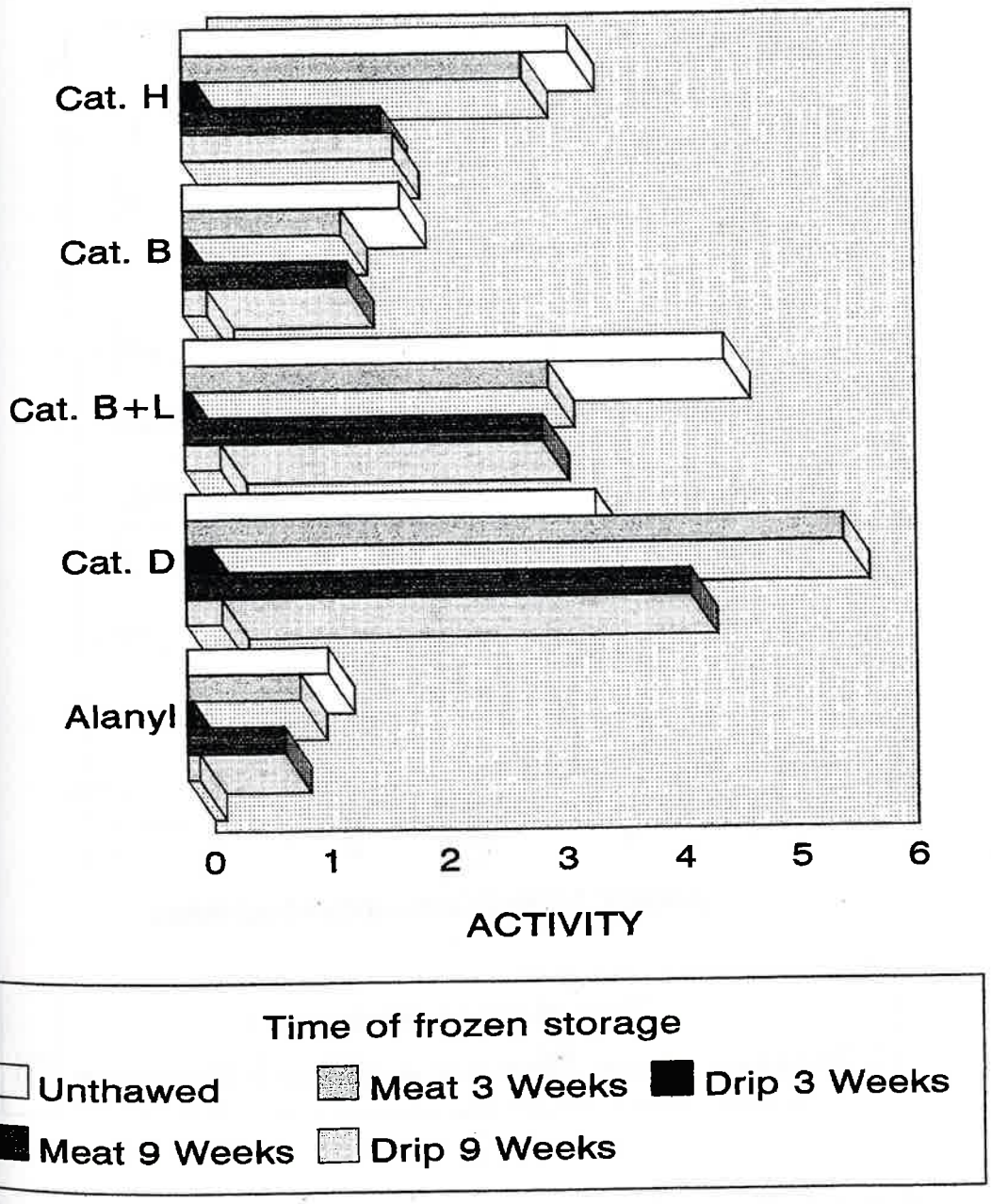


Figure 1. Protease activity in drip loss of frozen pork meat stored for 3 and 9 weeks and thawed at 22°C. Activity of Cathepsin H, B and B+L in U/g * 10^3, Cathepsin D in U/g * 10^2 and Alanyl hydrolyzing activity in U/g.

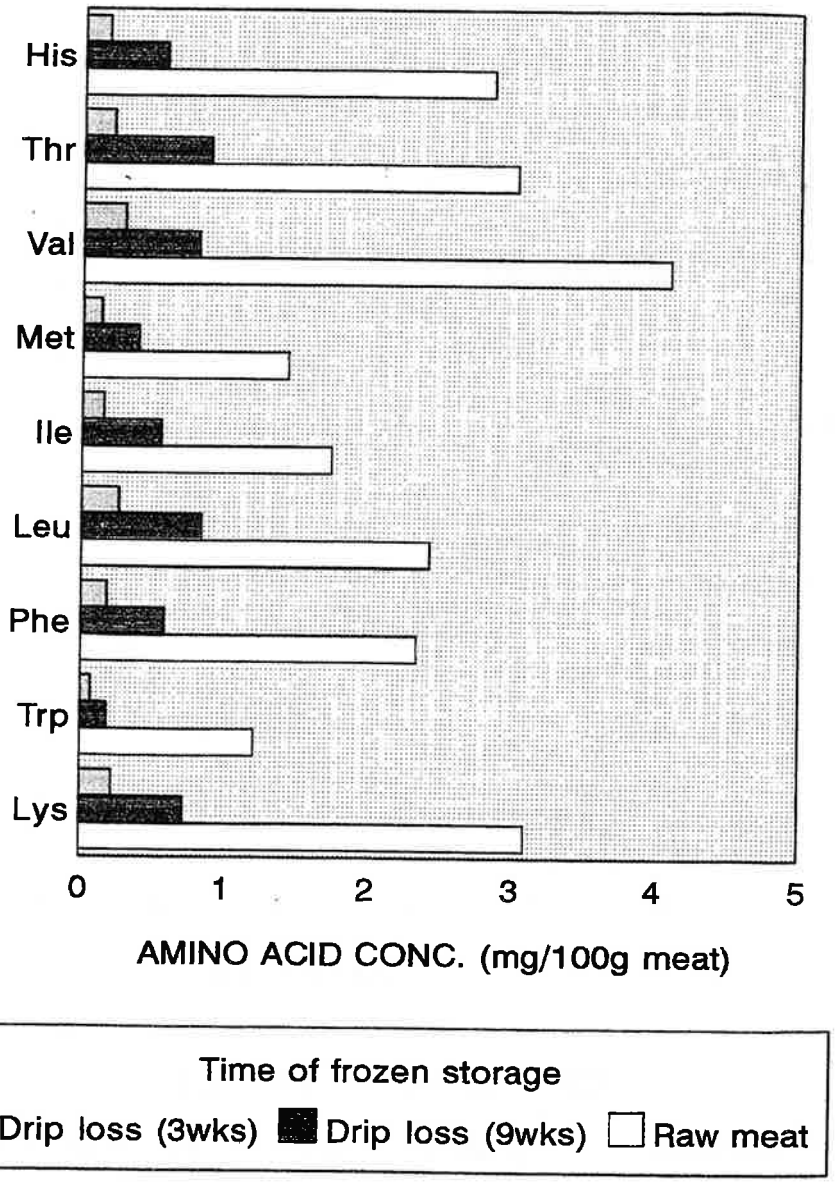


Figure 2. Essential amino acids in drip loss of frozen and thawed pork meat.

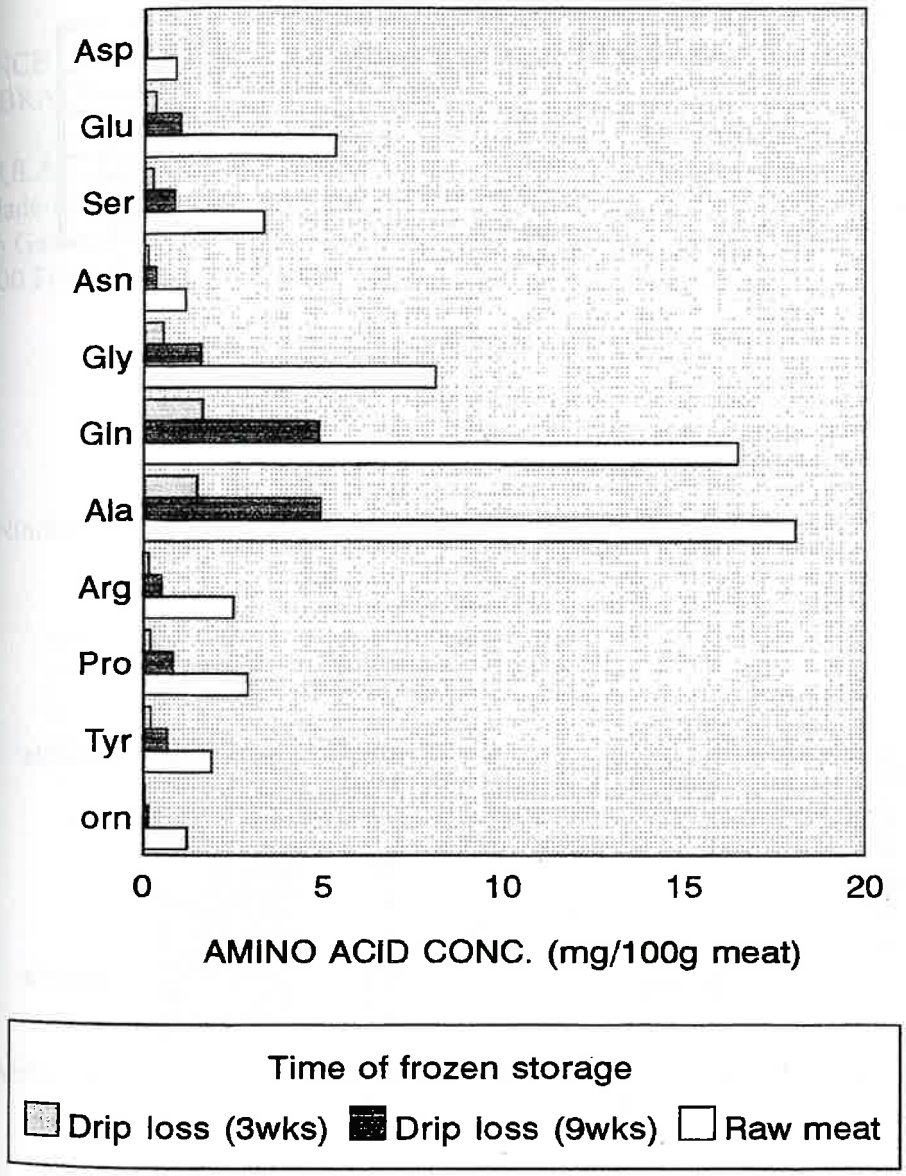


Figure 3. Non-essential amino acids in drip loss of frozen and thawed pork meat.

Table I

Summary of purification of lipoxygenase from *biceps femoris* of Iberian pig[a]

Step	Volume (mL)	Protein (mg/mL)	Protein (mg)	Activity (Units)[b]	Recovery (%)	Specific activity (U / mg)	Purification (Fold)
Crude extract	220	19.66	4326.3	0.704	100	0.16	1
20-40% $(NH_4)SO_4$	12	29.36	352.32	0.226	32.16	0.64	4
DEAE Sephadex	11	0.89	9.80	0.015	2.13	1.53	9.4
Phenyl sepharose							
Peak I	3	0.16	0.48	0.0005	0.072	1.04	6.4
Peak II	2.5	0.01	0.03	0.0013	0.200	30.30	241.5

[a]The data given in this table correspond to those of a typical preparation. Similar results have been obtained in three different preparations.

[b]One unit of enzyme activity is defined as the amount of enzyme that oxidizes 1 μmol of linoleate per min under the described conditions. Concentration of the enzymatic product has been calculated using a ε=25000 $M^{-1}cm^{-1}$ hydroperoxy linoleic acid.

Table II

Comparison of different kinetics parameters for various substrates.

Substrate	Vmax mU/mg	Km μM	Kcat s^{-1}	Kcat/Km $s^{-1}M^{-1}$
Arachidonic acid	17.79	6.43	0.029	4510
Linoleic acid	39.30	21.27	0.065	3055
Linolenic acid	23.16	23.6	0.038	1610

Assays were done against corresponding substrate blanks in 25 mM acetate buffer pH 5.4 at 20°C. Initial reaction rates were determined from the increase in absorbance caused by the formation of conjugated diene hydroperoxyde (ε_{234nm}= $2.5x10^4$ $M^{-1}cm^{-1}$) and fitted by linear regression to Lineweaver-Burk plot to calculate Vmax and Km. The Kcat values were calculated from Vmax.

Figure 1. Elution profile of lipoxygenase from Iberian pig *biceps femoris* muscle on a DEAE Sephadex column. Fractions of 3 mL were collected at a flow of 6 mL / hour.

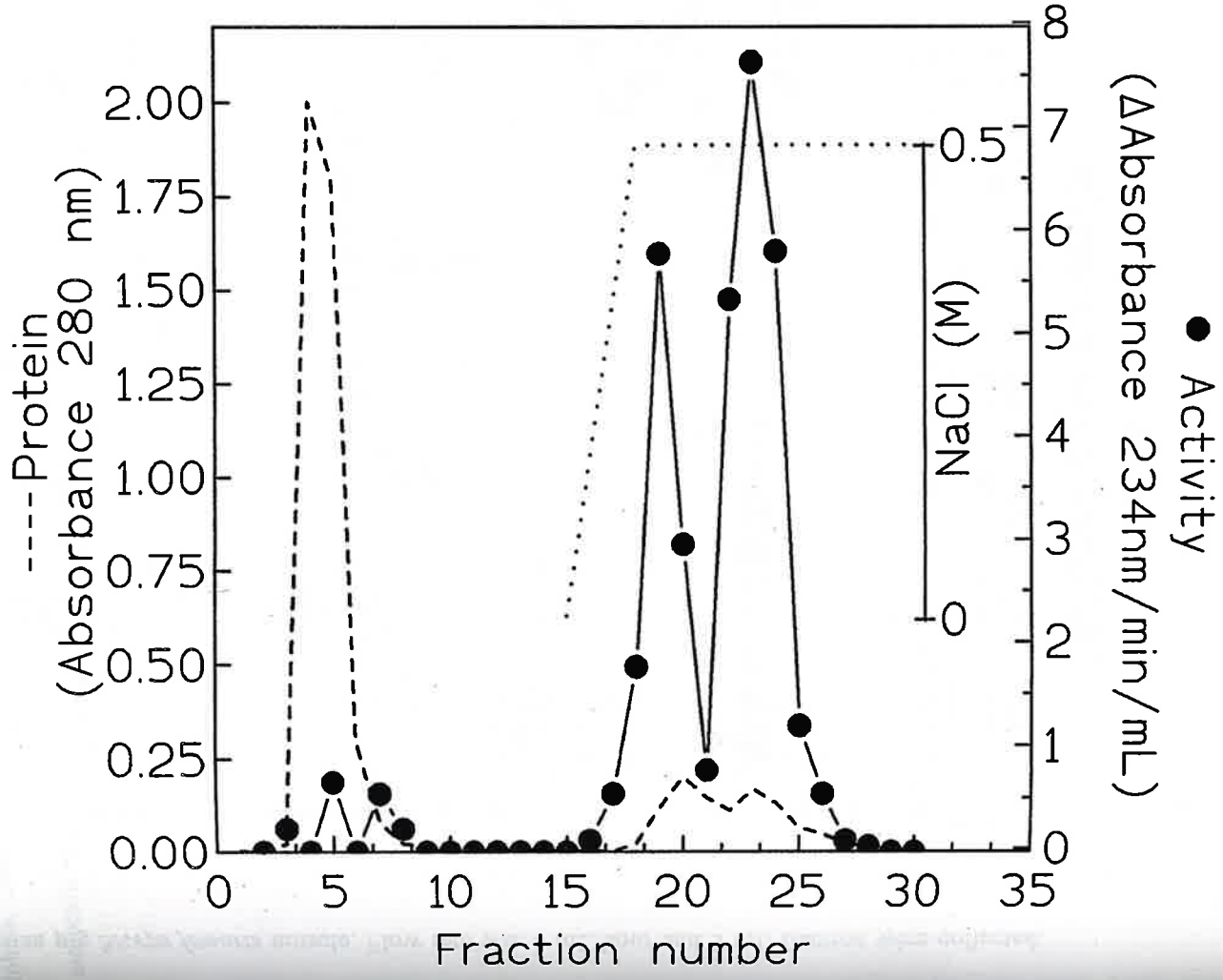


Figure 2. **Hydrophobic chromatography on a Phenyl Sepharose CL4b of lipoxygenase from Iberian pig *biceps femoris* muscle. Flow rate was 6 mL/hour and 3 mL fraction were collected.**

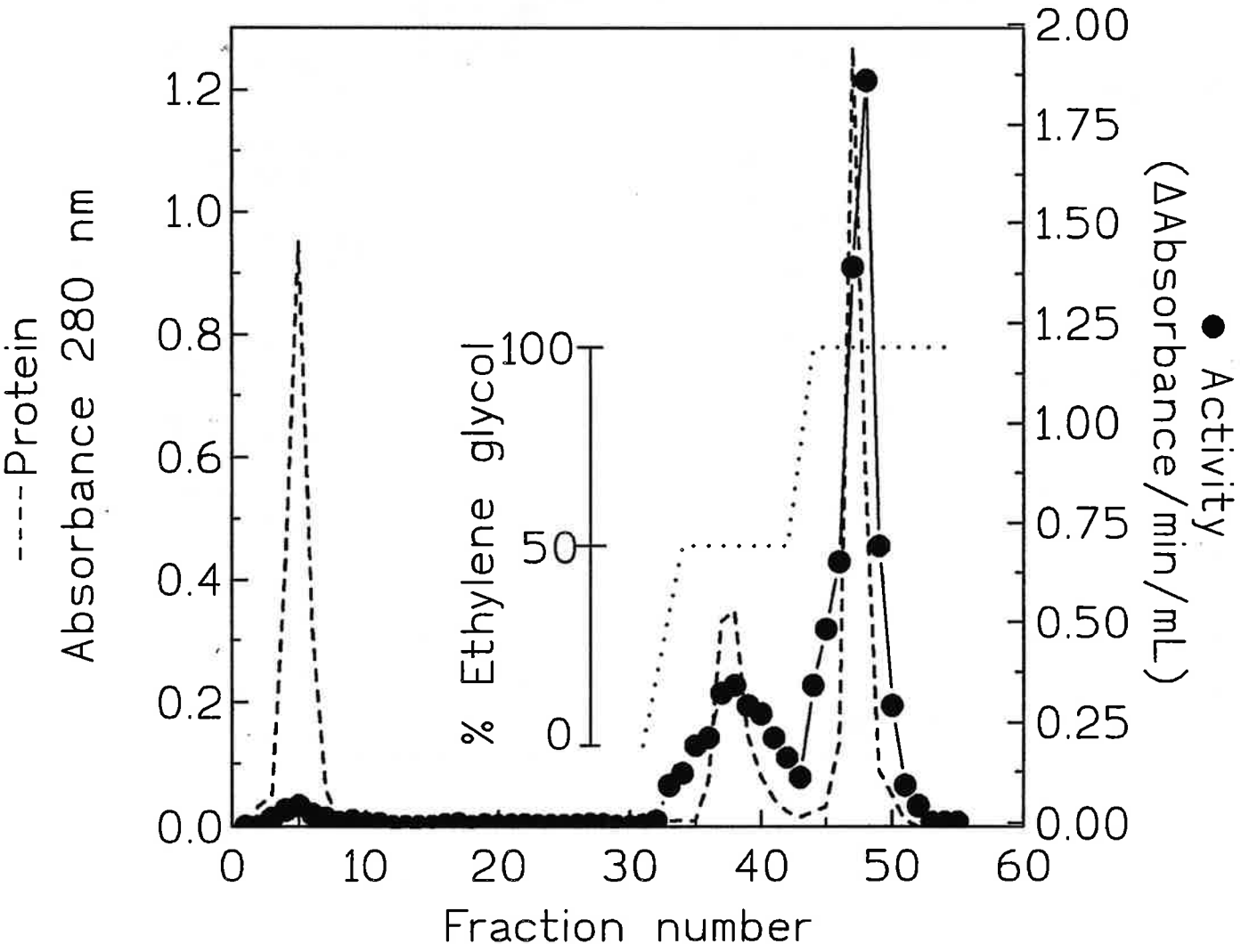


Figure 3. 10%SDS-PAGE of samples of purification process of lipoxygenase from biceps femoris from Iberian pigs. Lane 1, supernatant 100000xG. Lane 2, 20-40% saturation ammonium sulphate. Lane 3, eluted from DEAE-Sephadex. Lane 4, eluted from Phenyl Sepharose CL4b. Lane 5, molecular weigh markers.

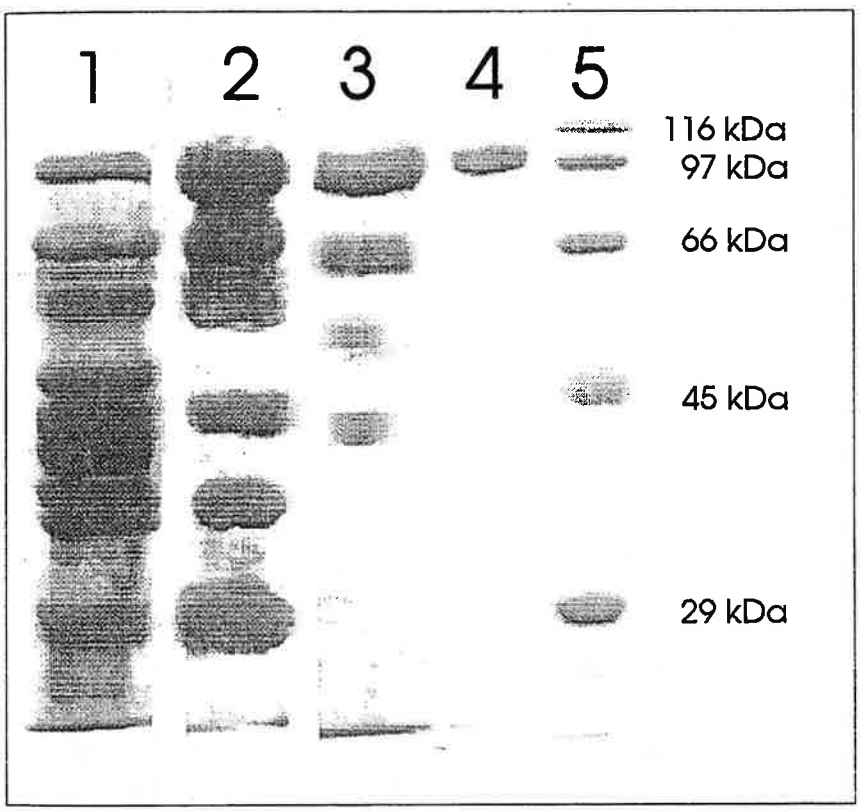


Figure 4. **pH - activity profile of *biceps femoris* lipoxygenase using linoleic acid as substrate.**

All buffers were 25 mM.

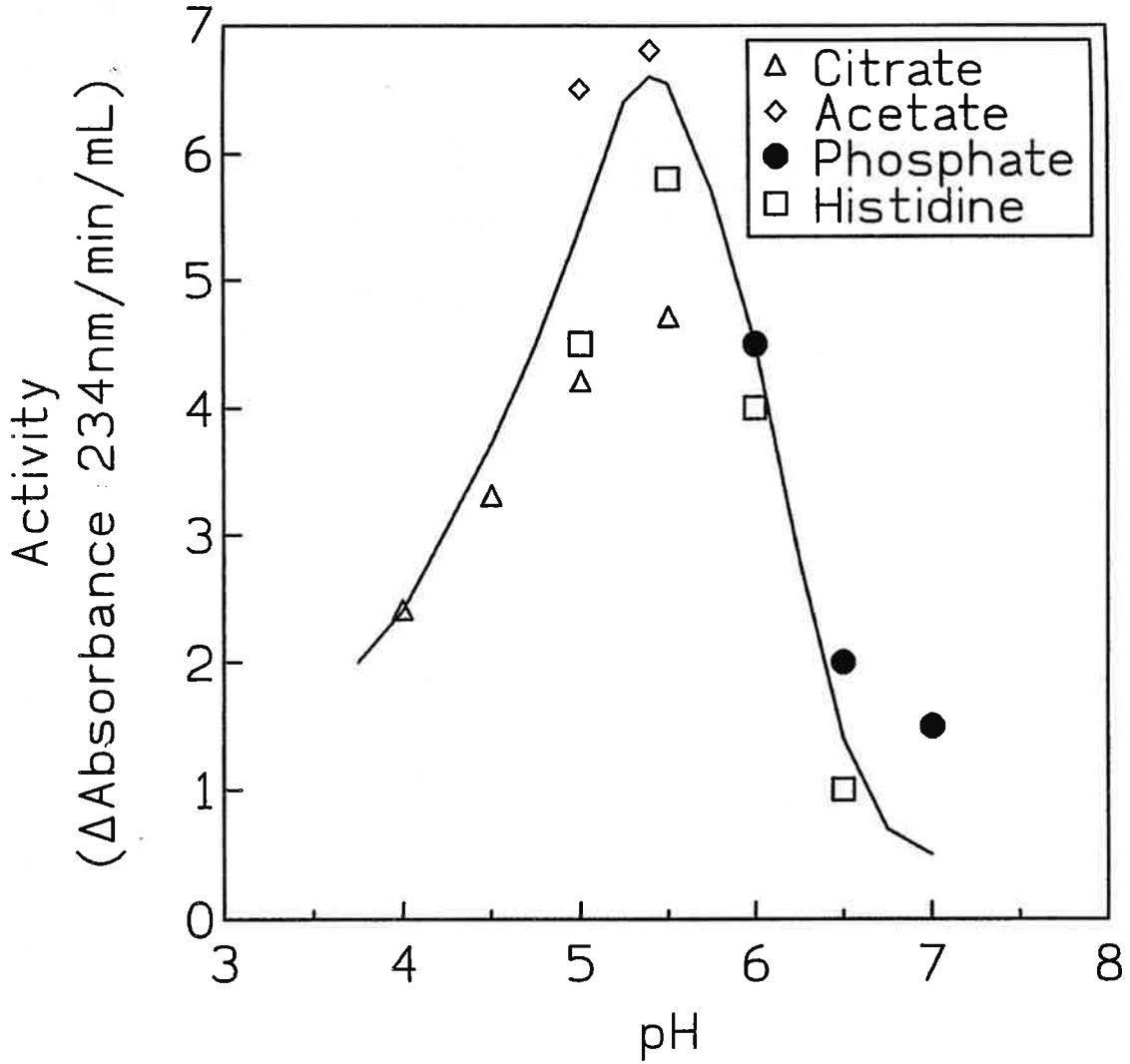


Figure 5. Inhibition of lipoxygenase activity by specific inhibitors. The compounds tested were added to reaction mixture inmediately prior to the enzyme addition. 100% activity correpond to 1.5 units of increase of absorbance at 234 nm per min. and mL of enzymatic solution.

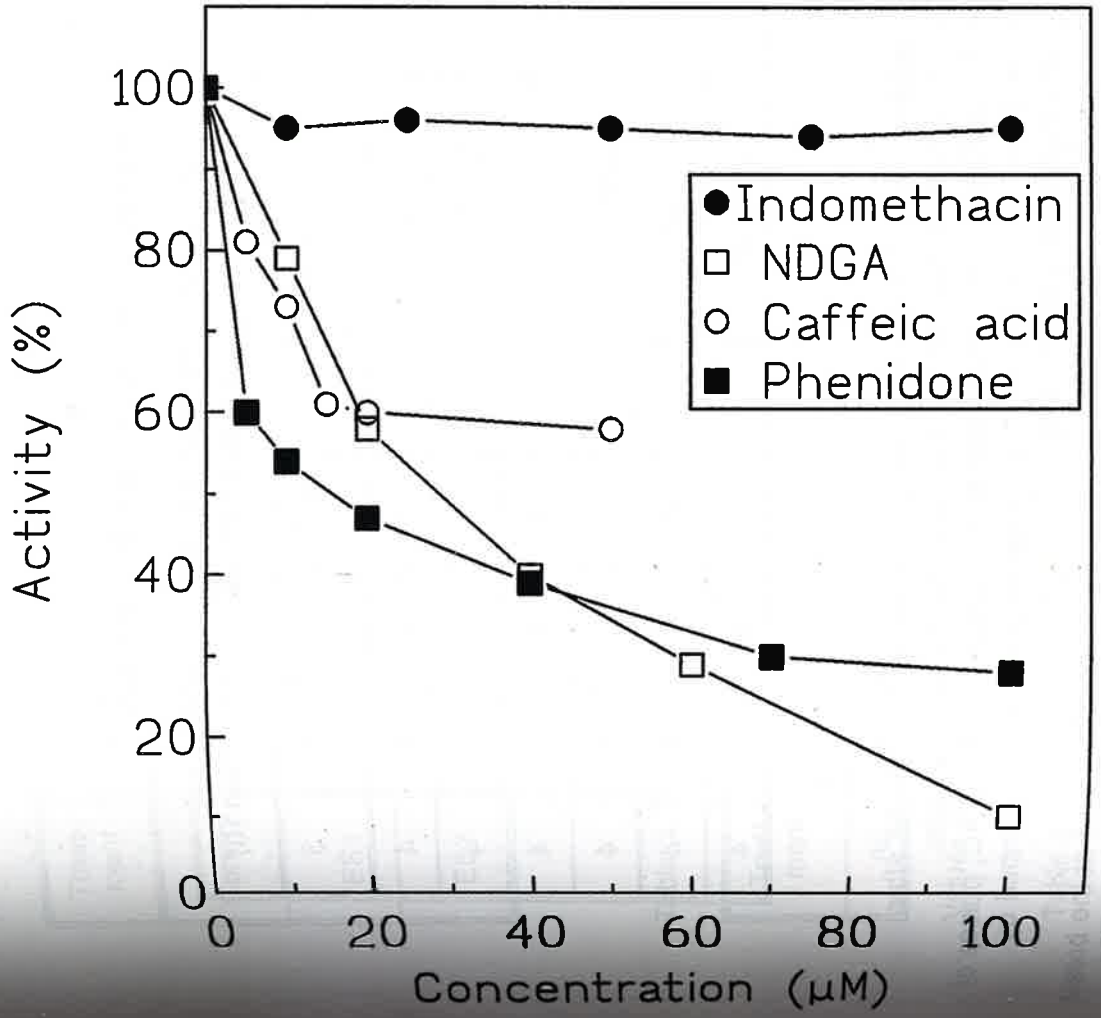


Table 1. Number of birds per treatment as used for each trial.

E.S. treatment	Chilling procedure	Boning time after evisceration (h)				
		0	0.5	1	2	3
Control	Air	4	4	4	4	4
	Slush ice		4	4	4	4
ES1	Air	4	4	4	4	4
	Slush ice		4	4	4	4
ES2	Air	4	4	4	4	4
	Slush ice		4	4	4	4

ES treatment

C: Non stimulated control birds. Birds were kept during 1.5 minute after bleeding to correct for time as compared to the stimulated birds.

ES1: Electrical stimulation was applied during 1.5 minute at 100 V AC, pulses of 0.5 s, relax time 1 s after bleeding. Equipment used as is described by Froning and Uijttenboogaart (1988)

ES2: Electrical stimulation was applied by a copper electrode placed at the breast of the birds. Time, voltage, type of current, etc was as described for ES1.

Table 2. Mean shear force values per treatment.

Treat-ment	Chilling procedure	Time of boning after evisceration (min)				
		0	30	60	120	180
Control	ice	56.09	59.67	58.04	43.08	38.13
	air		25.98	22.11	16.84	18.87
ES1	ice	62.80	47.82	39.54	28.43	26.74
	air		29.30	21.62	19.01	19.76
ES2	ice	56.97	33.96	32.93	21.73	22.93
	air		36.04	30.85	26.69	23.44

Table 3. Significant main effect of boning time on shear force values (N).

Treat-ment	Boning time after evisceration (min)				
	0	30	60	120	180
All	58.62^{a}	38.80^{b}	34.18^{b}	25.96^{c}	24.98^{c}

Values followed by a different letter are significantly different ($p<0.05$)

Table 4. Significant interaction effects of chilling and ES treatment on shear values (N).

Treat-ment	Ice	Air
Control	$^{a}49.73^{a}$	$^{a}20.95^{b}$
ES1	$^{b}35.63^{a}$	$^{a}22.42^{b}$
ES2	$^{c}27.89^{a}$	$^{b}29.26^{a}$

Values preceded (within columns) or followed (within rows) by a different letter are significantly different ($p<0.05$)

Table 5 Mean R-values per treatment and significant differences found.

Treat-ment	Chilling method	Boning time after evisceration (min)				
		0	30	60	120	180
Control	ice	$^{a}0.83^{a}$	$^{a}0.84^{a}$	$^{a}0.84^{a}$	$^{a}0.93^{b}$	$^{a}1.01^{b}$
	air		$^{a}0.84^{a}$	$^{a}0.90^{a}$	$^{b}1.02^{b}$	$^{b}1.12^{c}$
ES1	ice	$^{b}0.93^{a}$	$^{a}1.03^{b}$	$^{c}1.18^{c}$	$^{c}1.16^{c}$	$^{b}1.15^{c}$
	air		$^{b}1.14^{b}$	$^{c}1.18^{bc}$	$^{d}1.25^{c}$	$^{c}1.25^{c}$
ES2	ice	$^{b}0.92^{a}$	$^{a}1.03^{b}$	$^{b}1.01^{b}$	$^{c}1.15^{c}$	$^{b}1.14^{c}$
	air		$^{a}1.05^{b}$	$^{c}1.18^{c}$	$^{cd}1.19^{c}$	$^{c}1.24^{c}$

Values preceded (within columns) or followed (within rows) by a different letter are significantly different ($p<0.05$)

Table 6 Significant interaction effects of boning time * stimulation on R-values.

Treat-ment	0	30	60	120	180
Control	$^{a}0.83^{a}$	$^{a}0.84^{a}$	$^{a}0.87^{a}$	$^{a}0.98^{b}$	$^{a}1.06^{c}$
ES1	$^{b}0.93^{a}$	$^{b}1.08^{b}$	$^{c}1.18^{c}$	$^{b}1.21^{c}$	$^{b}1.20^{c}$
ES2	$^{b}0.92^{a}$	$^{b}1.04^{b}$	$^{b}1.10^{b}$	$^{b}1.17^{c}$	$^{b}1.19^{c}$

Values preceded (within columns) or followed (within rows) by a different letter are significantly different ($p<0.05$)

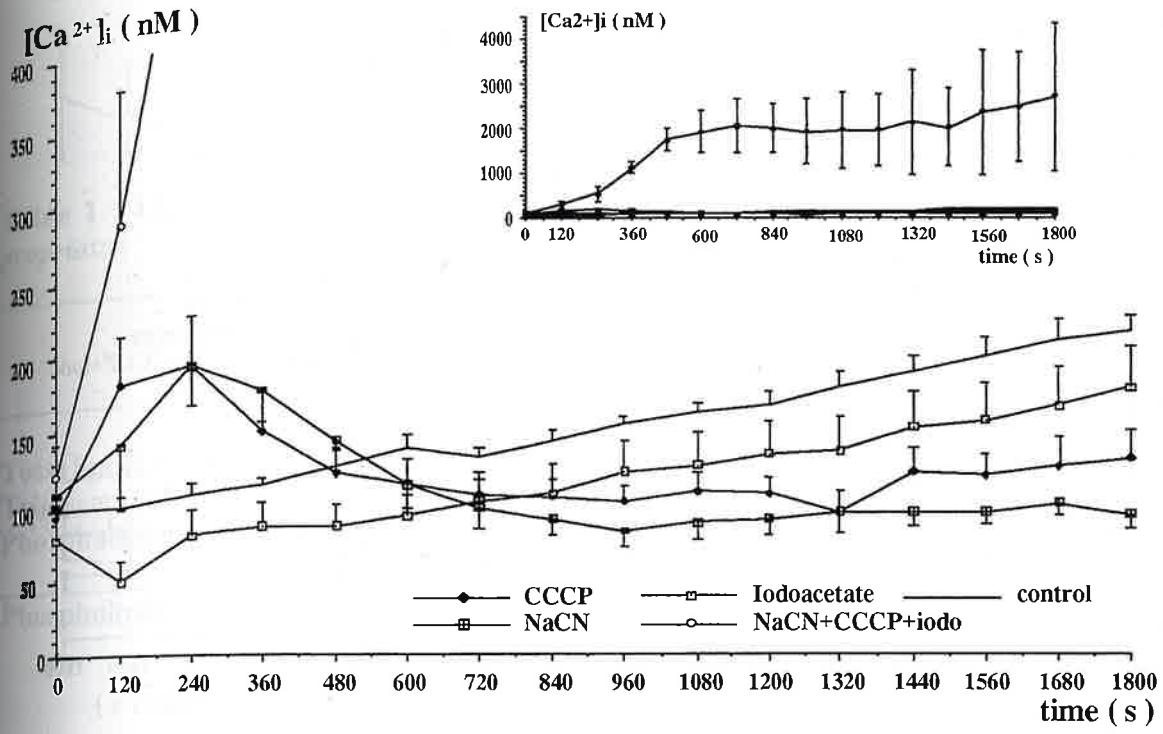
Table 7 Significant main effect of time of boning on R-values.

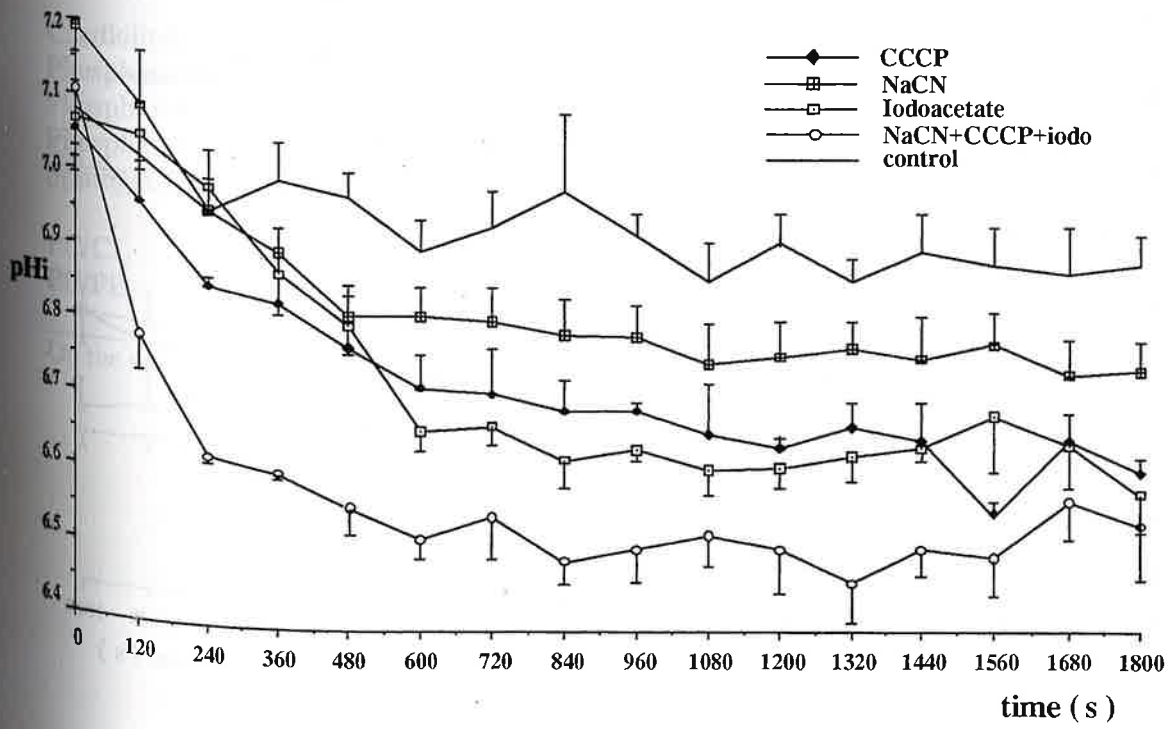
Treat-ment	Boning time after evisceration				
	0	30	60	120	180
All	0.89^{a}	0.99^{b}	1.05^{c}	1.12^{d}	1.15^{d}

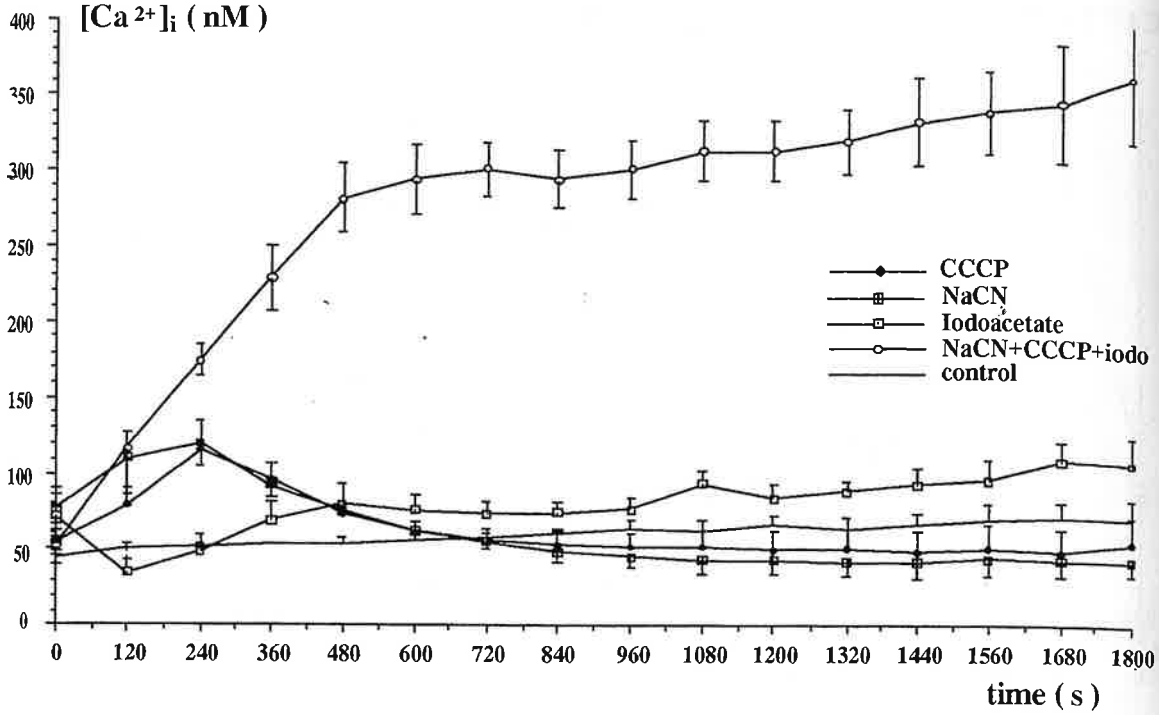
Values followed by a different letter are significantly different ($p<0.05$)

Table 8 Significant main effect of chilling method on R-values.

Treat-ment	Chilling method	
	Ice	air
All	1.04^{a}	1.11^{b}


[Ca 2+]i (nM)
[Ca2+]i (nM)
time (s)
CCCP
NaCN
Iodoacetate
NaCN+CCCP+iodo
control
time (s)


CCCP
NaCN
Iodoacetate
NaCN+CCCP+iodo
control
pHi
time (s)


[Ca 2+]i (nM)
400
350
300
250
200
150
100
50
0
0 120 240 360 480 600 720 840 960 1080 1200 1320 1440 1560 1680 1800
time (s)
CCCP
NaCN
Iodoacetate
NaCN+CCCP+iodo
control

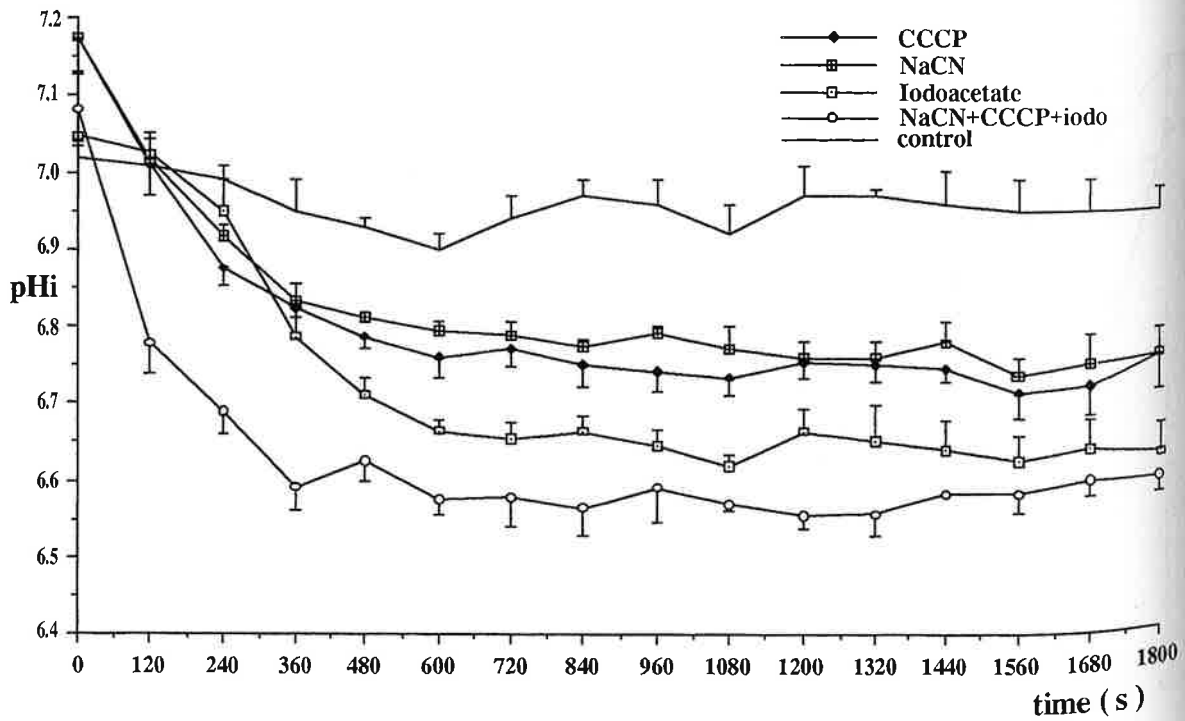

pHi
7.2
7.1
7.0
6.9
6.8
6.7
6.6
6.5
6.4
0 120 240 360 480 600 720 840 960 1080 1200 1320 1440 1560 1680 1800
time (s)
CCCP
NaCN
Iodoacetate
NaCN+CCCP+iodo
control

Table 1 : Lipid composition of rabbit *Longissimus dorsi* and *Semimembranosus propriosus*

	Longissimus dorsi	*Semimembranosus propriosus*
Total lipids (%of muscle)	1.08 ^{a}	2.86 ^{a}
Triglycerides (% of muscle)	0.47 ^{b}	2.03 ^{a}
Phospholipids (% of muscle)	0.61 ^{b}	0.83 ^{a}
Phospholipid composition		
	(as % of phospholipids)	
Cardiolipin	3.3 ^{b}	7.0 ^{a}
Phosphatidyl-ethanolamine	23.6 ^{b}	27.8 ^{a}
Phosphatidyl-inositol	7.1 ^{a}	5.1 ^{b}
Phosphatidyl-choline	64.4 ^{a}	58.8 ^{b}
Sphingomyelin	1.7	1.2
	(as mg/100 g of muscle)	
Cardiolipin	23 ^{b}	64 ^{a}
Phosphatidyl-ethanolamine	164 ^{b}	255 ^{a}
Phosphatidyl-inositol	49	48
Phosphatidyl-choline	448 ^{b}	541 ^{a}
Sphingomyelin	12	12
PC/CL	19.5 ^{b}	8.5 ^{a}
PC/PE	2.7 ^{b}	2.1 ^{a}

On the same row, means with different superscripts differ signicantly at the 1% level

Table 2 : Fatty acid composition of triglycerides and phospholipids of rabbit *Longissimus dorsi* (LD) and *Semimembranosus propriosus* (SM) (as % of methyl esters)

	Triglycerides		Phospholipids	
	L. D. n=18	**S. M.** n=18	**L. D.** n=18	**S. M.** n=18
Fatty acids				
14:0	3.6	3.5	0.9 *a*	0.7 *b*
15:0	0.7	0.7	0.7 *a*	0.5 *b*
16:0	28.8	28.4	24.1 *a*	26.0 *b*
17:0	0.7	0.7	0.8	0.7
18:0	6.4 *b*	7.3 *a*	7.9 *b*	10.5 *a*
20:0	0.1	0.2	0.1	0.1
Saturated	**40.3**	**40.8**	**34.5 *b***	**38.5 *a***
16:1	5.8	6.5	1.8 *a*	1.5 *b*
17:1	0.5	0.5	0.8 *a*	0.5 *b*
18:1	23.5	24.4	17.7	16.6
20:1	0.2	0.2	0.2	0.1
Monounsaturated	**30.0**	**31.6**	**20.5 *a***	**18.7 *b***
18:2 n-6	22.7	21.3	26.7	27.8
20:2 n-6	0.2	0.2	0.7	0.5
20:3 n-6	0.2	0.1	1.0	1.0
20:4 n-6	0.9	0.8	9.4 *a*	7.5 *b*
22:4 n-6			1.6	1.5
22:5 n-6			0.7	0.7
Total n-6	**24.0**	**22.4**	**40.1**	**39.0**
18:3 n-3	5.7	5.2	1.4 *a*	1.1 *b*
20:5 n-3			0.7 *a*	0.5 *b*
22:5 n-3			2.2 *a*	1.8 *b*
22:6 n-3			0.6 *a*	0.4 *b*
Total n-3	**5.7**	**5.2**	**4.9 *a***	**3.8 *b***
Polyunsaturated	**29.7**	**27.6**	**45.0**	**42.8**

5 For a given lipid fraction (triglycerides or phospholipids), means with different superscripts differ significantly at the 1% level.

Table 1. Body weight of the four genotypes of White Italian geese

Genetic groups	Number	Body weight, kg $\bar{x}$	S	V%
WD 1	12	6.5	0.1	1.3
WD 3	12	6.9	0.1	1.1
WD 13	12	7.0	0.1	1.3
WD 31	12	6.9	0.1	1.1
Male	24	6.9**	0.2	1.2
Female	24	6.1**	0.1	1.4

Note: ** P<.01

Table 2. Histological parameters of Pectoralis muscle four genotypes of White Italian geese

Histological parameters		Genotypes							
		WD 1	WD 3	WD 13	WD 31	WD 1	WD 3	WD 13	WD 31
Red fibers		Males				Females			
ϕ µm	x	29.2^{A}	26.2^{B}	24.9^{C}	26.2^{BC}	23.3^{A}	25.2^{B}	25.2^{B}	24.9^{B}
	S	10.0	6.6	5.8	7.6	6.4	6.8	6.1	6.3
%	x	75.7^{A}	73.9^{A}	74.0^{A}	80.3^{B}	79.7	76.7	75.0	75.3
	S	8.1	9.3	8.7	9.2	10.4	7.9	10.4	7.9
White fibers									
ϕ µm	x	52.9^{A}	51.1^{B}	51.3^{B}	49.6^{C}	51.4^{A}	52.7^{B}	53.8^{C}	53.8^{C}
	S	8.7	8.5	7.9	8.2	7.8	8.0	7.9	7.9
%	x	24.3^{A}	26.1^{A}	26.0^{A}	19.7^{B}	20.3	23.3	25.0	24.7
	S	8.1	9.3	8.7	9.2	10.4	7.9	10.4	7.9
Intramuscular fatty tissue									
area, μm^2	x	2294.5	1736.1	1659.9	1947.3	1340.1	1662.3	2763.3	1882.8
	S	1472.2	956.8	888.9	761.2	419.9	819.2	1089.2	904.5
%	x	14.7	12.4	12.9	10.4	11.3	15.2	15.3	11.3
	S	6.2	7.9	4.1	2.2	1.3	4.6	4.9	6.9

Means within a column with different superscripts differ (P<.01)

Table 3. Muscle fiber diameters in Pectoralis muscle of male and female of White Italian geese

Sex	Fiber diameters, μm					
	Red fibers			White fibers		
	$\bar{x}$	S	V%	$\bar{x}$	S	V%
Males n=24	26.2**	7.6	28.9	51.2	8.4	16.4
Females n=24	24.6**	6.5	26.2	53.0	7.7	14.5

** P<.01

Table 4. Meat quality traits of four genotypes of White Italian geese (Skrabka-Blotnicka et al.1992, 1993)

Traits	Breast muscle							
	Genotypes							
	WD 1	WD 3	WD 13	WD 31	WD 1	WD 3	WD 13	WD 31
	Males				Females			
Protein, %	21.7	22.3	22.8	22.0	22.0	21.9	22.9	22.9
Moisture,%	73.5	73.9	73.9	73.1	74.1	73.6	74.3	74.1
Fat, %	6.5	5.6	5.5	5.9	6.3	6.0	5.0	4.5
pH	5.8	5.8	5.8	5.8	5.9	5.9	5.9	5.8
WHC, %	40.0^{a}	43.2^{a}	48.5^{a}	40.0^{a}	31.4^{b}	25.8^{bc}	20.4^{cd}	15.6^{d}
Cooking loss, %	25.8^{a}	26.1^{a}	25.2^{a}	25.2^{a}	24.4^{ab}	21.8^{bc}	20.1^{cd}	18.4^{d}
Shear force of cooked meat, J/2cm	89.2^{d}	111.7^{a}	106.9^{ab}	114.7^{a}	94.1^{cd}	89.2^{d}	100.0^{bc}	81.4^{c}
Tenderness (taste panel score)	9.4	9.0	8.2	8.7	6.9	7.2	8.2	7.6
Emulsion stability (retained water, cm^2)	14.7^{a}	14.3^{b}	14.2^{b}	13.8^{c}	13.8^{c}	14.3^{b}	14.3^{b}	13.5^{c}

Means within a column with different superscripts differ (P<.05)

Table 5. Simple correlations of the histological parameters with some meat quality traits of the White Italian geese

Meat traits	Coefficient correlations					
	Red fibers		White fibers		Intermuscular fatty tissue	
	ϕ	%	ϕ	%	area	%
Protein, %	-.45	-.57+	.38	.51+	.25	-.32
Moisture, %	-.55+	-.53+	.60+	.56+	.09	.18
Fat, %	.35	.48	-.46	-.43	-.29	.10
pH	-.64+	.17	.13	-.10	-.27	.15
WHC, %	.34	.02	-.75*	-.06	.29	-.18
Cooking loss, %	.38	.19	-.76*	-.21	-.31	-.18
Tenderness (shear force)	.20	.09	-.79*	.42	.22	-.29
Tenderness (taste panel score)	.77*	-.47	-.12	.42	.25	.01
Emulsion stability (retained water, cm^3)	.64+	-.44	.17	.40	.42	.82*

Note: + P<.10
* P<.05

Table 1.Means of the temperature and pH values of semitendinosus (ST), semimembranosus (SM), and M.adductor (MA) muscles.

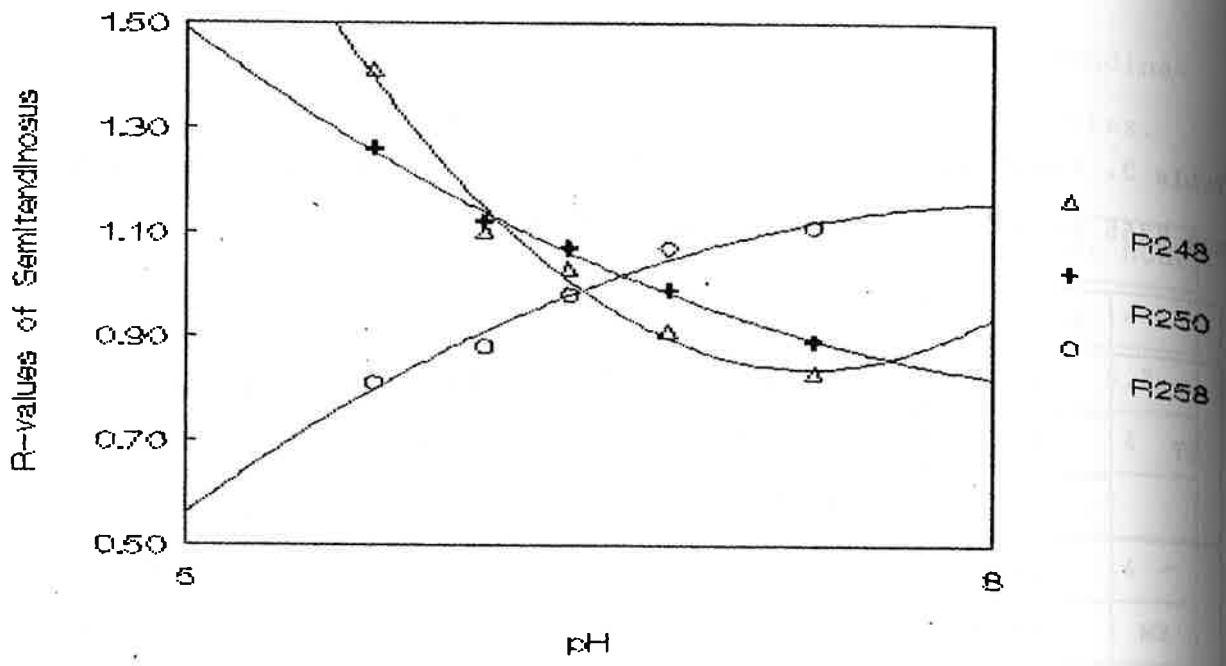
		0. hour	2. hour	4. hour	6. hour	24. hour
ST	temp.(°C)	36	27	14	9	4
	pH	7.33	6.7	6.02	6.11	5.7
SM	temp.(°C)	37	27	14	10	4
	pH	7.33	6.53	6.35	6.14	5.7
MA	temp.(°C)	36	26	14	10	4
	pH	7.34	6.68			

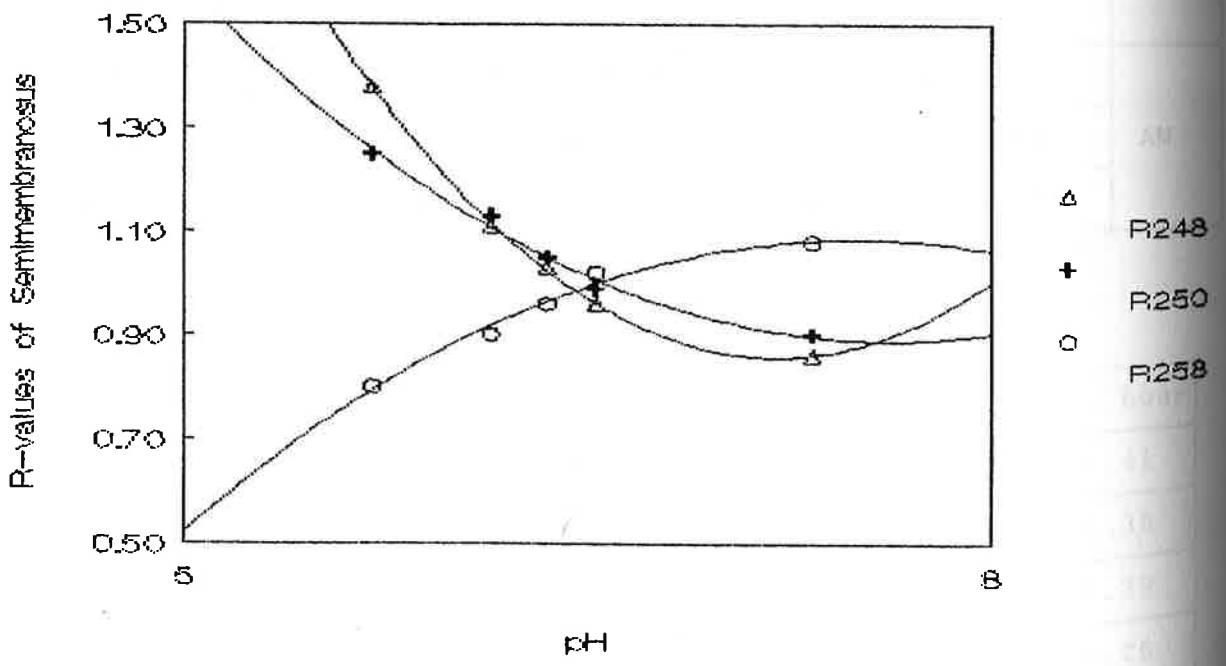
Table 2. The changes in R-values (R248, R250, and R258) of semitendinosus, semimembranosus and M.adductor muscles.

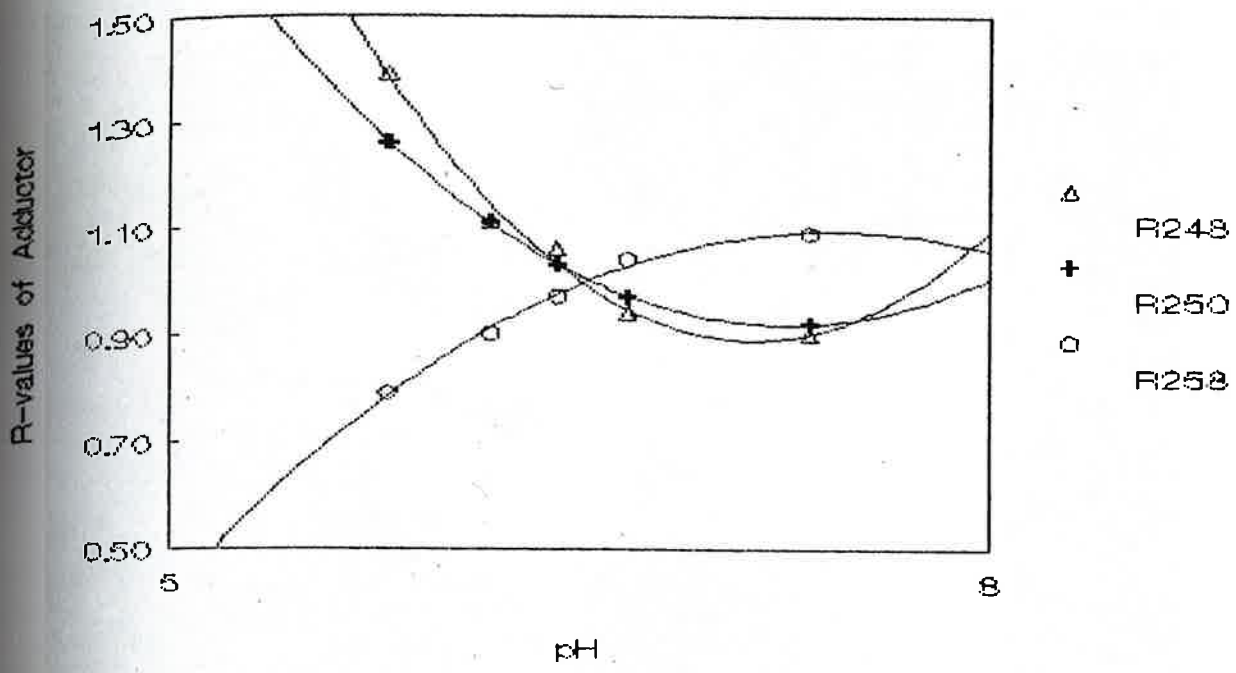
		0. hour	2. hour	4. hour	6. hour	24. hour
R248	ST	0.83	0.91	1.03	1.10	1.41
	SM	0.86	0.96	1.03	1.11	1.38
	MA	0.90	0.94	1.06	1.11	1.39
R250	ST	0.89	0.99	1.07	1.12	1.26
	SM	0.90	0.99	1.05	1.13	1.25
	MA	0.92	0.97	1.03	1.11	1.26
R258	ST	1.11	1.07	0.98	0.88	0.81
	SM	1.08	1.02	0.96	0.90	0.80
	MA	1.09	1.04	0.97	0.90	0.79

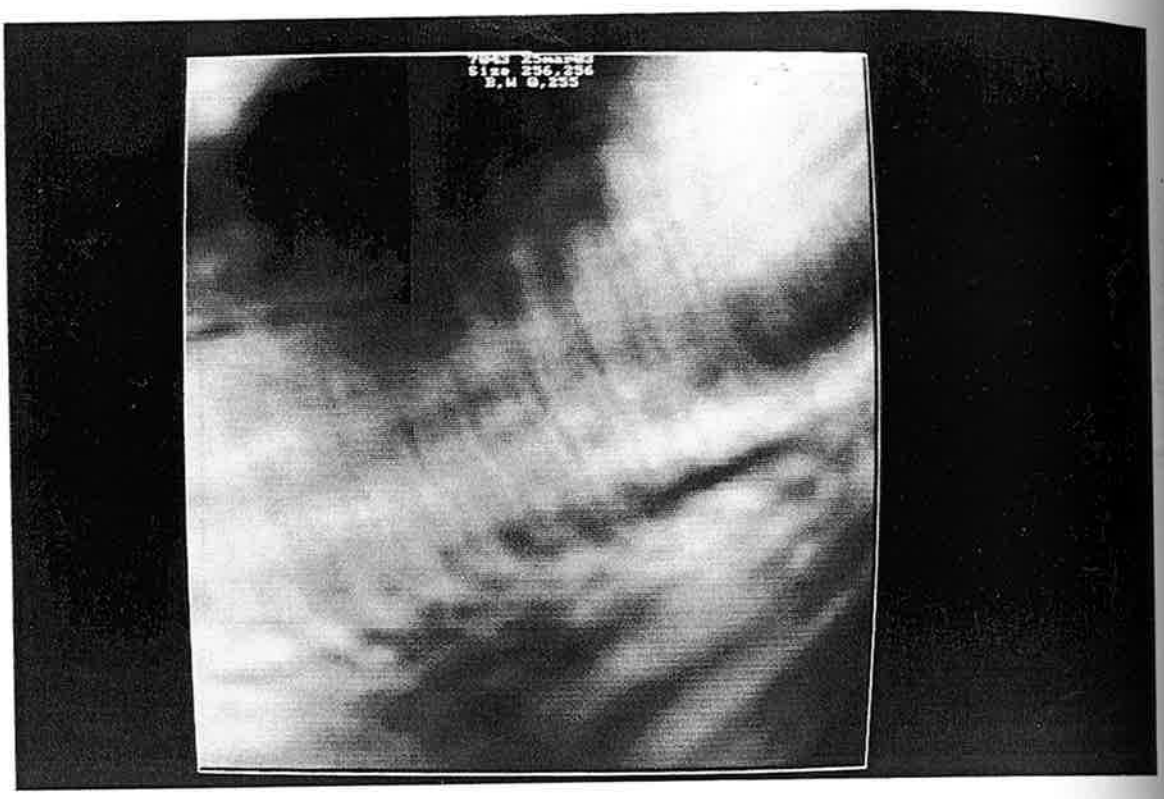
Table 3. Coefficients of the prediction Equation for pH by R248, R250, and R258 obtained by Regression Analysis.

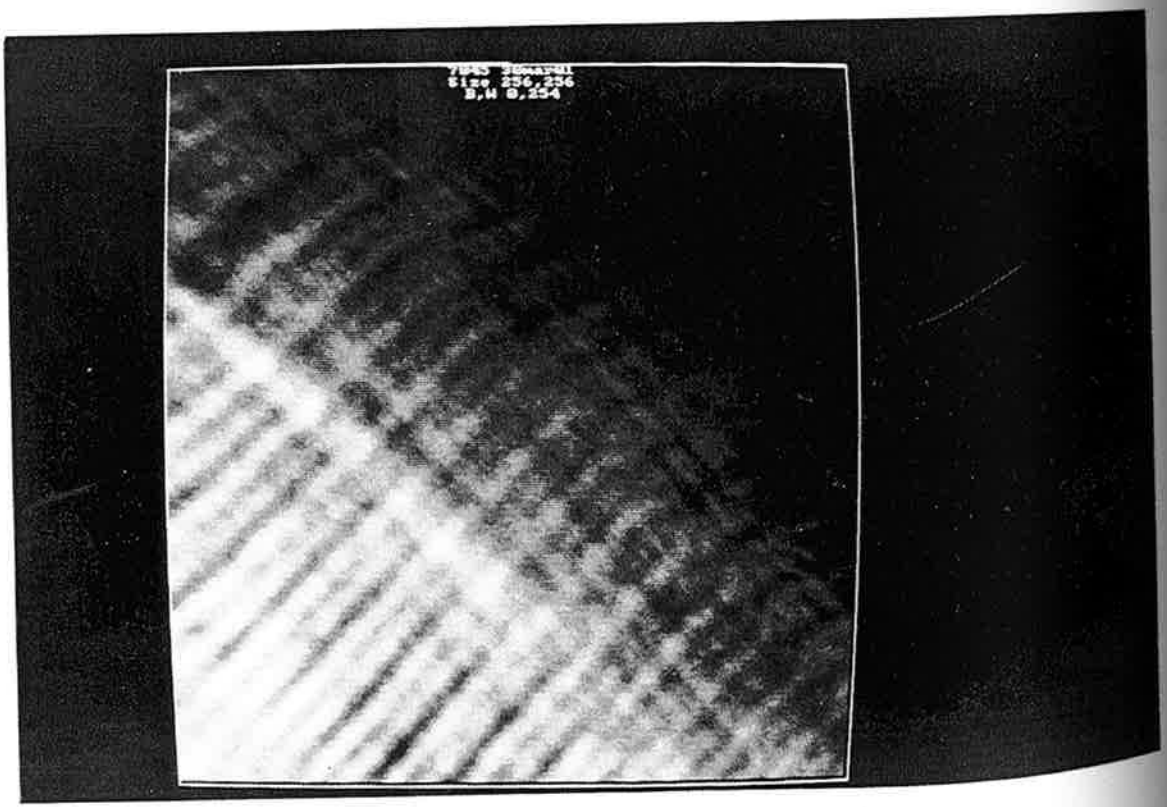
	R-values		R^2
ST	R248	$y=5.02x^2 - 13.93x + 15.36$	0.989
	R250	$y=5.29x^2 - 15.55x + 17.04$	0.997
	R258	$y=7.28x^2 - 9.1x + 8.43$	0.969
SM	R248	$y=6.87x^2 - 18.37x + 17.97$	0.988
	R250	$y=8.78x^2 - 23.24x + 21.07$	0.986
	R258	$y=14.04x^2 - 21.09x + 13.62$	0.977
MA	R248	$y=7.08x^2 - 19.00x + 18.52$	0.963
	R250	$y=26.16x^2 - 32.58x + 13.04$	0.9812
	R258	$y=12.36x^2 - 18.57x + 12.78$	0.981


R-values of Semitendinosus
1.50
1.30
1.10
0.90
0.70
0.50
5
8
pH
R248
R250
R258


R-values of Semimembranosus
1.50
1.30
1.10
0.90
0.70
0.50
5
8
pH
R248
R250
R258


1.50
1.30
1.10
0.90
0.70
0.50
R-values of Adductor
5
8
pH
R248
R250
R258





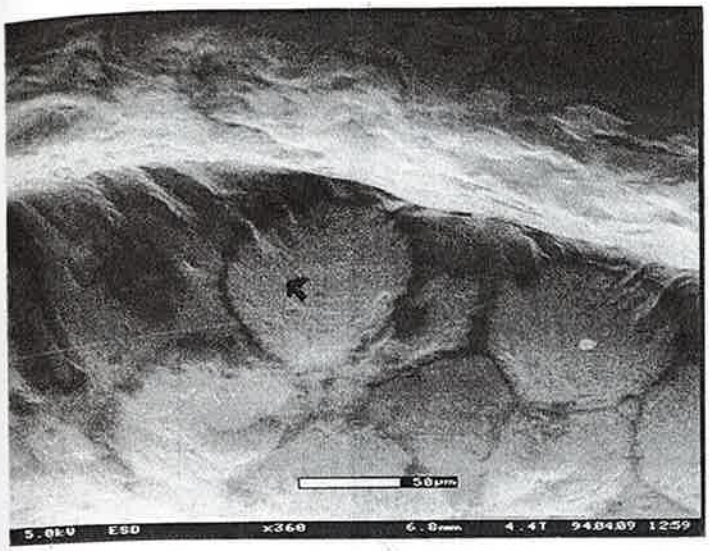


Figure 1 Transverse raw beef muscle section from near Achilles tendon. Myofibrils slightly emergent from cut ends may be seen (arrow). Magnification 360x

Figure 2 Longitudinal raw beef muscle section from near Achilles tendon. Condensed water droplets on surface may be seen (arrow). Subsurface evidence of sarcomeres may be discerned. Magnification 270x

Figure 3 Longitudinal raw beef muscle section from near Achilles tendon. Sarcomeres clearly evident (arrow). Endomysial connective tissue is discernible (double arrow). Magnification 655x

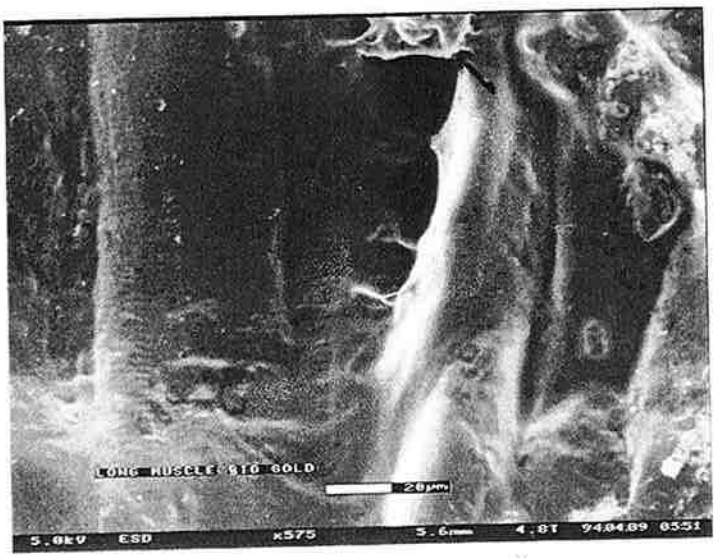


Figure 4 'Protogold' stained longitudinal beef muscle from near Achilles tendon. Slight tension between muscle fibres reveals connective tissue skeins (arrow). Magnification 575x

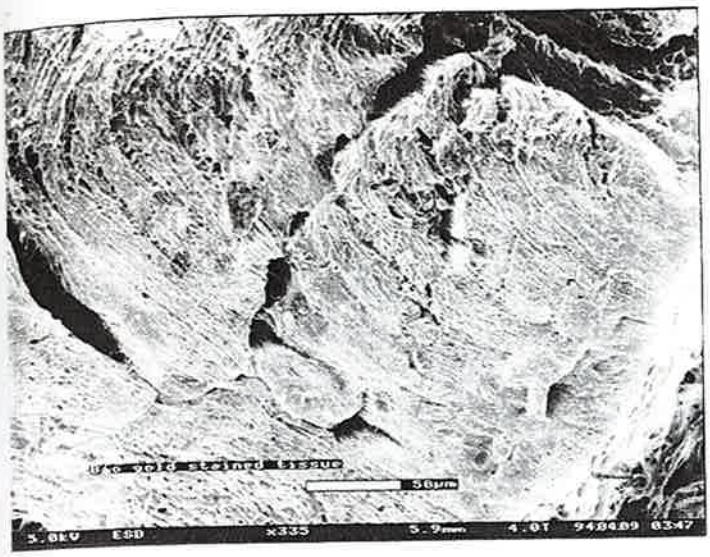


Figure 5 'Protogold' stained oblique section through beef muscle from near Achilles tendon. Connective tissue of endomysium is seen (arrowed). Magnification 335x

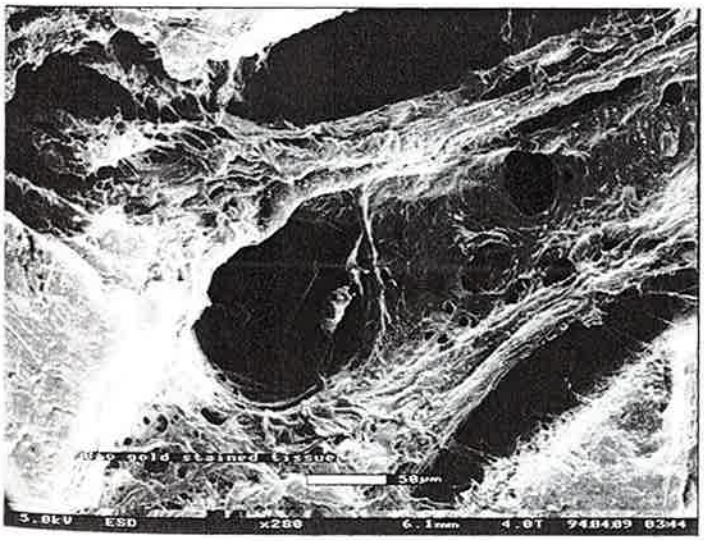


Figure 6 'Protogold' stained connective tissue of endomysium showing fibrils and sheets. Magnification 288x