Table 1. Effect of vascular infusion of cold water on carcass and offal yields

Trait	Control	Infused	Probab[illegible]
Live weight, kg	97.7	94.2	0.53[illegible]
Warm carcass weight, g kg^{-1}	824	863	0.00[illegible]
Chiller shrinkage, g kg^{-1}	30.6	28.9	0.20[illegible]
Liver, g kg^{-1}	16.5	24.7	0.00[illegible]
Heart, g kg^{-1}	3.5	4.9	0.00[illegible]
Spleen, g kg^{-1}	1.7	2.7	0.25[illegible]
Lungs, trachea, tongue g kg^{-1}	19.6	24.5	0.02[illegible]

g kg^{-1} of live weight

Table 2. Effect of vascular infusion of cold water on muscle temperature and pH

Trait	Control	Infused	Probabil[illegible]
Longissimus thoracis			
Temp, ^{0}C:			
45 min	39.6	37.8	0.012
3h	18.9	18.4	0.780
24h	1.8	1.8	0.954
pH			
45 min	5.55	5.56	0.756
3h	5.54	5.57	0.336
24h	5.52	5.55	0.314
Semimembranosus			
Temp, ^{0}C:			
45 min	41.9	40.0	0.00[illegible]
3h	27.6	26.6	0.42[illegible]
24h	2.5	2.3	0.75[illegible]
pH			
45 min	5.69	5.70	0.86[illegible]
3h	5.62	5.65	0.55[illegible]
24h	5.62	5.65	0.39[illegible]

Table 3. Effect of vascular infusion of cold water on longissimus thoracis muscle quality

Trait	Control	Infused	Probability
Colour score	1.33	1.50	0.586
Structure score	1.17	1.71	0.023
Minolta Meter:			
L*	64.6	63.1	0.144
a*	10.9	11.1	0.783
b*	7.1	6.4	0.207
Drip loss, mg g^{-1}	51.8	58.8	0.256
Soluble protein, mg g^{-1}	103.3	119.6	0.001
Moisture, mg g^{-1}	754	763	0.045
Lipid, mg g^{-1}	22.5	19.2	0.285
Shear, kg	7.76	7.62	0.823

Table 4. Effect of vascular infusion of cold water on semimembranosus muscle quality

Trait	Control	Infused	Probability
Colour score	2.17	2.07	0.794
Structure score	2.00	2.07	0.527
Minolta Meter:			
L*	54.0	55.6	0.426
a*	14.0	13.9	0.929
b*	6.9	7.6	0.376
Drip loss, mg g^{-1}	54.6	58.0	0.530
Soluble protein, mg g^{-1}	144.5	143.6	0.921
Moisture, mg g^{-1}	765	767	0.606
Lipid, mg g^{-1}	12.8	12.2	0.774
Shear, kg	10.1	9.6	0.605

Table 1. The rise in temperature (°C) subcutaneous and in the m. biceps femoris (n = 6) at a depth of 5 cm below the skin surface during scalding up to 12 minutes.

scalding	subcutaneous		biceps femoris (5 cm)	
minutes	mean	s.e.	mean	s.e.
0	31.1	0.6	39.7	0.5
1	37.8	2.5	39.7	0.5
2	42.9	2.3	39.8	0.5
3	45.7	2.0	39.9	0.5
4	47.7	1.8	40.0	0.5
5	49.3	1.4	40.1	0.4
6	50.4	1.3	40.1	0.4
7	51.0	1.3	40.2	0.4
8	51.6	1.3	40.3	0.4
9	52.0	1.2	40.3	0.4
10	52.3	1.2	40.4	0.4
11	52.6	1.1	40.4	0.3
12	53.0	1.2	40.5	0.3

Table 1. Mean subcutaneous (skin) and muscle (m. biceps femoris; BF) temperatures (°C) measured immediately after forced chilling (-5 °C, 120 min or -30 °C, 30 min; air velocities: 1, 2 and 4 m/s) or during corresponding periods of conventional chilling (4 °C, air velocity: 0.5 m/s).

	conventional chilling (4 °C, 0.5 m/s)				forced chilling				
	120 min		30 min		m/s	-5 °C, 120 min		-30 °C, 30 min	
	mean	s.e.	mean	s.e.		mean	s.e.	mean	s.e.
skin	16.0	0.4	20.4	0.4	1	7.2	0.7	13.0	0.7
					2	8.4	0.7	5.0	0.7
					4	6.2	0.7	4.8	0.7
BF	30.3	0.7	37.8	0.7	1	27.1	0.8	36.9	0.8
					2	26.9	0.8	36.7	0.8
					4	26.3	0.8	36.1	0.8

The subcutaneous and BF temperatures of rapidly chilled carcasses differed significantly ($P < 0.001$) from those of the corresponding conventionally chilled ones.

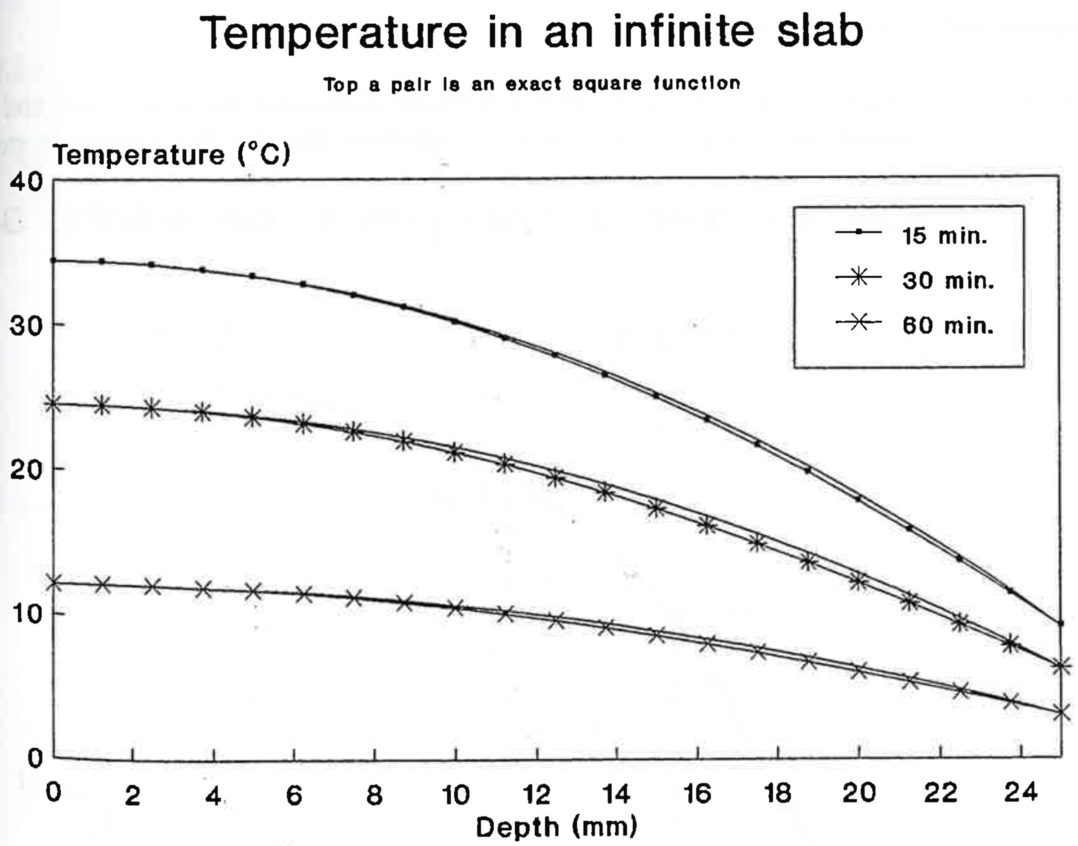
Table 2. Mean values of drip (Filter paper, mg; FP) and parameters for meat tenderness, i.e. Warner-Bratzler shear force (Newton; W-B) and sarcomere length (μm; SL), measured on samples of the m. longissimus lumborum 24 hrs post mortem as a consequence of conventional (4 °C, air velocity 0.5 m/s) and forced chilling (-5 °C, 120 min, or -30 °C, 30 min) with air velocities 1, 2 and 4 m/s.

	conventional chilling		forced chilling				
	4 °C, 0.5 m/s		m/s	-5 °C, 120 min		-30 °C, 30 min	
	mean	s.e.		mean	s.e.	mean	s.e.
FP	29.7	2.4	1	25.8	4.7	33.9	4.6
			2	23.7	4.8	28.0	4.6
			4	21.0	4.6	28.3	4.6
W-B	36.1	1.1	1	37.6	1.8	39.1	1.8
			2	34.0	1.8	35.5	1.8
			4	38.4	1.8	39.9	1.8 ($P < .05$)
SL	1.71	0.02	1	1.70	0.03	1.70	0.03
			2	1.70	0.03	1.67	0.03
			4	1.66	0.04	1.65	0.03

As a standard example, this publication uses following conditions: a body cools from 40°C in an environment of 0°C at a heat transfer rate of 100 W/m²K.
All variables are as mentioned below:

T_b	=	40°C	c	=	3360 J/kgK	Bi	=	5
T_i	=	0°C	ρ	=	1050 kg/m²	τ	=	45.8 min
d	=	0,025 m	α	=	100 W/m²K	j_k	=	1.313
λ	=	0,5 W/mK				j_o	=	0,375

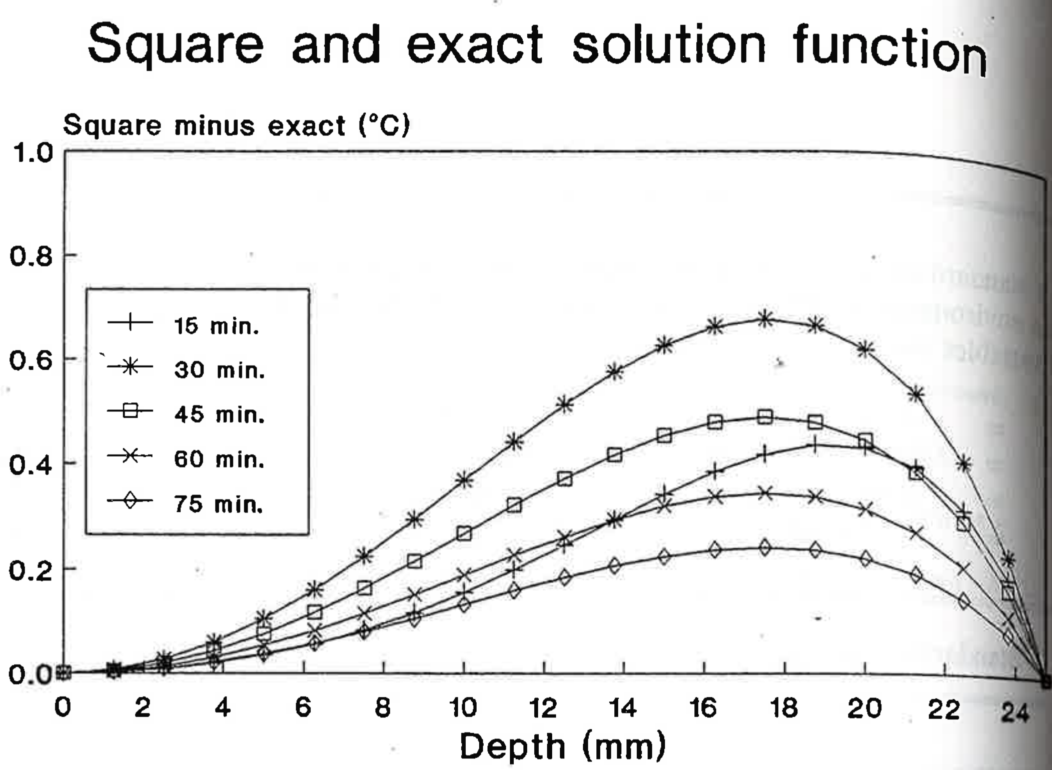
Fig. 1 Standard cooling process



"Temperature in an infinite slab".

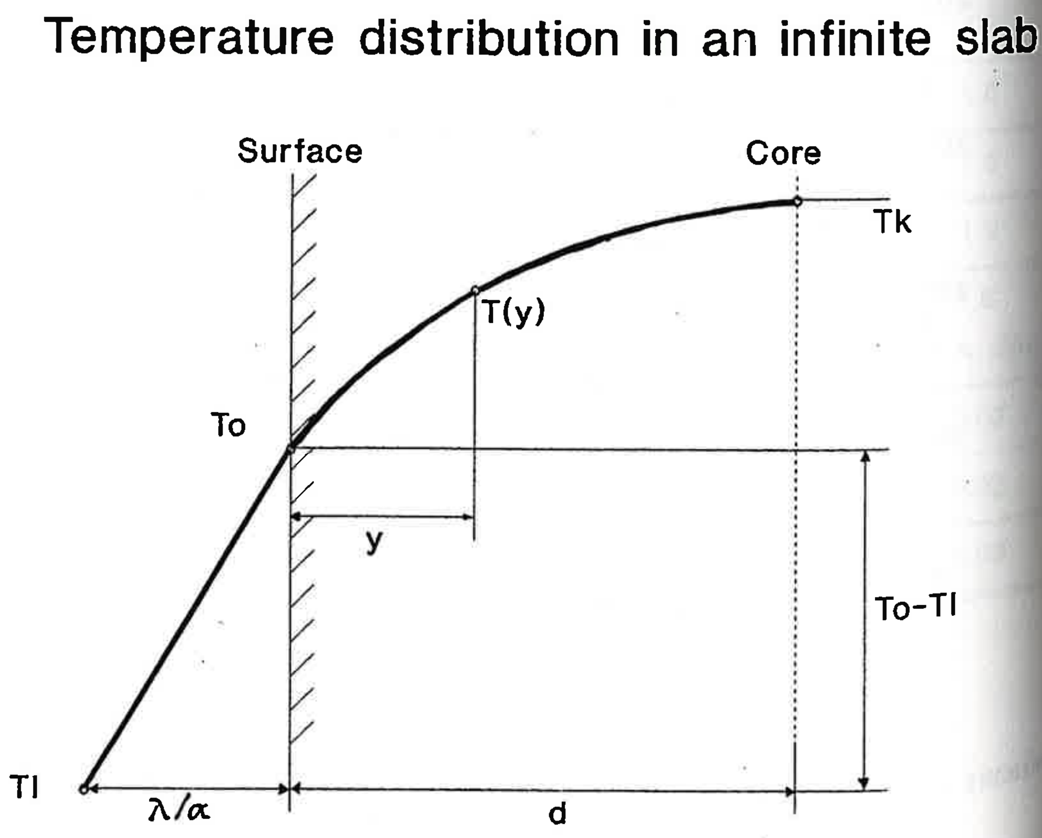
Fig. 2

As a function of depth at the standard process the exact temperature distribution is compared with the square profile.



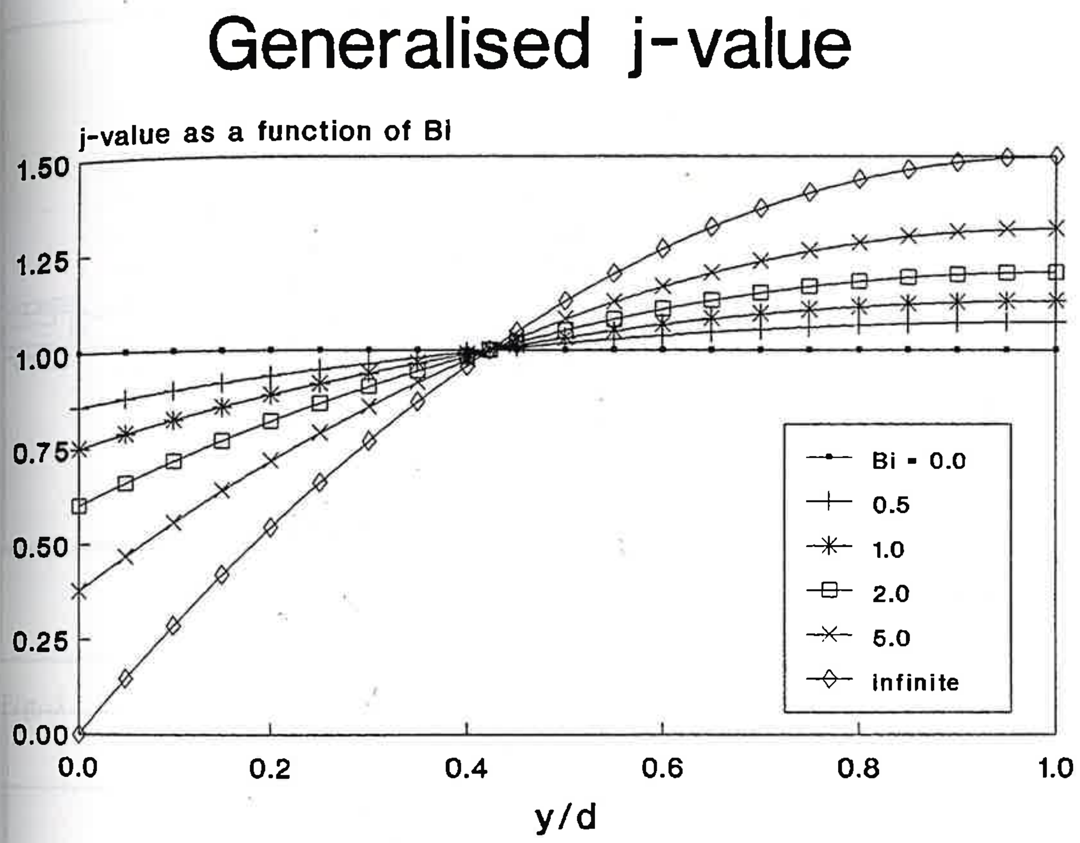
"Square and exact solution function".

Fig. 3 As a function of depth the temperature difference between exact and square distribution is given at standard conditions (fig. 1). No difference exceeds 0.8°C.



"Temperature distribution in an infinite slab".

Fig. 4 At a certain cooling time the temperature distribution is given.



"Generalized j-value".

Fig. 5

From this figure the generalized j-value can be taken as a function of depth at typical Bi-values.

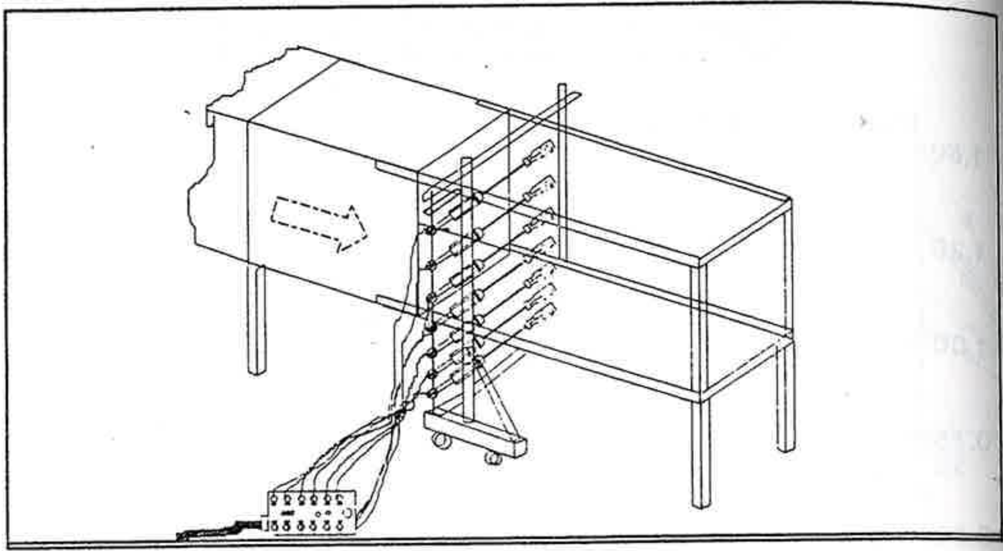


Fig. 1

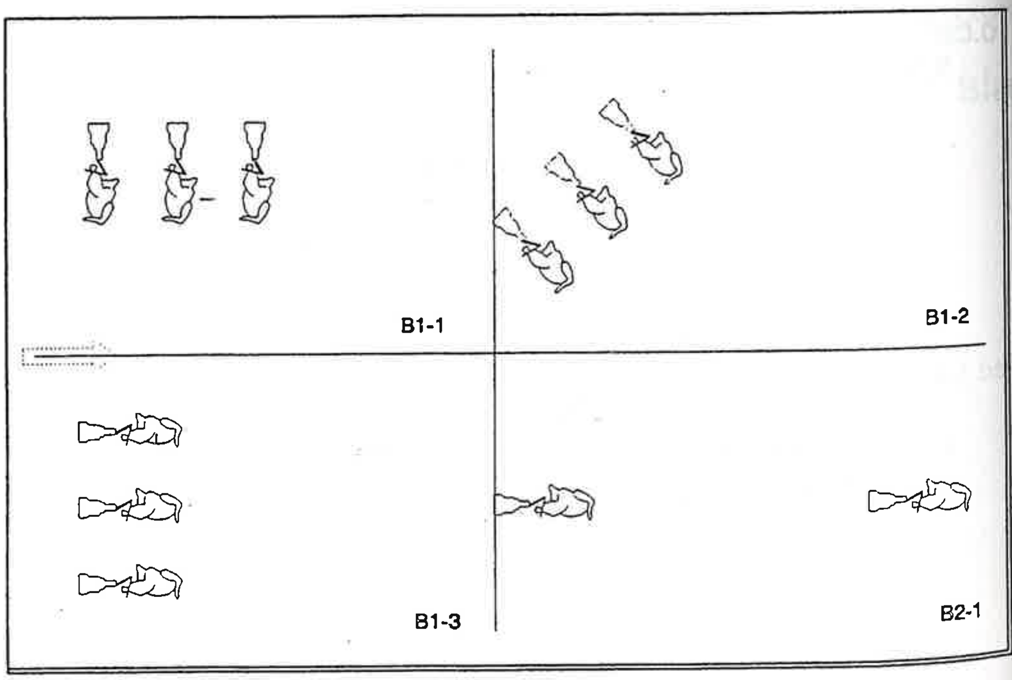


Fig. 2

Fig. 1 and 2: The measuring section of the windtunnel. Carcass positions in the windtunnel, flow direction from left to right.

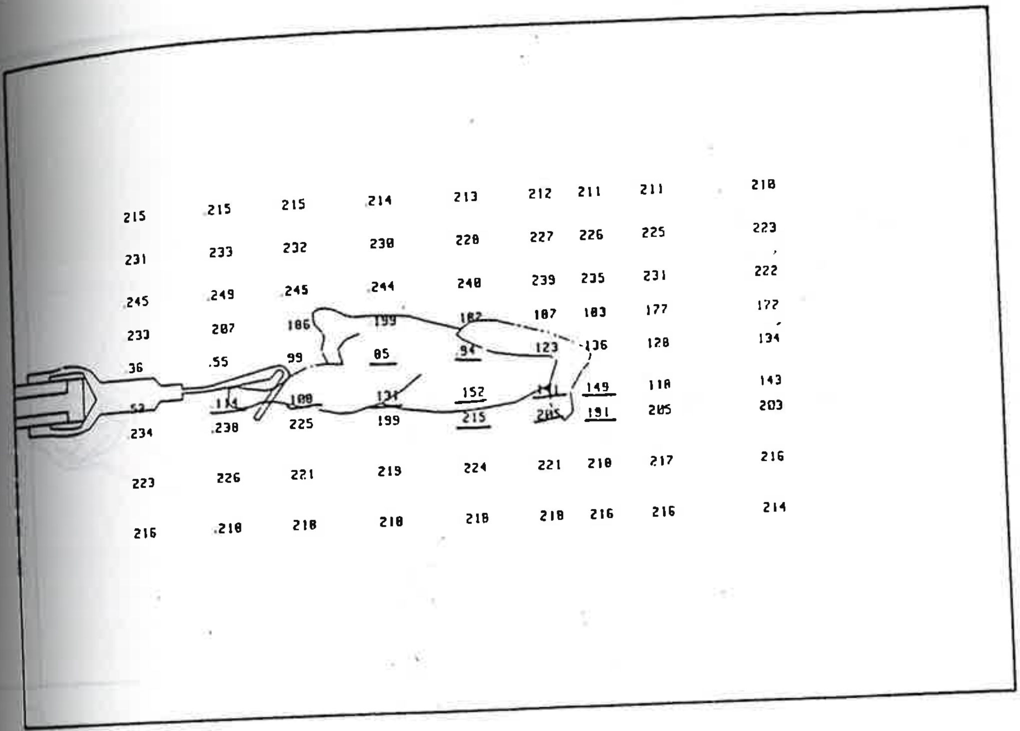


Fig. 3

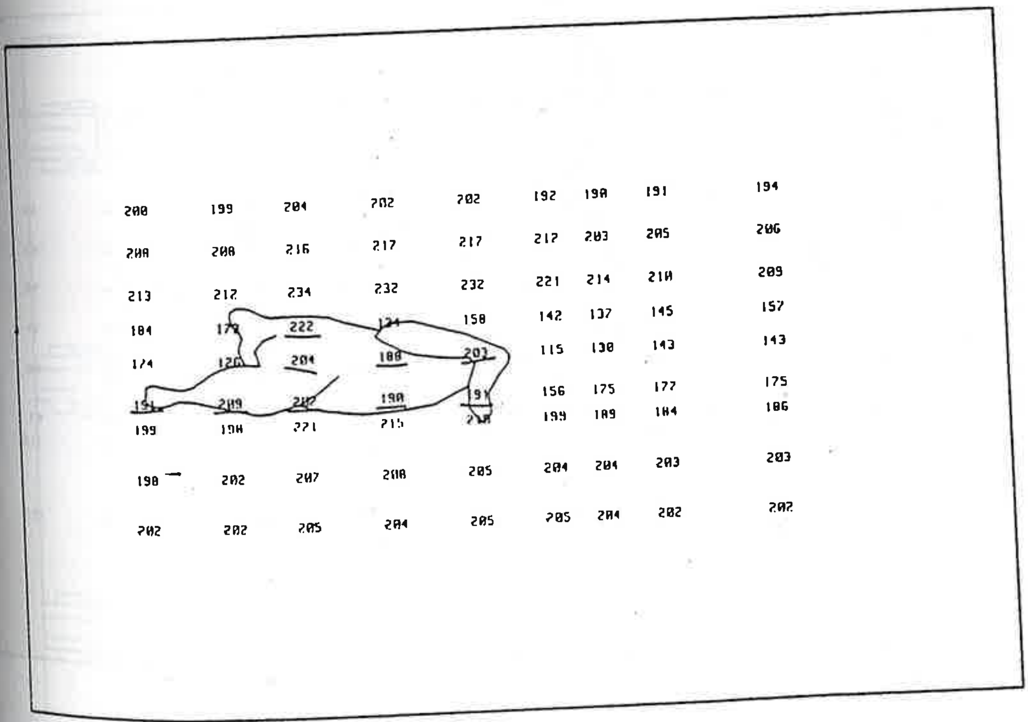


Fig. 4

Fig. 3 and 4: Velocity measurements parallel flow, with and without the suspension hook. Velocity in cm/s, flow direction from left to right.

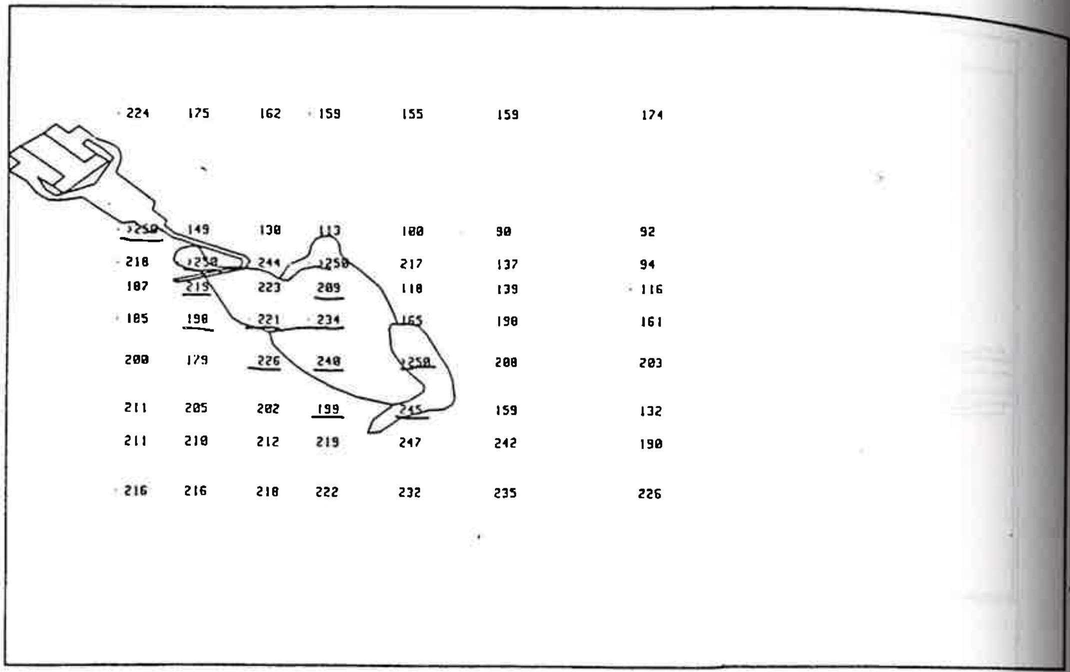


Fig. 5

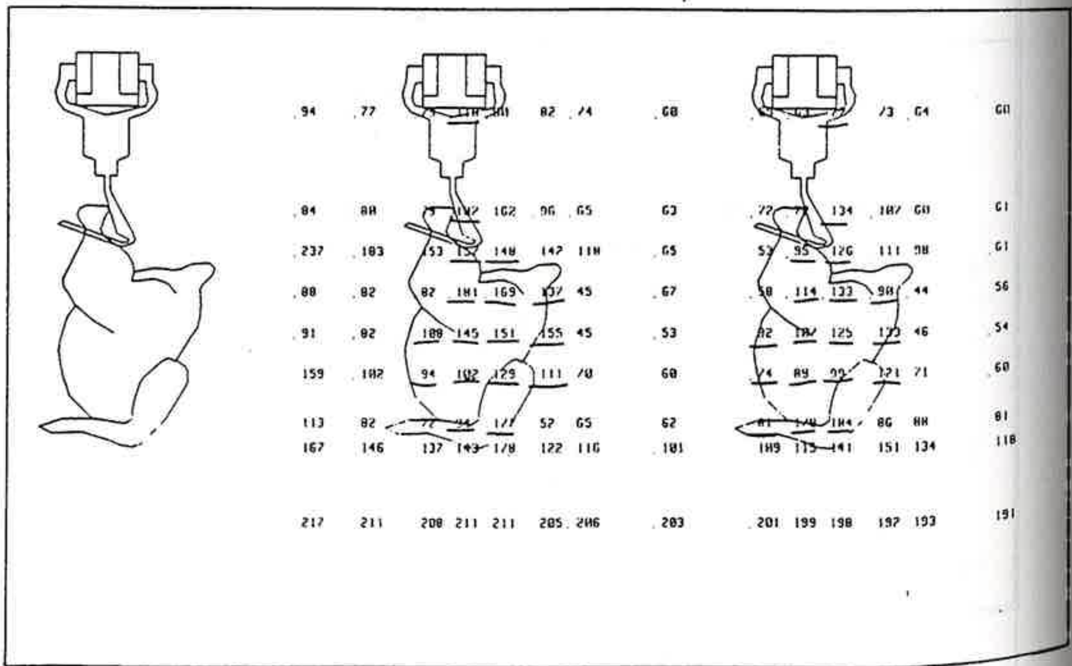


Fig. 6

Fig. 5 and 6: Velocity measurements single and multiple carcass. Velocity in cm/s, flow direction from left to right.

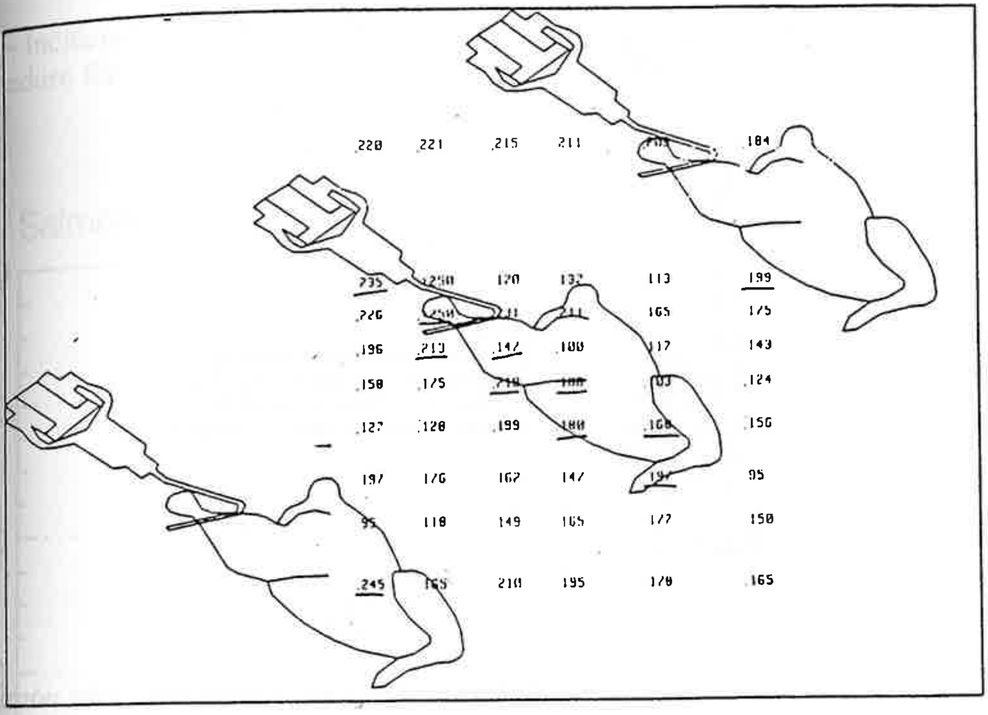


Fig. 7

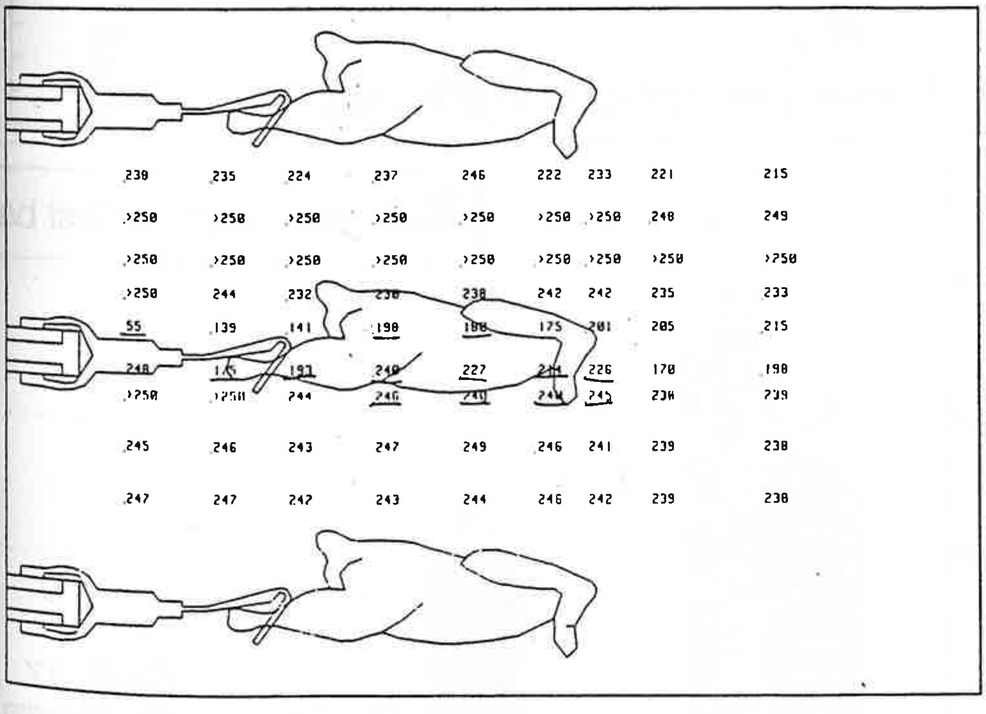


Fig. 8

Fig. 7 and 8: Velocity measurements multiple carcasses. Velocity in cm/s, flow direction from left to right.

Figure 1 – Sampling from the carcasses

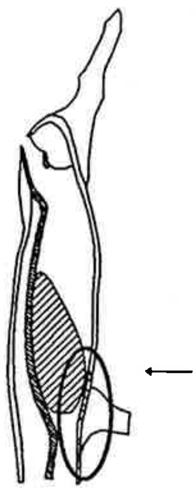


Figure 1.

Figure 2 – Incidence of Yersinia enterocolitica 0:3 for 3 measuring points for normal slaughter (control) and new procedure for pluck set removal.

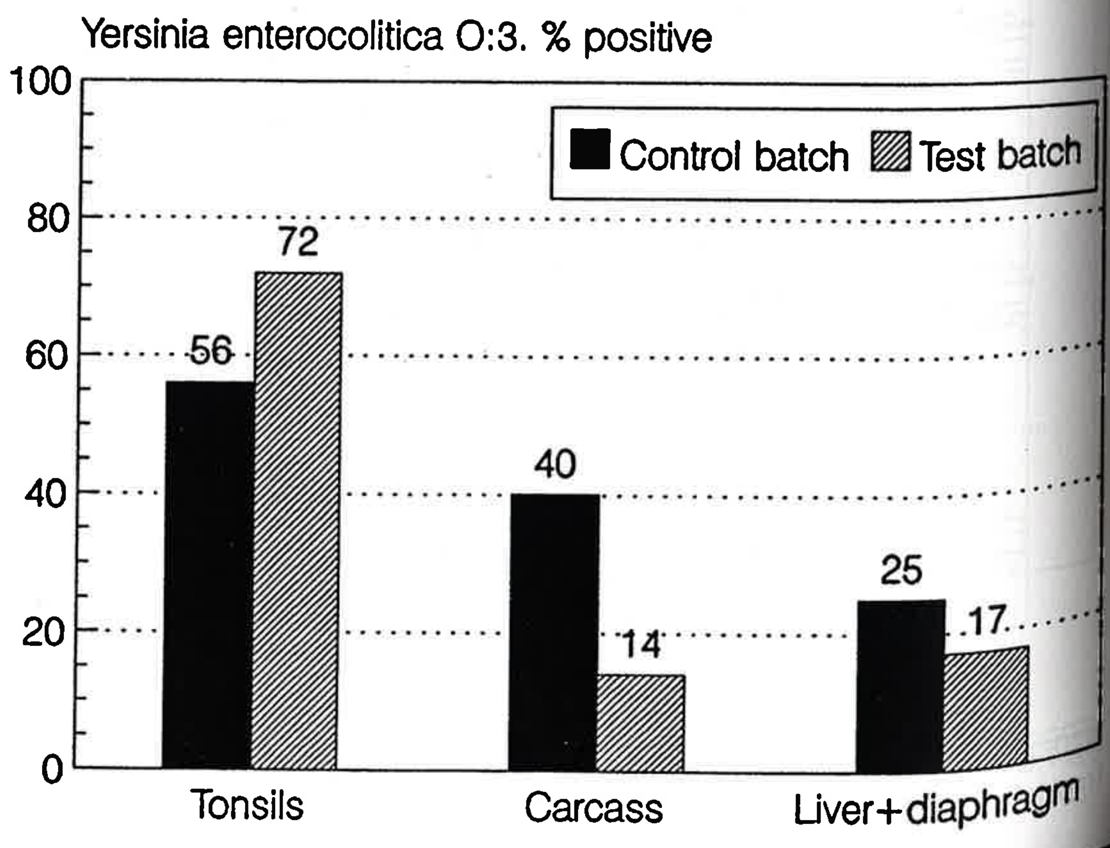


Figure 3 - Incidence of Salmonella Sp. for 3 measuring points for normal slaughter (control) and new procedure for pluck set removal.

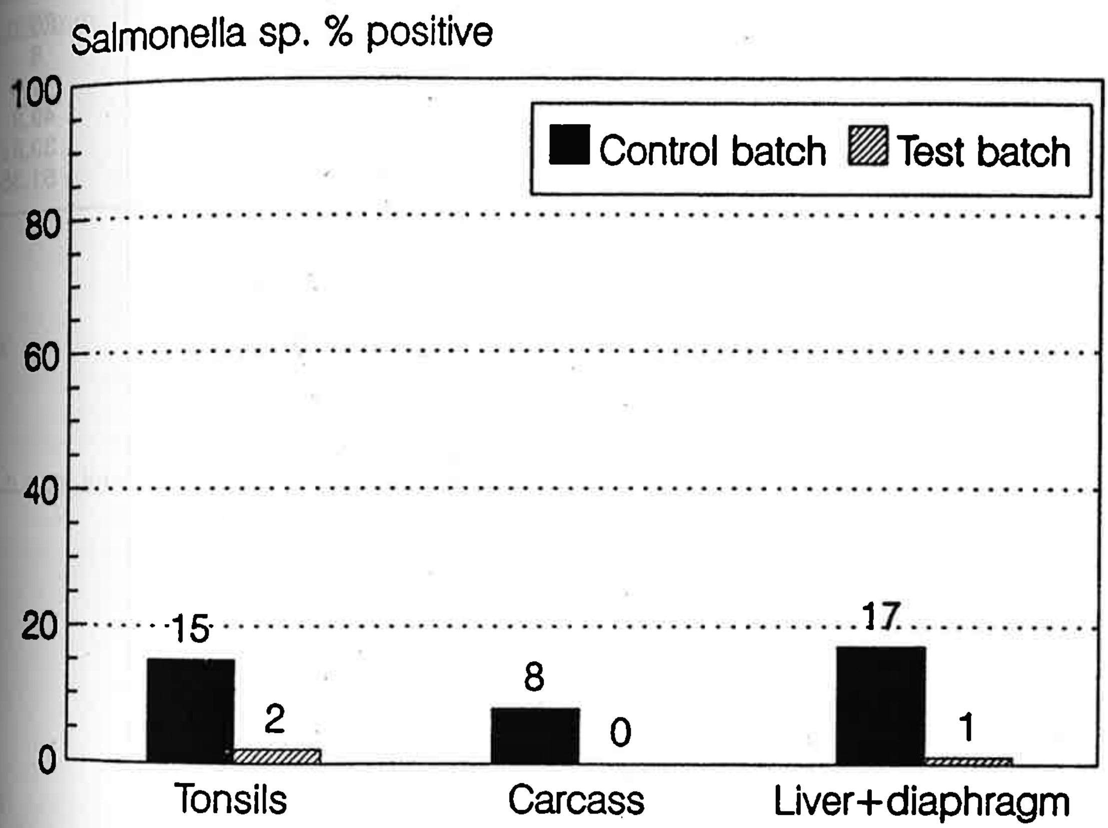


Table I : sample size and means of predictors, lean content and concomitant variables

MEMBER STATE	VARIABLE	OVERALL	GILTS	BARROWS	BOARS
SPAIN	N	120	61	34	25
	n	30	15	9	6
	X4 FOM	17,8	16,4	19,4	19,0
	X5 FOM	51,2	52,1	51,0	49,3
	Z	40,71	41,53	39,91	39,81
	Y	54,68	57,01	53,02	51,35
THE NETHERLANDS	N	200	100	100	
	n	50	24	26	
	X4 HGP	19,2	18,5	19,9	
	X5 HGP	52,7	53,6	51,9	
	Z	54,05	55,08	53,02	
	Y	53,97	55,51	52,55	
FRANCE	N	113	58	55	
	n	31	17	14	
	X4 ELT	17,5	15,3	19,7	
	X5 ELT	53,6	55,1	52,0	
	Z	64,15	66,11	62,07	
	Y	53,82	55,78	51,45	
FRANCE Mid-line	N	120	60	60	
	n	32	17	15	
	G REG	18,5	15,9	21,0	
	M REG	68,4	70,1	66,7	
	Z	64,09	66,23	61,95	
	Y	53,61	55,78	51,15	

N = Sample size
n = Sub-sample size
X4 = Fat depth at 3/4 last rib (mm)
X5 = Muscle depth at 3/4 last rib (mm)
G = Minimal fat depth over the gluteus medius (mm)
M = Minimal lumbar muscle depth under the gluteus medius (mm)
HGP = Hennessy Grading Probe
ELT = Endoscope 5 000
REG = Rule
FOM = Fat O'Meater
Z = Concomitant variable in double regression (%)
Y = Lean content (%)

Table 1. Means and standard deviations for colour characteristics of six muscles at 45 min p.m., 24 h p.m. after fresh cut and 24 h p.m. (same cut) after 1 h blooming.

Muscle[A]	L^*	a^*	b^*
	mean ± s.d.	mean ± s.d.	mean ± s.d.
45 min p.m.			
PP	29.99 ± 3.73[a]	11.82 ± 1.15[a]	7.61 ± 1.34[a]
TB	28.12 ± 3.35[b]	11.28 ± 1.43[b]	6.59 ± 1.51[b]
RA	29.53 ± 3.22[a]	11.23 ± 1.23[b]	5.96 ± 1.87[cd]
LD	27.43 ± 3.69[bc]	9.77 ± 1.56	5.71 ± 1.71[c]
GM	26.71 ± 3.91[c]	10.86 ± 1.06[b]	6.42 ± 1.22[bd]
ST	33.06 ± 5.40[d]	11.97 ± 1.56[a]	9.50 ± 2.43[e]
24 h p.m. immediately after a fresh cut			
PP	33.40 ± 4.64[a]	13.88 ± 2.02[ab]	11.41 ± 2.67[a]
TB	30.78 ± 4.46[b]	14.67 ± 1.54[cd]	11.78 ± 2.08[a]
RA	33.38 ± 3.37[a]	15.10 ± 1.65[d]	12.89 ± 1.78[b]
LD	31.20 ± 4.37[b]	13.34 ± 1.56[a]	10.60 ± 2.05[c]
GM	30.73 ± 3.63[b]	14.36 ± 1.79[bc]	11.30 ± 2.24[a]
ST	36.85 ± 5.75[c]	13.35 ± 1.67[a]	13.13 ± 2.12[b]
24 h p.m. (same cut) after 1 h blooming			
PP	33.99 ± 6.19[a]	18.11 ± 1.72[a]	14.08 ± 2.40[a]
TB	31.22 ± 4.52[b]	18.72 ± 1.85[c]	14.54 ± 2.09[a]
RA	34.23 ± 6.03[a]	20.16 ± 2.63[b]	16.11 ± 2.47[b]
LD	32.24 ± 4.96[b]	18.55 ± 2.15[ab]	14.17 ± 2.51[a]
GM	32.21 ± 4.80[b]	18.53 ± 1.93[ab]	13.93 ± 2.33[a]
ST	37.68 ± 6.48[c]	18.89 ± 2.13[b]	16.82 ± 2.41[b]

[abcde]Means in the same column and same time p.m. with different letters differ significantly ($P < 0.05$).

[A]Muscles are semitendinosus (ST), gluteus medius (GM), longissimus dorsi (thoracic part) (LD), rectus abdominis (RA), triceps brachii (caput longum) (TB) and pectoralis profundus (PP).

Table 2. Correlation coefficients between CIELAB-values at 45 min p.m. and CIELAB-values at 24 h p.m. after a fresh cut (1) and after 1 h blooming (2).

Muscle[A]	L*		a*		b*	
	1	2	1	2	1	2
PP	0.75	0.71	0.50	0.44	0.59	0.62
TB	0.82	0.70	0.26	0.18	0.22	0.26
RA	0.72	0.65	0.17	0.16	0.25	0.23
GM	0.81	0.76	0.08	-0.03	0.37	0.28
LD	0.77	0.71	0.30	0.13	0.70	0.62
ST	0.89	0.90	-0.18	-0.20	0.29	0.27

[A]For abbreviations of the muscles see Table 1.

Table 3. Correlation coefficients between CIELAB-values of PP and the other muscles.

Muscle[A]	L^*	a^*	b^*
45 min p.m.			
TB	0.84	0.58	0.73
RA	0.64	0.37	0.66
LD	0.86	0.55	0.68
GM	0.80	0.40	0.57
ST	0.71	0.42	0.59
24 h p.m. immediately after fresh cut			
TB	0.74	0.69	0.70
RA	0.75	0.34	0.61
LD	0.84	0.77	0.78
GM	0.73	0.65	0.71
ST	0.67	0.60	0.86
24 h p.m. (same cut) after 1 h blooming			
TB	0.81	0.57	0.63
RA	0.79	0.46	0.54
LD	0.85	0.51	0.66
GM	0.84	0.50	0.61
ST	0.89	0.61	0.62

[A]For abbreviations of the muscles see Table 1.

Table 1. Ultrasonic backfat thickness (in mm) at various positions cranial from last rib (LR) onwards at 6 cm off the midline as measured by the Renco LM (n = 86).

Position	Backfat depth	s.d.	
LR	9,62	1,82	
4LR	9,49	1,76	
6LR	9,57	1,73	
8LR	9,78	1,74	
10LR	9,81	1,89	
12LR	10,16	2,10	
14LR	10,56	2,25	
16LR	11,20	2,37	
18LR	11,41	2,56	
20LR	11,44	2,31	(n = 18)
22LR	12,42	2,98	
26LR	12,50	2,68	(n = 18)
50 % TE*	10,95	2,46	

* 50 % of the length between implantation of the tail and a position just between the ear bases.

Table 2. Correlation coefficients between pairs of backfat thickness and Renco LM and HGP measurements.

Positions	14LR	16LR	HGP backfat	HGP % lean meat
5LR	0,88	0,90	0,84	-0,75
7LR	0,91	0,90	0,85	-0,79
9LR	0,93	0,92	0,87	-0,81
11LR	0,94	0,94	0,89	-0,83
13LR	0,98	0,94	0,88	-0,84
15LR	0,98	0,98	0,88	-0,84
17LR	0,94	0,98	0,89	-0,86
50 % TE	0,93	0,95	0,88	-0,83

```
22    20    18    16       14     12     10      8      6      4            LR
*-----*-----*------* + -----*------*------*------*------*------*------------*
                  50 %

         -0,86          -0,84         -0,81         -0,75
         *------*       *------*      *------*      *------*

              -0,84          -0,83         -0,79
              *------*       *------*      *------*

              -0,83
       50 %   *------*
```

1. Correlation coefficients between pairs of Renco measurements of backfat depth and HGP lean meat percentage.

```
                           50 %            58,2 cm              TI
Live animal                *------------------------------------------*

                                  LR       42,9 cm              TI
Live animal                       *-----------------------------------*

                                  LR       34,0 cm         ti   TI
Carcass                           *-----------------------------*-----*
                                                               8,9 cm

                               lr LR       37,1 cm         ti
Carcass                        *--*-----------------------------*
                               3,1 cm

                     3/4 last rib          49,4 cm         ti
Carcass                    *------------------------------------*
```

implantation of the tail, live animal
marking opposite last rib, live animal
implantation of the tail, carcass
last rib, carcass

2. Conformity between measurements at the live animal and at the carcass.

INSTRUMENT	MEASUREMENT PLACE		5 cm	6 cm	7 cm	8 cm
ULTRA-FOM	3/4 rib	thickness of fat	- 0.6906	-0.7318	-0.7313	-0.7661
		thickness of muscle	0.1415	0.0840	0.1117	0.0581
	th last rib	thickness of fat	- 0.7696	-0.7800	-0.7310	-0.6582
		thickness of muscle	0.2785	0.2723	0.1213	0.1706
	3/4 lumbar ring	thickness of fat	- 0.6047	-0.6447	-0.6452	-0.5911
		thickness of muscle	0.3040	0.3895	0.2465	0.1925
PG - 200	3/4 rib	thickness of fat	- 0.7886	-7895	-0.6305	-0.7719
		thickness of muscle	0.2802	0.2227	0.2415	0.2141
	the last rib	thickness of fat	-0.7440	-0.7912	-0.7163	-0.6595
		thickness of muscle	0.3746	0.2539	0.1195	0.2242
	3/4 lumbar ring	thickness of fat	-0.7769	-0.6193	-0.6535	-0.6535
		thickness of muscle	0.0159	0.0343	0.0529	0.0856

Table 1. Coefficients of single correlation between fat thickness and LD muscle thickness measured by the ULTRA-FOM and PG-200 devices.

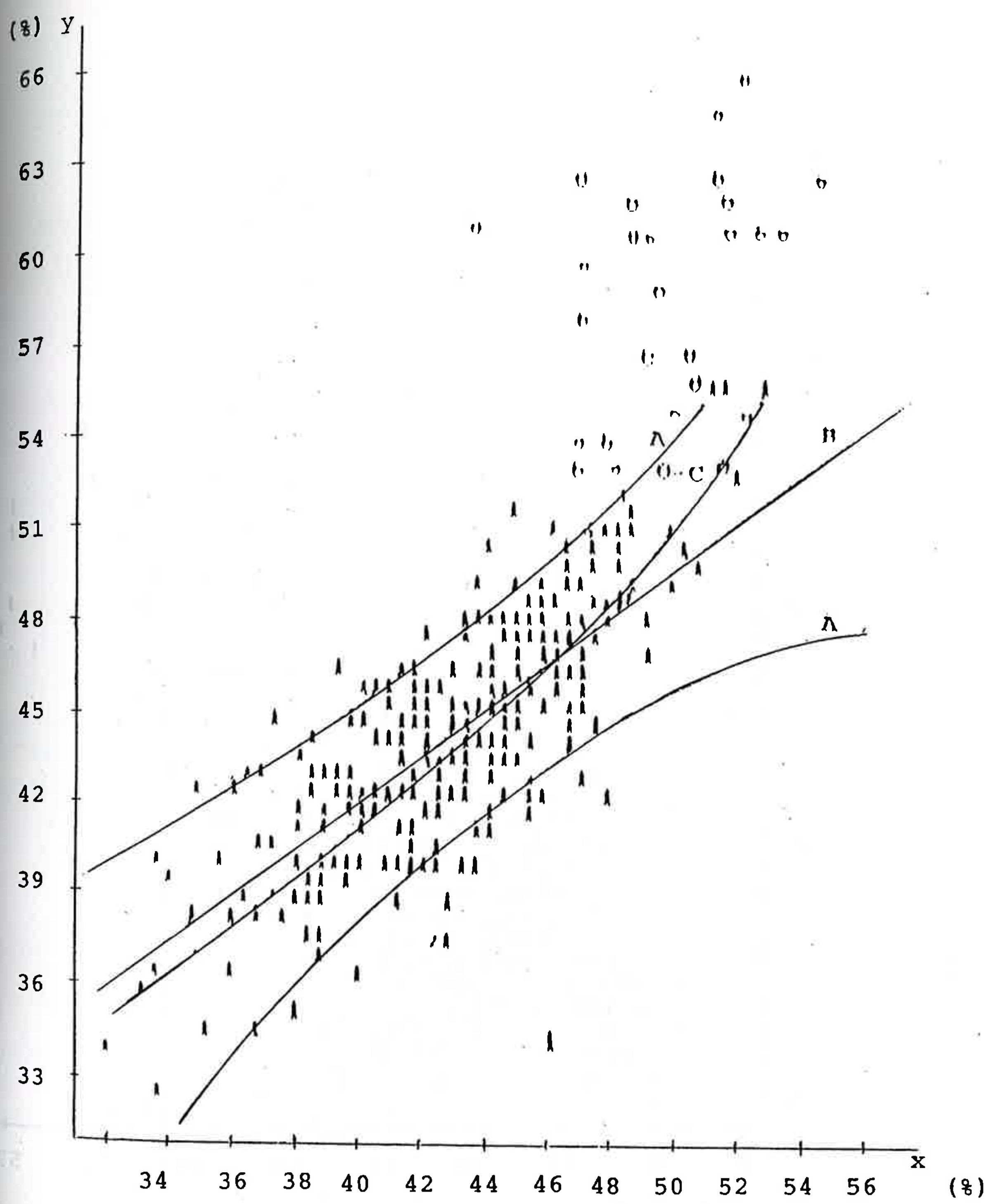


Fig.1. Comparison of estimated % content of meat with values achieved in result of dissection (y) using the regression equation nr 1 (x)

A - confidence curves

B - relationship by equation for ULTRA-FOM device

C - hipotetic curve of the best estimation of meatness

∧ - carcasses form industry

o - high-meat carcasses from pedigree breeding

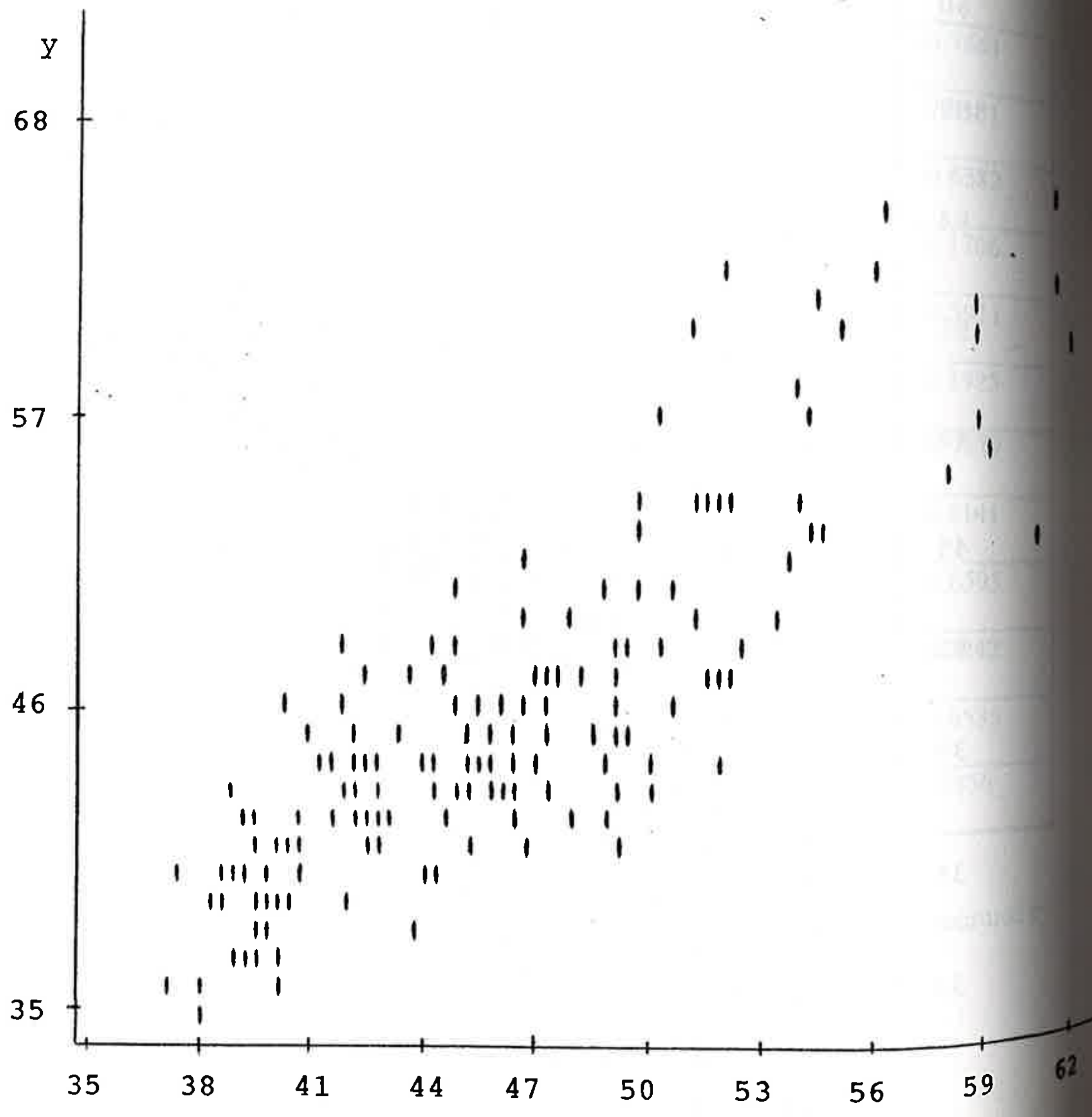


Fig.2. The diagnostic diagram of the regression equation nr 3.

x - observations

y - values form the regression equation

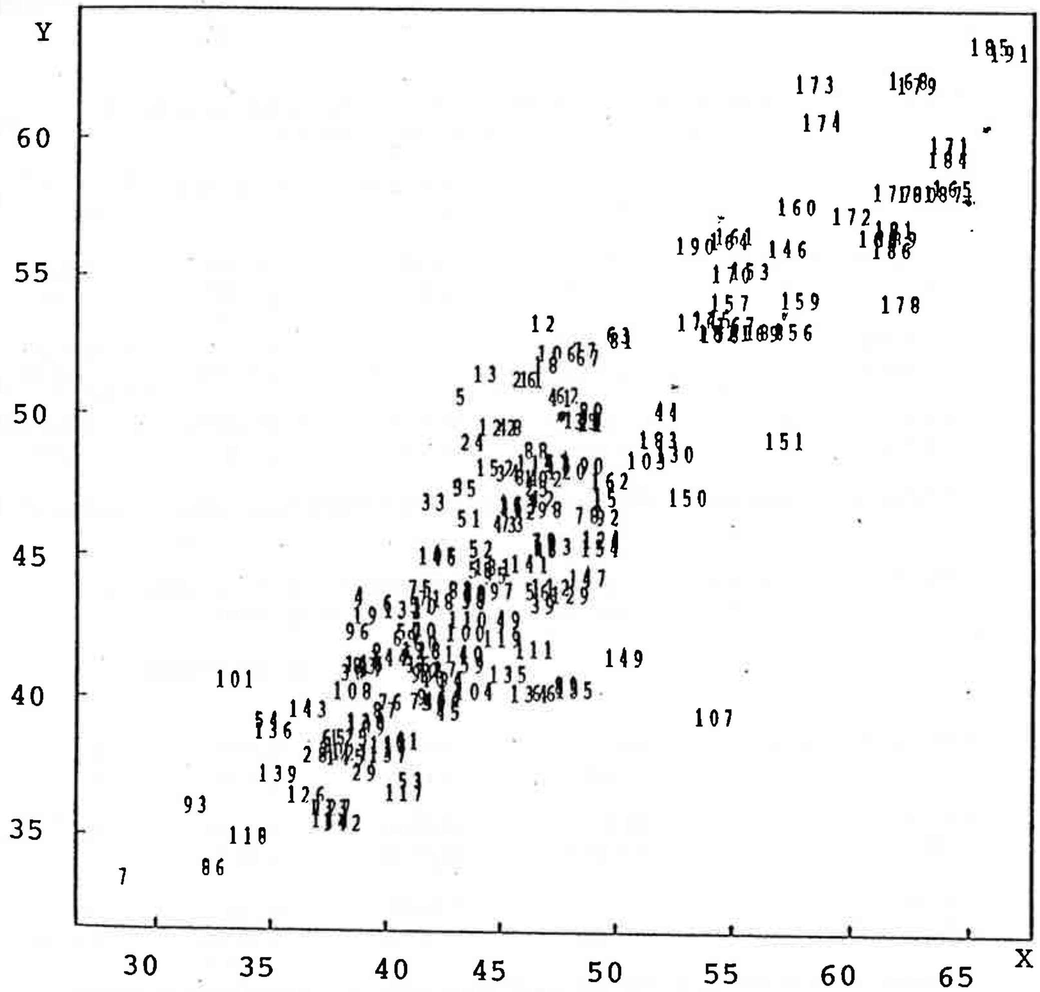


Fig.3. The diagnostic diagram of the regression equation nr 4

x - observations

y - values form the regression equation

Table 1: Results of multifactorial analyses of variance on various parameters measured: main factors

Parameter	Significance level (P) of the main factors				
	Age class	Fat class	Mass group	Ageing (d)	Muscle
Sensory tender	0,0001	0,5749	0,5018	0,2691	0,0001
Shear force	0,0001	0,4651	0,3573	0,0082	0,0001
Collagen sol.	0,0001	0,0041	0,2115	0,5239	0,0006

Table 2a. Mean values and standard deviations of the various parameters of the M. biceps femoris as influenced by age class

Parameter	Age class (permanent incisors)				
	0	2	4	6	8
Sensory tenderness score	5,76[a] ±1,10	4,60[b] ±1,30	4,49[bc] ±1,32	4,33[c] ±1,44	3,84[d] ±1,42
Shear force (N/25 mm)	107,49[a] ±13,69	134,05[b] ±25,90	136,72[b] ±24,18	161,37[c] ±34,76	191,52[d] ±42,59
Collagen solubility (%)	22,60[a] ±9,34	13,83[b] ±6,15	16,36[b] ±9,81	9,94[c] ±4,34	7,63[c] ±4,57

[abcd] Mean values in rows with different superscripts within each major factor group differ P≤0,05

Table 2b. Mean values and standard deviations of the various parameters of the M. longissimus thoracis as influenced by age class

Parameter	Age class (permanent incisors)				
	0	2	4	6	8
Sensory tenderness score	5,79[a] ±1,31	5,43[b] ±1,24	5,30[bc] ±1,11	5,24[cd] ±1,25	5,08[d] ±1,19
Shear force (N/25 mm)	99,06[a] ±23,54	100,55[a] ±23,66	102,98[a] ±17,54	99,59[a] ±23,37	99,74[a] ±18,30
Collagen solubility (%)	24,11[a] ±14,55	19,08[ab] ±12,58	20,44[a] ±14,55	14,35[b] ±8,29	9,17[c] ±5,03

[abcd] Mean values in rows with different superscripts within each major factor group differ P≤0,05

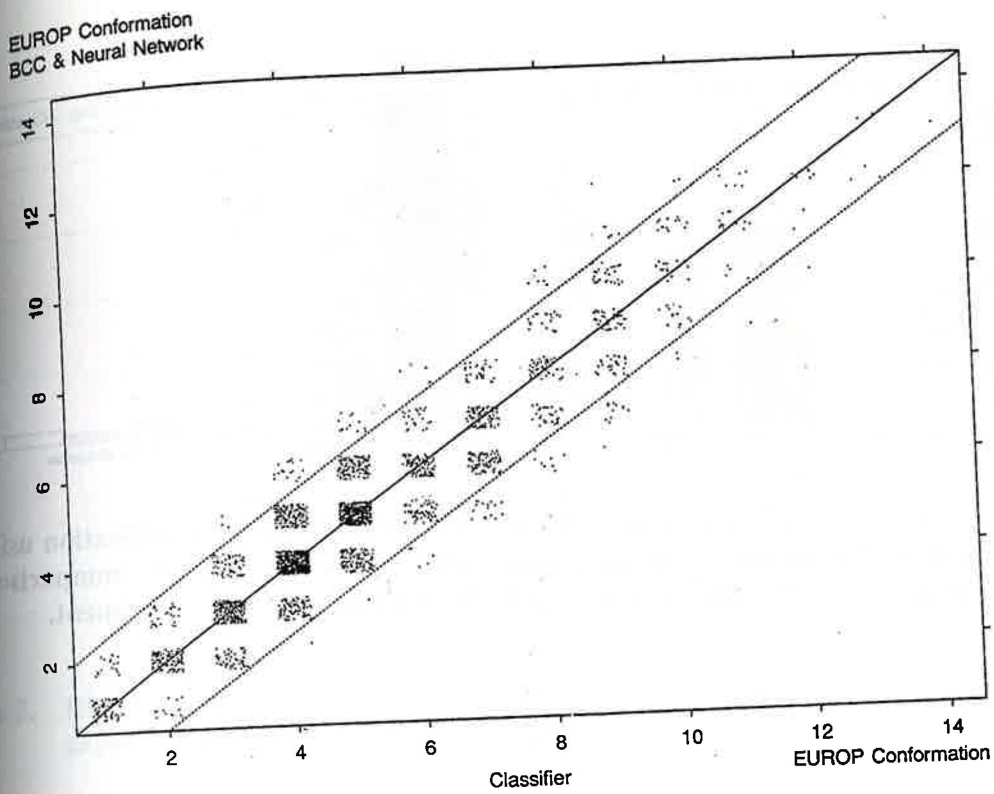


Figure 1. **Relation between EUROP conformation determined by slaughterhouse classifier or BCC using neural networks on 2810 carcasses in 1993**

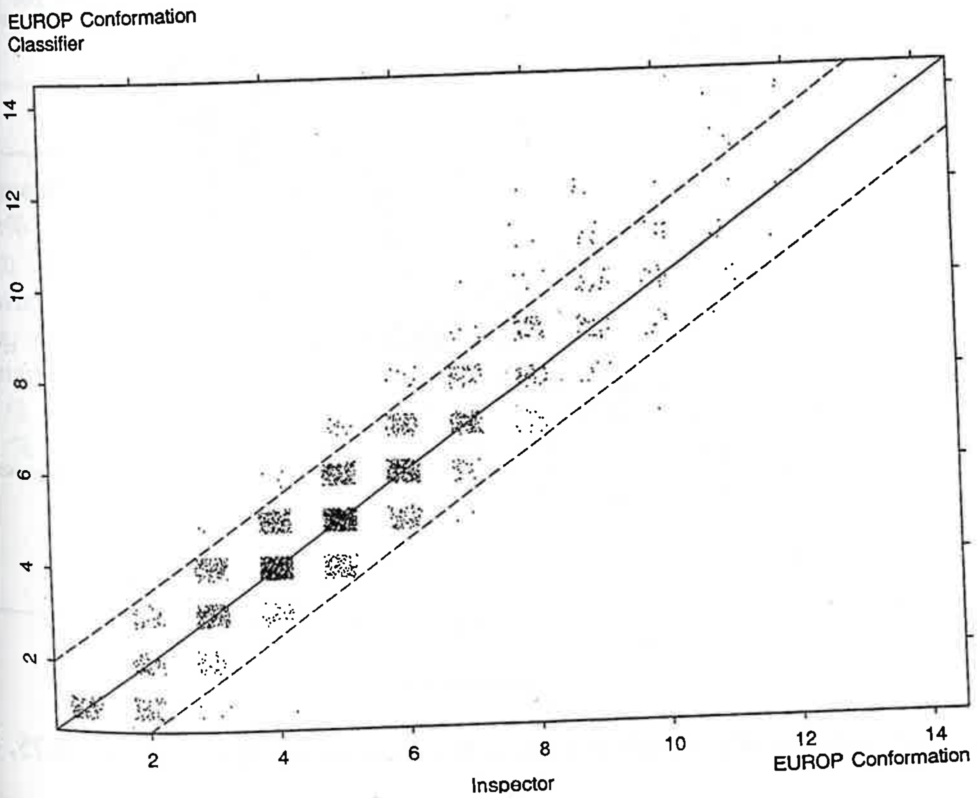


Figure 2. **Relation between EUROP conformation determined by classification inspector or slaughterhouse classifier on 2481 carcasses in 1990**

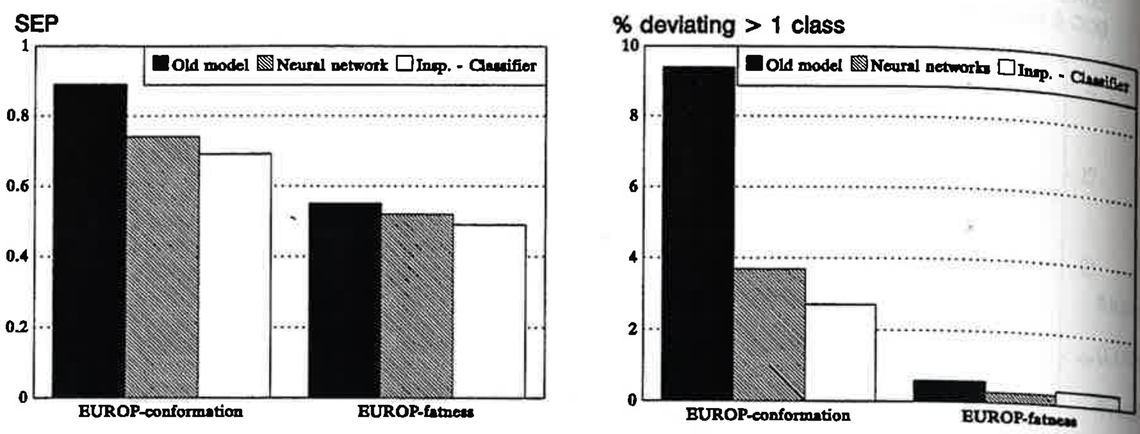


Figure 3. **SEP, and % deviating more than 1 class for EUROP classification using either the old model or the neural network in the BCC, for comparison inspector – classifier agreement is shown from a 1990 experiment.**

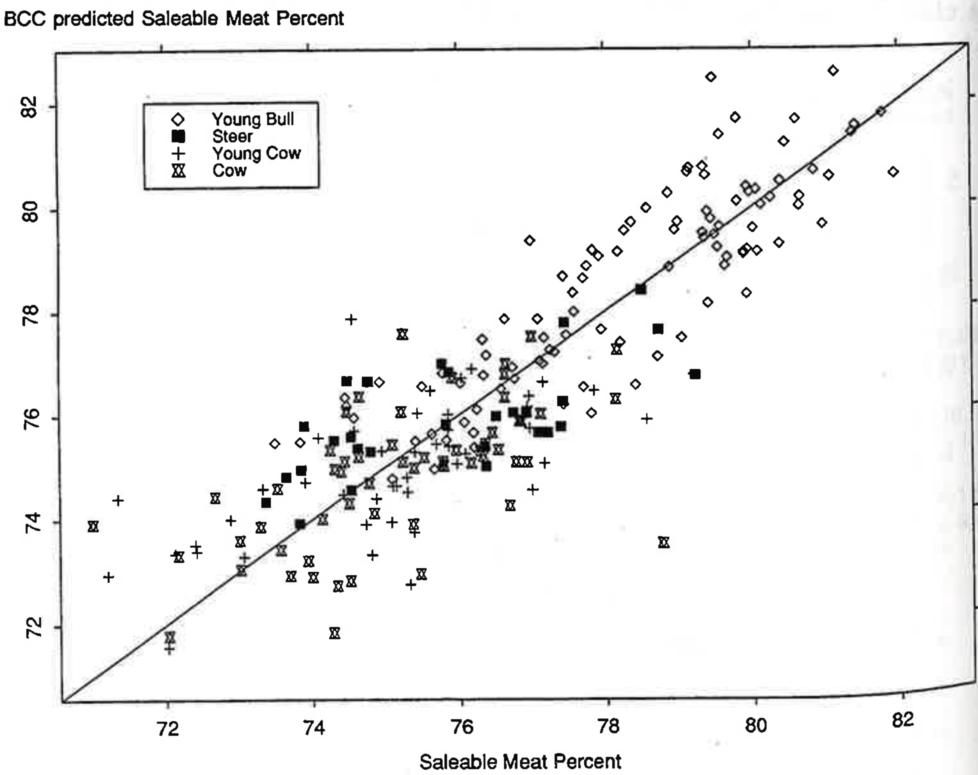


Figure 4. **Saleable meat% predicted for 230 carcasses by the BCC, R^2=0.75, SEP=1.23.**

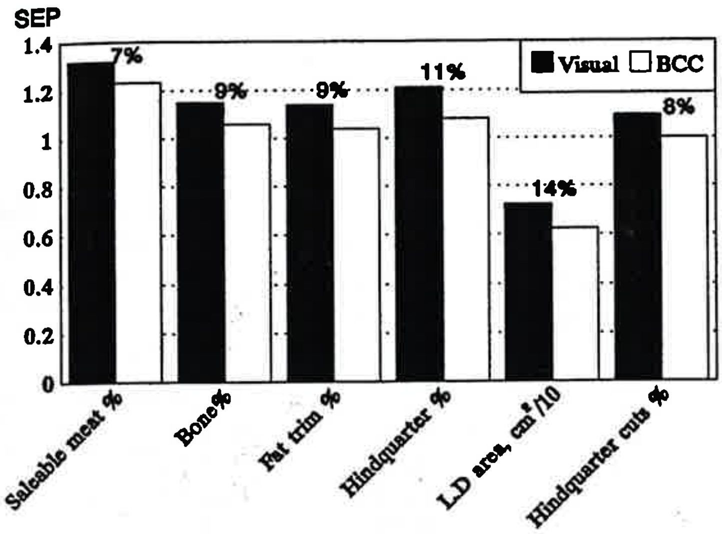


Figure 5. Differences in SEP for carcass composition determined by either neural networks in the BCC or from EUROP and weight.

Table 1. Carcass composition traits, means, standard deviation, SEP and R^2 from either visual or BCC model, BCC SEP advantage over visual classification %, n=230.

			EUROP		BCC		BCC advantage SEP, %
	Mean	Std.	SEP	R^2	SEP	R^2	
Saleable meat%	76.59	2.33	1.32	0.70	1.23	0.75	7
Bone%	17.83	2.33	1.15	0.77	1.06	0.82	9
Fat trim %	7,12	2.62	1.14	0.82	1.04	0.86	9
Hind quarter %	45.84	1.69	1.21	0.52	1.08	0.63	11
L.D.area, cm^2	61.37	12.53	7.24	0.68	6.26	0.78	14
Hind quarter cuts %	33.68	1.63	1.09	0.57	1.00	0.67	8
L.D. %	5.54	0.57	0.43	0.48	0.40	0.57	7

Table 1

Complex index of quality evalution of cattle

Sex	Age, months	Orientation of productivity		
		meat	combined	dairy
Heifers	12	0.683	0.679	0.616
	18	0.726	0.624	0.587
	24	0.811	0.690	0.711
	36	0.786	0.672	0.758
Bulls	12	0.747	0.663	0.551
	18	0.788	0.700	0.671
	24	0.805	0.775	0.765
	36	0.884	0.824	0.825
Steers	12	0.565	0.517	0.509
	18	0.606	0.484	0.622
	24	0.661	0.640	0.740
	36	0.720	0.743	0.743

Table 2

Complex index of quality evalution of pig carcasses

Sex	Age, months	Orientation of productivity		
		meat	universal	lard
Barrows	6	0.784	0.764	0.648
	7	0.777	0.761	0.625
	8	0.808	0.761	0.612
	9	0.807	0.767	0.610
Boars	6	0.782	0.762	0.637
	7	0.779	0.759	0.646
	8	0.793	0.780	0.636
	9	0.821	0.761	0.614
Gilts	6	0.790	0.761	0.601
	7	0.797	0.764	0.598
	8	0.825	0.756	0.593
	9	0.821	0.745	0.582

Table 1. Overall means (x), standard deviation (s), coefficients of variance (cv), for carcass measurements and tissue composition in cow carcasses.

TRAIT	RESULTS		
	x	s	cv, %
carcass weight, kg	262.28	38.72	14.8
kidney fat, %	2.76	0.89	32.2
TRADITIONAL MEASUREMENTS			
carcass length, cm	140.2	8.47	6.0
carcass width I, cm	65.4	3.48	5.3
carcass width II, cm	45.8	2.61	5.7
fat score	3.18	0.78	24.5
VISIONAL MEASUREMENTS			
carcass length, cm	248.5	9.00	3.6
maximal width, cm	67.73	4.41	6.5
minimal width, cm	42.48	4.01	9.4
meat area, %	52.09	11.66	22.4
TISSUE COMPOSITION			
meat, %	62.95	3.24	5.1
subcutaneous fat, %	5.50	1.80	32.7
intermuscular fat, %	9.82	2.57	26.1
total fat, %	15.32	4.20	27.4
bone, %	18.66	1.68	9.0

Table 2. Conformation indices for traditional and visional measurements of cow carcasses.

ITEM	RESULTS		
	x	s	cv, %
INDICES FOR TRADITONAL MEASUREMENTS			
carcass weight : length, kg/cm	1.865	0.208	11.2
carcass weight : width I, kg/cm	4.000	0.490	12.2
carcass weight : width II, kg/cm	5.750	0.820	14.3
INDICES FOR VISIONAL MEASUREMENTS			
carcass weight : length, kg/cm	1.053	0.144	13.7
carcass weight : max. width , kg/cm	3.860	0.420	10.9
carcass weight : min. width , kg/cm	6.190	0.760	12.2

Table 3. Simple correlation coefficients for traditional and visional measurements and conformation indices of cow carcasses.

TRADITONAL MEASUREMENTS	VISIONAL MEASUREMENTS AND INDICES		
	length	max. width	min. width
LINEAR MEASUREMENTS			
carcass length, cm	0.75**	0.71**	0.42*
carcass width I, cm	0.49*	0.81**	0.55**
carcass width II, cm	0.24	0.65**	0.54**
INDICES OF CONFORMATION			
carcass weight : length , kg/cm	0.97**	0.90**	0.69**
carcass weight : width I, kg/cm	0.93**	0.95**	0.77**
carcass weight : width II, kg/cm	0.90**	0.95**	0.82**

Table 4. Simple correlation coefficients among the various carcass measurements and tissue composition in cow carcasses.

ITEM	TISSUE COMPOSITION (%)				
	meat	subcutaneous fat	intermuscular fat	total fat	bone
TRADITIONAL MEASUREMENTS					
carcass length	- 0.38	0.29	0.47*	0.41*	- 0.37
carcass width I	- 0.40	0.19	0.44*	0.35	- 0.20
carcass width II	- 0.10	- 0.08	0.10	0.03	0.03
carcass weight : length	- 0.61**	0.72**	0.81**	0.80**	- 0.81**
carcass weight : width I	- 0.59**	0.77**	0.79**	0.81**	- 0.86**
carcass weight : width II	- 0.64**	0.75**	0.81**	0.82**	- 0.79**
fat score	- 0.62**	0.76**	0.73**	0.77**	- 0.73**
VISIONAL MEASUREMENTS					
carcass length	- 0.31	0.19	0.30	0.26	- 0.14
carcass maximal width	- 0.59**	0.43*	0.67**	0.59**	- 0.42*
carcass minimal width	- 0.43*	0.30	0.38	0.36	- 0.43*
carcass weight : length	- 0.62**	0.73**	0.81**	0.81**	- 0.82**
carcass weight : max width	- 0.52**	0.72**	0.72**	0.75**	- 0.84**
carcass weight : min width	- 0.44*	0.57**	0.52**	0.56**	- 0.59**
meat area %	0.65**	- 0.81**	- 0.72**	- 0.78**	0.68**

Correlations for $P < 0.05$ ($r > 0.41$) - *
Correlations for $P < 0.01$ ($r > 0.52$) - **

TABLE 1: THE SIX FAT CLASSES OF THE SOUTH AFRICAN BEEF CARCASS CLASSIFICATION SYSTEM (KLINGBIEL, 1984: CURRENT REGULATION AND PROPOSED REGULATION) AND NUMBER OF CARCASSES PER FAT CLASS

	SUBCUTANEOUS FAT RANGE (%)	
FAT CLASS	CURRENT REGULATION (n)	PROPOSED REGULATION
1	<3,58 (24)	1,1 - 3,6
2	3,64 - 4,66 (24)	3,7 - 5,6
3	4,71 - 5,73 (29)	5,7 - 7,6
4	5,78 - 6,81 (32)	7,7 - 9,6
5	6,86 - 8,42 (28)	9,7 - 11,6
6	>8,42 (25)	>11,6

TABLE 2: THE ACCURACY OF PREDICTING (R-SQAURED) CARCASS AND CUT (FORE QUARTER) COMPOSITION FROM THE SUBCUTANEOUS FAT (%) OF THE CARCASS

CUT (FQ)	MUSCLE (%)	TOTAL FAT (%)	BONE (%)	CUT (%)
NECK	48,6	54,8	10,0	0,0
CHUCK	0,0	0,0	0,0	0,0
SHOULDER	83,7	79,1	18,9	0,0
BRISKET	62,2	80,4	45,7	28,5
FORE SHIN	0,0	57,6	12,2	0,0
PRIME RIB	70,0	75,9	10,6	0,0
CARCASS	66,4	88,6	45,2	-

A-AGE GROUP

TABLE 3: THE ACCURACY OF PREDICTING (R-SQUARED) CUT COMPOSITION OF THE HIND- QUARTER FROM THE SUBCUTANEOUS FAT (%) OF THE CARCASS

CUT (HQ)	MUSCLE (%)	TOTAL FAT (%)	BONE (%)	CUT (%)
WING RIB	68,2	71,4	21,0	0,0
LOIN	73,9	81,7	17,4	0,0
RUMP	67,9	82,3	23,3	0,0
FILLET	0,0	0,0	-	17,0
THIN FLANK	67,1	67,1	8,1	61,2
TOPSIDE	50,5	61,7	0,0	27,3
SILVERSIDE	78,2	78,1	0,0	14,4
THICK FLANK	38,9	44,0	13,1	21,9
HINDSHIN	0,0	24,0	0,0	41,2

TABLE 4: THE MUSCLE (%) OF THE CARCASS AND PRIME RIB FOR THE SIX FAT CLASSES WITHIN THE THREE AGE CLASSES

	CARCASS			PRIME RIB		
FAT CLASS	A	B	C	A	B	C
1	71,71*	71,71	72,09	71,98	69,02	68,24
2	70,19	69,18	69,34	67,69	64,83	63,95
3	68,06	66,98	66,95	63,96	61,18	60,22
4	65,18	64,78	64,56	60,23	57,54	56,50
5	61,54	62,58	62,17	56,50	53,90	52,77
6	<59,55	<61,53	<61,04	<54,72	<52,16	<51,00

*- **PREDICTED VALUES:**

CARCASS A: $Y=72,23-0,09426X^2$

CARCASS B: $Y=74,29-1,099X$

CARCASS C: $Y=74,90-1,195X$

PRIME RIB A: $Y=76,37-1,866X$

PRIME RIB B: $Y=73,30-1,822X$

PRIME RIB C: $Y=72,62-1,864X$

TABLE 5: THE TOTAL CARCASS FAT (%) OF THE CARCASS AND PRIME RIB FOR THE SIX FAT CLASSES WITHIN THE THREE AGE CLASSES

	CARCASS			PRIME RIB		
FAT CLASS	A	B	C	A	B	C
1	8,42*	8,46	9,05	10,03	9,32	10,99
2	12,61	13,67	12,60	15,19	17,14	16,31
3	16,25	17,19	15,68	19,68	22,44	20,94
4	19,89	20,22	18,77	24,16	26,99	25,57
5	23,53	22,91	21,85	28,65	31,04	30,19
6	<25,26	<24,10	<23,32	<30,78	<32,82	<32,39

* **PREDICTED VALUES:**

CARCASS A: $Y=4,143+1,820x$

CARCASS B: $Y=8,346\sqrt{X}-4,33$

CARCASS C: $Y=5,43+1,542X$

PRIME RIB A: $Y=4,76+2,243X$

PRIME RIB B: $Y=12,55\sqrt{X}-9,92$

PRIME RIB C: $Y=5,55+2,314X$

TABLE 6: THE BONE (%) OF THE CARCASS AND PRIME RIB FOR THE SIX FAT CLASSES WITHIN THE THREE AGE GROUPS.

	CARCASS			PRIME RIB		
FAT CLASS	A(R2=45,2)*	B(R2=60,2)	#C(R2=34,1)*	A*	B*	C*
1	17,17	19,70	18,44	17,54	20,85	20,41
2	17,33	17,26	18,55	17,65	17,92	20,43
3	16,30	15,98	17,29	16,41	16,05	19,11
4	14,81	15,04	16,46	14,79	16,36	18,12
5	14,65	14,30	16,31	15,32	14,61	17,26
6	14,81	<14,00	16,69	15,70	17,06	17,50

* - AVERAGE VALUES (ANALYSIS OF VARIANCE; R-SQUARED OF REGRESSION < 50%)

\# - PREDICTED VALUES ($Y = 22,748 - 3,571 \ln X$)

TABLE 1 ESTIMATES OF CHILD (< 5 YEARS) MALNUTRITION IN VARIOUS REGIONS OF MALAWI.

DISTRICT	PERCENTAGE
Lilongwe Rural	36
Rumphi	38
Mzimba	55
Mulange	55
Zomba	55
Ntchisi	70

TABLE 2. PROXIMATE ANALYSIS OF MAIZE BRAN (MADEYA).

Dry Matter %	91.0
Crude Protein %	10.1
Ether Extract %	8.8
Crude Fibre %	7.0
Ash %	6.2
Nitrogen Free Extract %	59.0
Est. Metabolisable Energy (MJ/kg)	14.0

TABLE 3 COMPOSITION OF JOINTS: 1989 - 90 SLAUGHTERWEIGHT 5KG.

	LEAN(g)	FAT (g)	BONE(g)
Shoulder	139.5 ± 31	4.4 ± 4	94.1 ± 11
Foreleg	129.7 ± 28	4.7 ± 6	84.0 ± 21
B E Neck	39.0 ± 12	0.3 ± 0.6	40.4 ± 11
Loin	59.1 ± 13	4.5 ± 3	46.6 ± 12
Breast	86.9 ± 15	3.5 ± 2	20.3 ± 7
Hindle	282.3 ± 26	11.0 ± 9	129.6 ± 25
TOTAL	1156.0 ± 154	28.4 ± 16	414.9 ± 69

TABLE 4 COMPOSITION OF JOINTS 1989-90: SLAUGHTERWEIGHT 10KG

	LEAN(g)	FAT (g)	BONE(g)
Shoulder	231.5 ± 52	27.8 ± 17	155.4 ± 22
Foreleg	253.5 ± 36	50.7 ± 45	201.7 ± 35
B E Neck	66.2 ± 22	4.5 ± 6	69.8 ± 14
Loin	125.4 ± 32	8.0 ± 8	75.2 ± 11
Breast	91.5 ± 15	13.6 ± 13	30.4 ± 6
Hindleg	552.5 ± 68	26.6 ± 22	228.8 ± 30
TOTAL	1320.6 ± 173	131.1 ± 110	761.2 ± 52

TABLE 5 COMPOSITION OF JOINTS: 1989-90 SLAUGHTERWEIGHT 10KG

	LEAN(g)	FAT(g)	BONE(g)
Shoulder	326.5 ± 103	28.9 ± 7	174.7 ± 16
Foreleg	350.3 ± 53	38.9 ± 28	245.2 ± 20
B E Neck	101.5 ± 34	3.8 ± 2	72.4 ± 14
Loin	195.6 ± 34	6.8 ± 6	107.6 ± 36
Breast	124.9 ± 37	5.2 ± 3	39.6 ± 6
Hindleg	793.7 ± 92	42.3 ± 23	263.2 ± 41
TOTAL	1892.0 ± 241	125.9 ± 55	902.7 ± 94

TABLE 6 COMPOSITION OF JOINTS: 1989 - 90 SLAUGHTERWEIGHT 20KG

	LEAN(g)	FAT(g)	BONE(g)
Shoulder	528.4 ± 69	31.0 ± 17	259.1 ± 72
Foreleg	578.5 ± 96	32.3 ± 20	346.0 ± 60
B E Neck	163.8 ± 44	8.7 ± 1	114.2 ± 26
Loin	345.0 ± 107	9.8 ± 2	115.7 ± 38
Breast	197.2 ± 20	11.2 ± 1	69.1 ± 34
Hindleg	1208.0 ± 85	53.3 ± 27	441.9 ± 63
TOTAL	3021.0 ± 54	146.2 ± 41	1346.0 ± 20.9

TABLE 7 COMPOSITION OF JOINTS 1989 - 90: SLAUGHTERWEIGHT 25KG

	LEAN(g)	FAT (g)	BONE (g)
Shoulder	722.2 ± 56	24.5 ± 12	413.0 ± 63
Foreleg	695.2 ± 50	35.5 ± 8	370.9 ± 47
B E Neck	171.7 ± 9	14.1 ± 1	164.9 ± 25
Loin	329.9 ± 17	10.8 ± 4	149.8 ± 33
Breast	197.3 ± 46	23.9 ± 6	71.5 ± 16
Hindleg	1286.7 ± 88	38.5 ± 20	528.1 ± 59
TOTAL	3402.0 ± 148	147.3 ± 36	1698.1 ± 131

TABLE 8 ALLOMETRIC GROWTH CO-EFFICIENTS FOR JOINTS AND TISSUE

JOINTS	CO-EFFICIENT
Breast	0.84
Shoulder	1.00
Best End Neck	0.99
Loin	1.02
Foreleg	1.06
Hindleg	1.01
TISSUES	
Bone	0.676
Lean	1.110
Fat	2.260

[TAB]LE 9 WEIGHTS (KG) OF KIDS BORN IN YEAR 1991-92 BY AGE AND [TRE]ATMENT GROUP

	TREATMENT			
	NON MILKED		MILKED	
AGE (WKS)	NON SUPPLEMENT	SUPPLEMENT	NON SUPPLEMENT	SUPPLEMENT
Birth	1.88 ± 0.125	1.88 ± 0.08	1.78 ± 0.07	2.00 ± 0.11
4	3.00 ± 0.102	3.14 ± 0.09	3.06 ± 0.03	3.18 ± 0.24
8	3.42 ± 0.46	3.60 ± 0.19	3.17 ± 0.11	3.59 ± 0.20
12	4.17 ± 0.36	4.50 ± 0.79	3.96 ± 0.18	4.32 ± 0.29
16	4.83 ± 0.22	5.19 ± 0.65	4.55 ± 0.27	5.05 ± 0.29
20	5.58 ± 0.46	5.88 ± 0.59	5.25 ± 0.37	5.73 ± 0.36
24	6.25 ± 0.76	6.56 ± 0.58	5.88 ± 0.52	6.39 ± 0.42
28	7.25 ± 0.87	7.63 ± 0.55	6.75 ± 0.66	7.33 ± 0.60
52	14.00 ± 1.73	13.67 ± 3.76	13.25 ± 1.03	15.67 ± 0.88

[TAB]LE 10 REGRESSION EQUATIONS USED IN PREDICTING CARCASE COMPOSITION OF 1992 GOATS FROM 1989 - 90 SAMPLE - JOINT DATA

PREDICTOR JOINT	TISSUE	EQUATION
BEN	LEAN	14.7- 0.17 BEN W + 2.03 BEN L + 0.497 SWT
BEN	FAT	-103 - 1.58 BEN W + 14.4 BEN F + 0.255 SWT
BEN	BONE	72.6 - 0.712 BEN W + 3.98 BEN B + 0.195 SWT
HL	LEAN	-82.4 + 0.279 HL W + 1.30 HL L + 0.201 SWT
HL	FAT	92.7 - 0.835 HL W + 0.54 HL F + 0.445 SWT
HL	BONE	85.1 - 0.22HL W + 1.82 HL B + 0.165 SWT

WHERE:
BEN W/HL W = Weight of sample joint
BEN F/HL F = Fat in sample joint
BEN L/HL L = Lean in sample joint
BEN B/HL B = Bone in joint
SWT = Sideweight

[TAB]LE 11 PREDICTED AND ACTUAL CARCASE COMPOSITION (g)

	LEAN	FAT	BONE
Actual	2061.1	503.5	895.9
BEN Prediction	2014.2	514.2	944.0
HL Prediction	1981.9	530.6	894.2

[TAB]LE 12 CORRELATION CO-EFFICIENTS BETWEEN PREDICTED AND ACTUAL CARCASE COMPOSITION : 1992 SLAUGHTERING

	LEAN	FAT	BONE
BEN	0.993	0.972	0.941
HL	0.997	0.989	0.968

Table 1. Means and standard deviations of carcass-side measures in hypertrophic (H) and normal (N) cattle.

	H		N		mean
CSV (l)	137.05±10.79		130.64±8.60		133.84±10.34
FQV (l)	77.25±6.09	A	72.49±5.04	B	74.87±6.03
HQV (l)	59.80±5.08		58.15±4.38		58.97±5.10
CSW (kg)	147.16±9.72		133.03±7.92		140.10±11.90
CSL (cm)	120.83±4.77		127.25±2.91		124.04±5.88
CSM (kg)	121.01±9.04		100.39±6.07		110.70±14.75
FQM (kg)	55.19±4.78		47.28±4.72		51.23±7.14
HQM (kg)	65.82±6.33		53.11±3.99		59.47±9.04
1QM (kg)	55.06±4.70		42.37±2.34		48.71±8.29
2QM (kg)	40.21±3.41		35.32±2.68		37.76±4.78
3QM (kg)	25.74±3.49		22.71±3.12		24.22±3.72
LDM (kg)	12.66±1.23		10.45±1.08		11.55±2.02
CSW/CSV	1.08±0.05		1.02±0.05		1.05±0.07
CSW/CSL	1.22±0.07		1.05±0.06		1.13±0.12
CSV/CSL	1.13±0.07	a	1.03±0.07	b	1.08±0.09
CSV/CSM	1.13±0.08		1.32±0.07		1.23±0.16

Different letters on the same row mean significant differences: for P<.001 if capital, for P<.05 if small.

CSV: carcass-side volume; FQV: fore-quarter volume; HQV: hind-quarter volume; CSW: carcass-side weight; CSL: carcass-side length; CSM: carcass-side wholesale cuts weight; FQM: fore-quarter wholesale cuts weight; HQM: hind-quarter wholesale cuts weight; 1QM: 1st quality cuts weight; 2QM: 2nd quality cuts weight; 3QM: 3rd quality cuts weight; LDM: Longissimus thoracis et lomborum muscle weight.

ble 2. Means and standard deviations of carcass-side measures in hypertrophic emontese (HP), hypertrophic crossbred Piemontese x Friesian (HPxF), nornal emontese (P) and normal Friesian (F) cattle.

	HP	HPxF	P	F	
SV (l)	137.57±2.05	136.53±9.93	128.19±6.85	133.09±0.38	NS
QV (l)	77.23±7.03	77.27±5.31	72.51±4.18	72.47±5.97	NS
QV (l)	60.34±5.42	59.26±4.95	55.68±3.73	60.62±5.12	*
SW (kg)	148.06±11.88	146.27±7.51	138.14±6.78	127.92±9.23	*
SL (cm)	119.08±3.90	122.58±5.70	123.50±2.94	131.00±.02	***
SM (kg)	122.40±10.73	119.63±7.46	110.30±5.50	90.48±7.18	***
QM (kg)	55.26±5.66	55.11±3.96	52.32±4.81	42.24±4.85	***
QM (kg)	67.13±6.62	64.52±6.31	57.98±3.83	48.24±4.31	***
QM (kg)	56.71±5.26	53.41±4.29	47.37±2.34	37.36±2.45	***
QM (kg)	40.45±3.78	39.97±3.17	39.15±3.18	31.48±2.23	***
QM (kg)	25.24±4.31	26.24±2.63	23.78±2.50	21.63±3.76	NS
M (kg)	12.84±1.49	12.48±0.96	12.16±1.31	8.73±0.85	***
SW/CSV	1.08±0.05	1.07±0.06	1.08±0.04	0.96±0.06	***
SW/CSL	1.24±0.08	1.19±0.06	1.12±0.04	0.98±0.08	***
SV/CSL	1.15±0.09	1.11±0.06	1.04±0.04	1.02±0.09	NS
SV/CSM	1.13±0.06	1.14±0.10	1.16±0.05	1.47±0.10	***

P<.05; ** : P<.01; *** : P<.001; NS : not significant.

SV: carcass-side volume; FQV: fore-quarter volume; HQV: hind-quarter volume; CSW: rcass-side weight; CSL: carcass-side length; CSM: carcass-side wholesale cuts weight; QM: fore-quarter wholesale cuts weight; HQM: hind-quarter wholesale cuts weight; 1QM: t quality cuts weight; 2QM: 2nd quality cuts weight; 3QM: 3rd quality cuts weight; LDM: ngissimus thoracis et lomborum muscle weight.

Table 3. Correlation coefficients.

	CSV		FQV		HQV	
FQV	.941	***	--		--	
HQV	.916	***	.725	***	--	
CSW	.652	***	-.299	*	.480	***
CSL	.126	NS	.027	NS	.223	NS
CSM	.434	**	.552	***	.226	NS
FQM	.534	**	.665	***	.296	*
HQM	.286	NS	.376	**	.135	NS
1QM	.326	*	.431	**	.152	NS
2QM	.356	*	.514	***	.113	NS
3QM	.536	***	.569	***	.413	**
LDM	.216	NS	.378	**	-.008	NS
CSW/CSV	-.304	*	-.161	NS	-.426	**
CSW/CSL	.457	**	.546	***	.281	NS
CSV/CSL	.838	***	.838	***	.708	***
CSV/CSM	.141	NS	-.030	NS	.321	*

* : P<.05; ** : P<.01; *** : P<.001; NS : not significant.

CSV: carcass-side volume; FQV: fore-quarter volume; HQV: hind-quarter volume; CSW: carcass-side weight; CSL: carcass-side length; CSM: carcass-side wholesale cuts weight; FQM: fore-quarter wholesale cuts weight; HQM: hind-quarter wholesale cuts weight; 1QM: 1st quality cuts weight; 2QM: 2nd quality cuts weight; 3QM: 3rd quality cuts weight; LDM: Longissimus thoracis et lomborum muscle weight.

4. Linear equation parameters ($y = a + bx$).

x	a	b	
CSV	27.8864	0.6187	**
CSV	13.6825	0.2617	*
CSV	15.7473	0.1645	*
CSV	-1.5434	0.1925	***
FQV	9.5774	1.3506	***
FQV	-7.7102	0.7873	***
FQV	4.3346	0.5927	**
FQV	7.2678	0.4073	***
FQV	-2.0249	0.3506	***
FQV	2.0854	0.1265	**
HQV	6.4526	0.3013	***

<.05; ** : P<.01; *** : P<.001

Table 1. Means and standard deviations of fibre dimensions: area (µm²).

muscle	H		N		mean
Ct	2758.24±366.63		2900.44±406.44		2829.34±383.14
Pp	2813.45±306.73		2965.22±377.62		2889.33±340.33
Af	2791.84±292.50		2994.60±504.31		2893.22±407.83
mean	2787.84±318.96	B	2953.13±426.87	A	2870.63±391.74

muscle	HP	HPxF	P	F
Ct	2667.12±383.84	2849.36±477.98	3015.12±477.98	2785.76±343.08
Pp	2851.75±371.61	2775.14±242.12	2904.50±397.60	3025.94±374.27
Af	2782.21±304.40	2801.47±293.65	2976.10±583.32	3013.10±437.63
mean	2767.03±344.71	2808.66±295.89	2965.24±477.94	2941.60±375.78

Different capital letters on the same row mean significant differences for $P<0.01$.

H: double muscled cattle

N: normal cattle

HP: double muscled Piemontese

HPxF: double muscled crossbred Piemontese x Friesian

P: normal Piemontese

F: normal Friesian

Ct: Cutaneus trunci muscle

Pp: Pectoralis profundus muscle

Af: Adductor femoris muscle

le 2. Means and standard deviations of fibre dimensions: perimeter (µm).

scle	H		N		mean
	227.78±13.21		230.55±12.24		229.17±12.60
	229.37±11.95		236.44±13.00		232.90±12.35
	227.99±12.07		234.46±22.66		231.23±17.96
an	228.38±12.25	B	233.82±16.42	A	231.10±15.06

scle	HP	HPxF	P	F
	226.31±13.71	229.26±13.31	236.61±12.66	224.66±12.37
	230.01±11.14	228.73±13.22	234.81±12.20	238.06±14.30
	229.02±13.63	226.96±10.91	232.79±24.67	236.12±21.56
an	228.49±12.51	228.32±12.17	234.74±16.99	232.89±16.07

ferent capital letters on the same row mean significant differences for P<0.01.

le 3. Means and standard deviations of fibre dimensions: equivalent diameter (µm).

scle	H		N		mean
	58.49±3.94		59.99±4.31		59.24±4.08
	59.09±3.21		60.73±4.00		59.91±3.59
	59.06±2.92		60.88±4.85		59.97±3.96
an	58.88±3.33	B	60.53±4.34	A	59.70±4.02

	HP	HPxF	P	F
	57.52±4.26	59.46±3.77	61.13±4.95	58.84±3.77
	59.46±3.87	58.72±2.56	60.17±4.35	61.28±3.81
	58.77±3.31	59.34±2.62	60.66±5.67	61.09±4.12
ean	58.59±3.72	59.17±2.95	60.66±4.88	60.40±3.79

fferent capital letters on the same row mean significant differences for P<0.01.

Table 4. Means and standard deviations of fibre dimensions: maximum axis (μm).

muscle	H	N	mean	
Ct	74.04±5.04	75.72±4.09	74.88±4.54	b
Pp	75.29±4.75	77.90±5.78	76.59±5.23	ab
Af	76.98±6.75	79.50±9.51	78.24±8.16	a
mean	75.44±5.50	77.70±6.75	76.57±6.55	

muscle	HP	HPxF	P	F
Ct	73.83±5.45	74.25±4.84	77.27±4.90	74.16±3.31
Pp	75.62±4.95	74.96±4.76	75.88±5.38	79.91±6.39
Af	77.44±8.15	76.52±5.36	77.19±7.72	81.80±11.38
mean	75.63±6.16	75.24±4.85	76.78±5.95	78.63±7.55

Different small letters on the same column mean significant differences for $P<0.05$.

Table 5. Means and standard deviations of fibre dimensions: minimum axis (μm).

muscle	H	N	mean
Ct	51.14±3.92	51.86±4.14	51.50±3.99
Pp	50.81±3.64	52.01±4.43	51.41±4.01
Af	49.93±2.91	51.82±4.25	50.88±3.60
mean	50.63±3.47	51.90±4.21	51.26±3.97

muscle	HP	HPxF	P	F
Ct	50.31±4.33	51.96±2.64	52.93±4.80	50.79±3.57
Pp	50.99±4.62	50.62±2.53	52.17±3.61	51.84±5.28
Af	49.43±3.66	50.44±2.08	52.40±5.32	51.23±3.06
mean	50.24±4.10	51.01±2.75	52.50±4.50	51.29±3.97

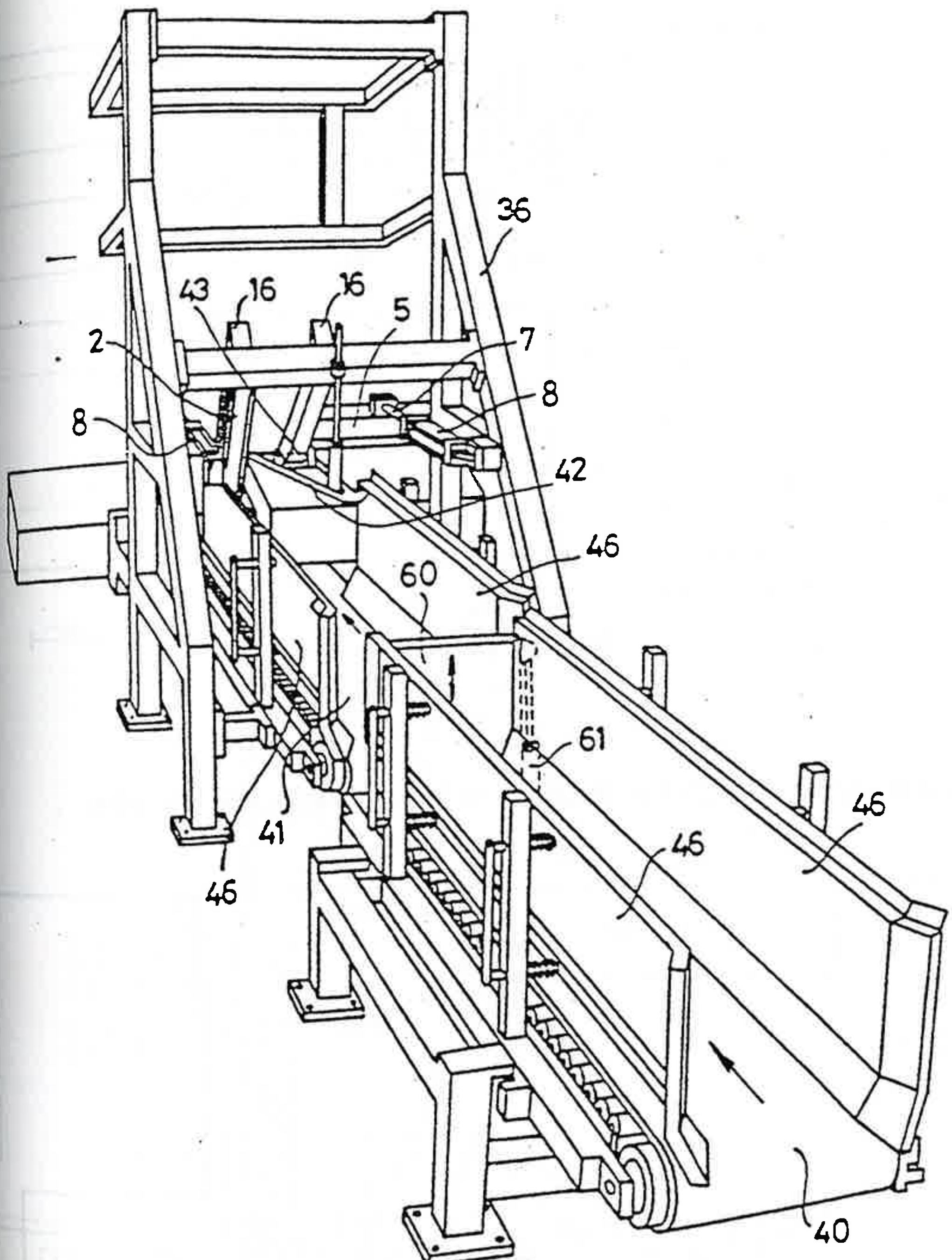


Fig. 3

LAYOUT FIRST PART SLAUGHTERLINE 2000

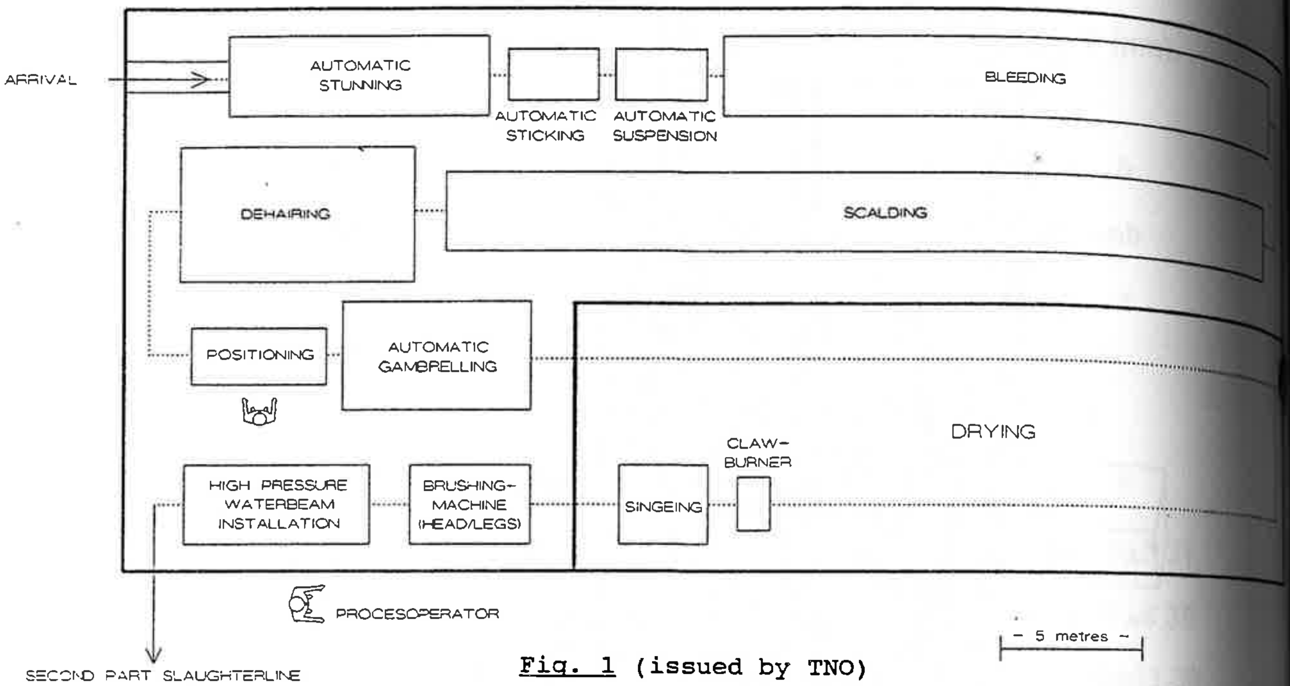


Fig. 1 (issued by TNO)

LAYOUT SECOND PART SLAUGHTERLINE 2000

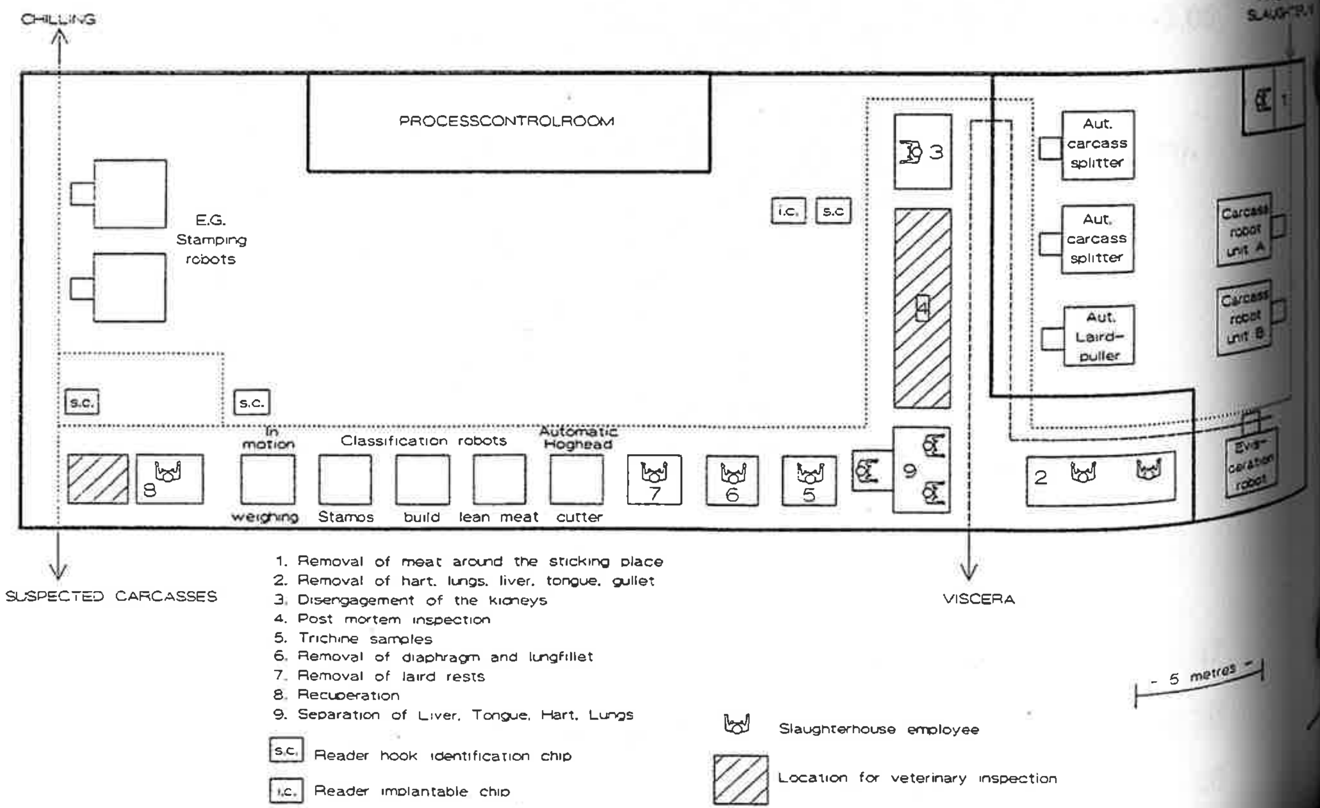


Fig. 2 (issued by TNO)

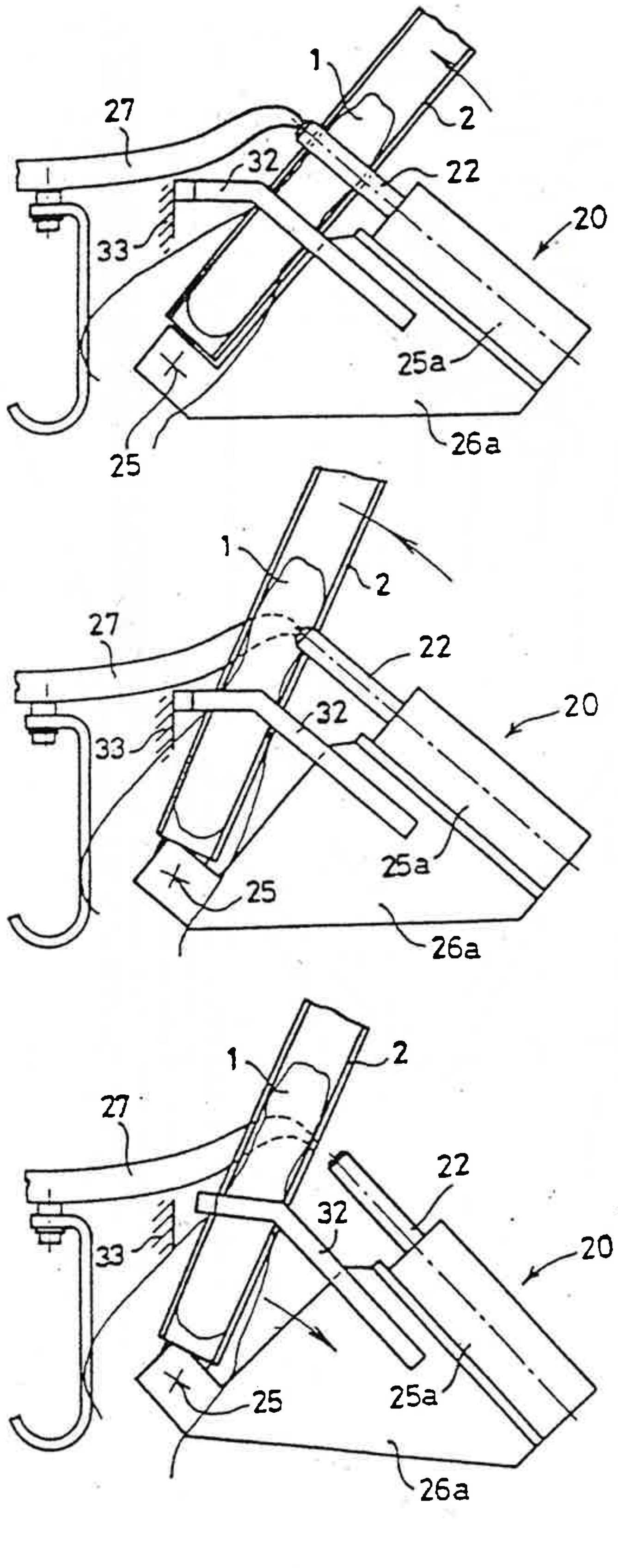


Fig. 4

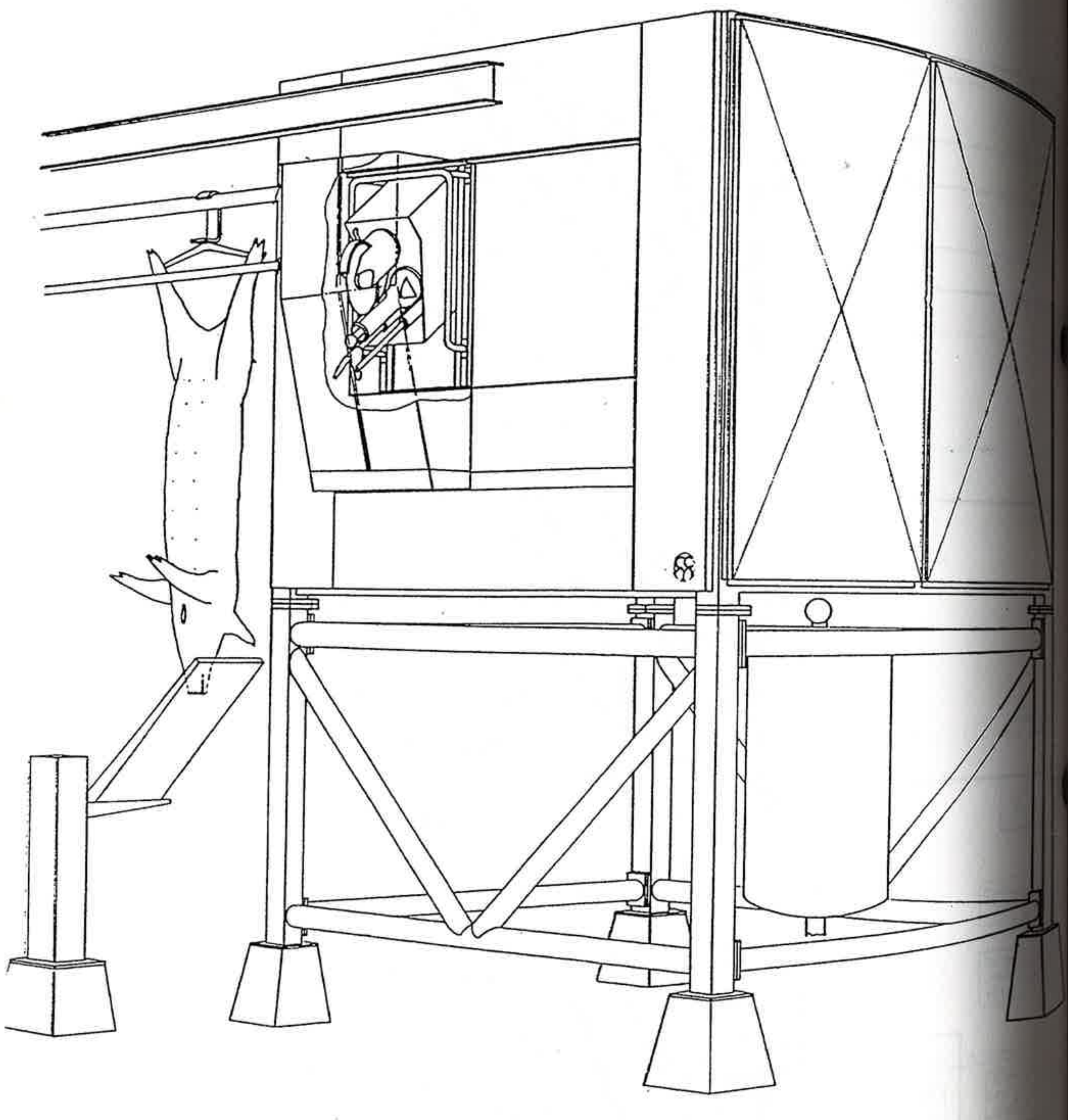


Fig. 5

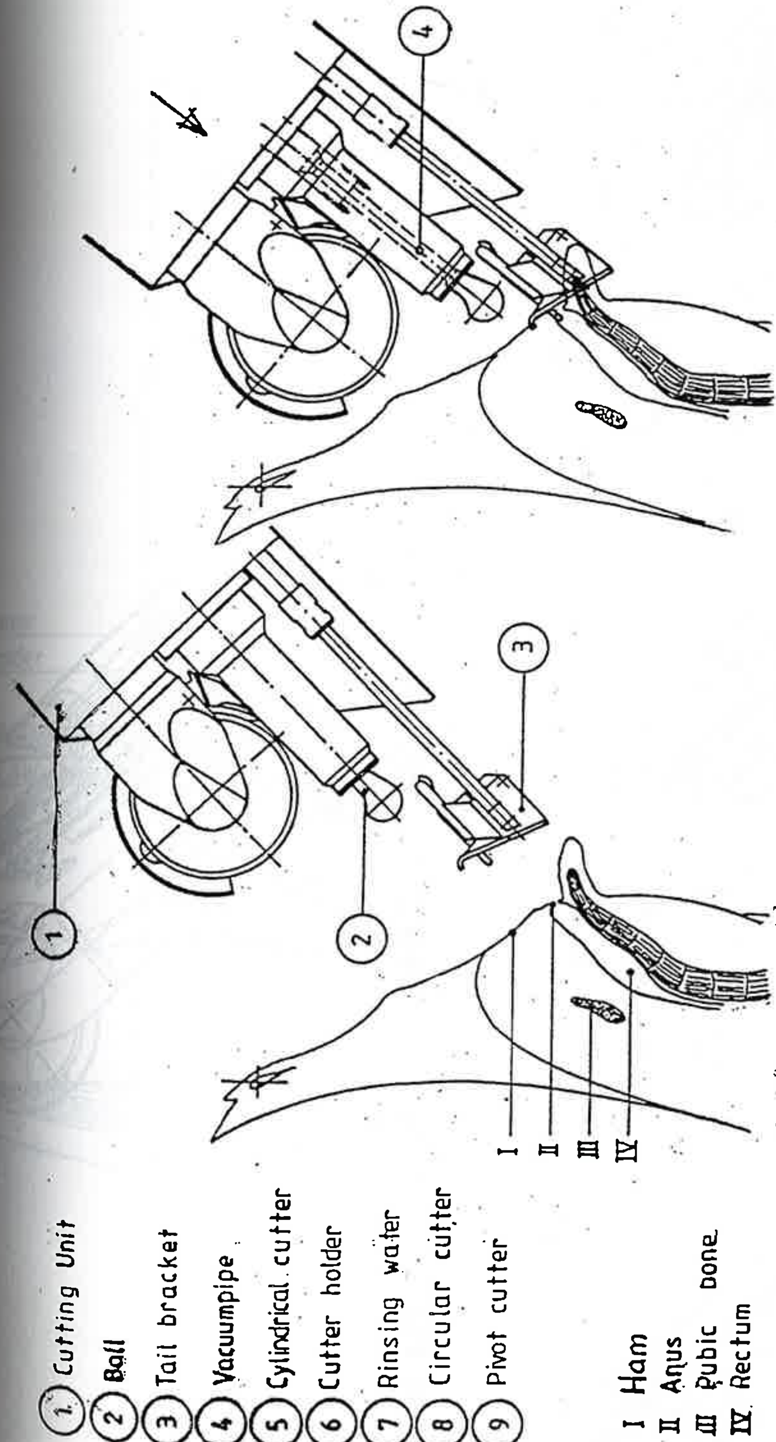


fig.1. Cleaning position

fig.2 Pre-position (depending on carcass length)

Fig. 6a

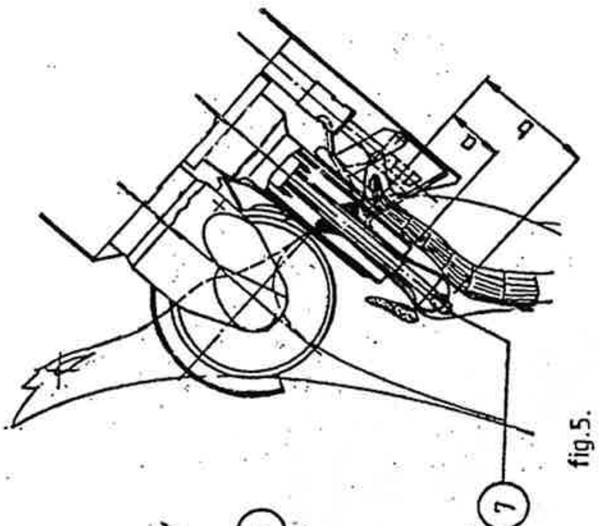


fig.5.

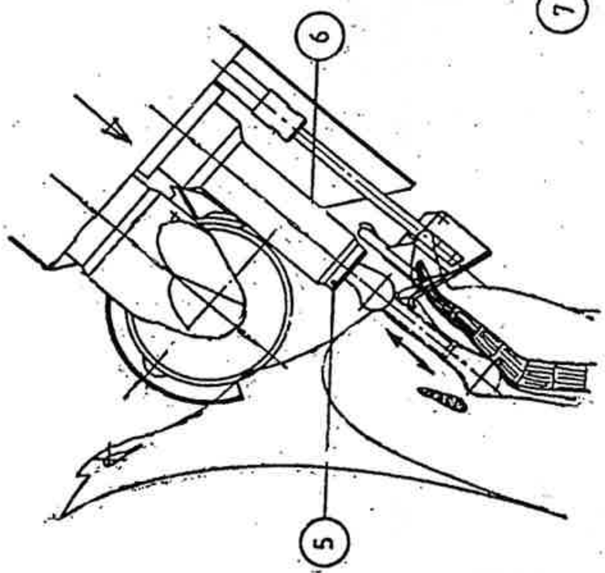


fig.4.

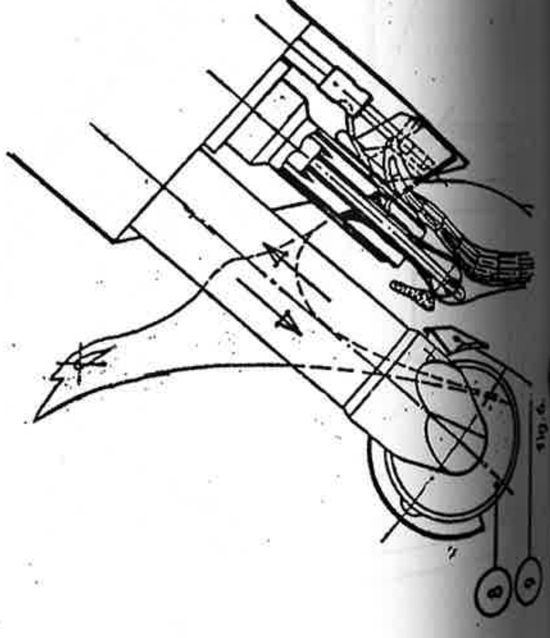


fig.6.

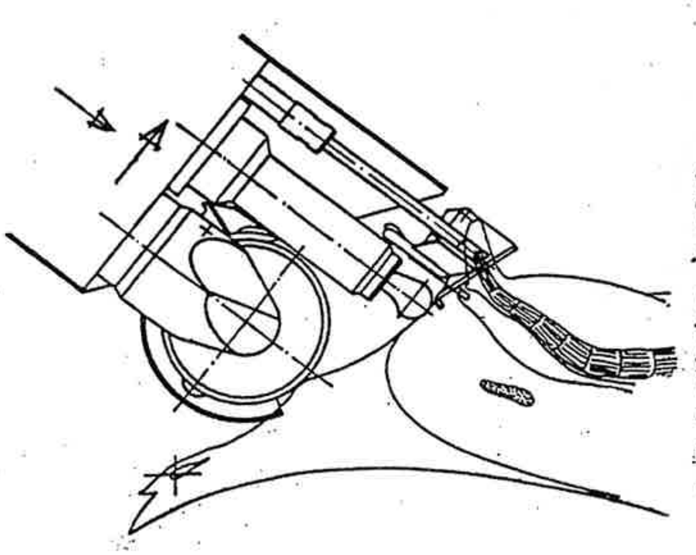


fig.3. Positioning in anus

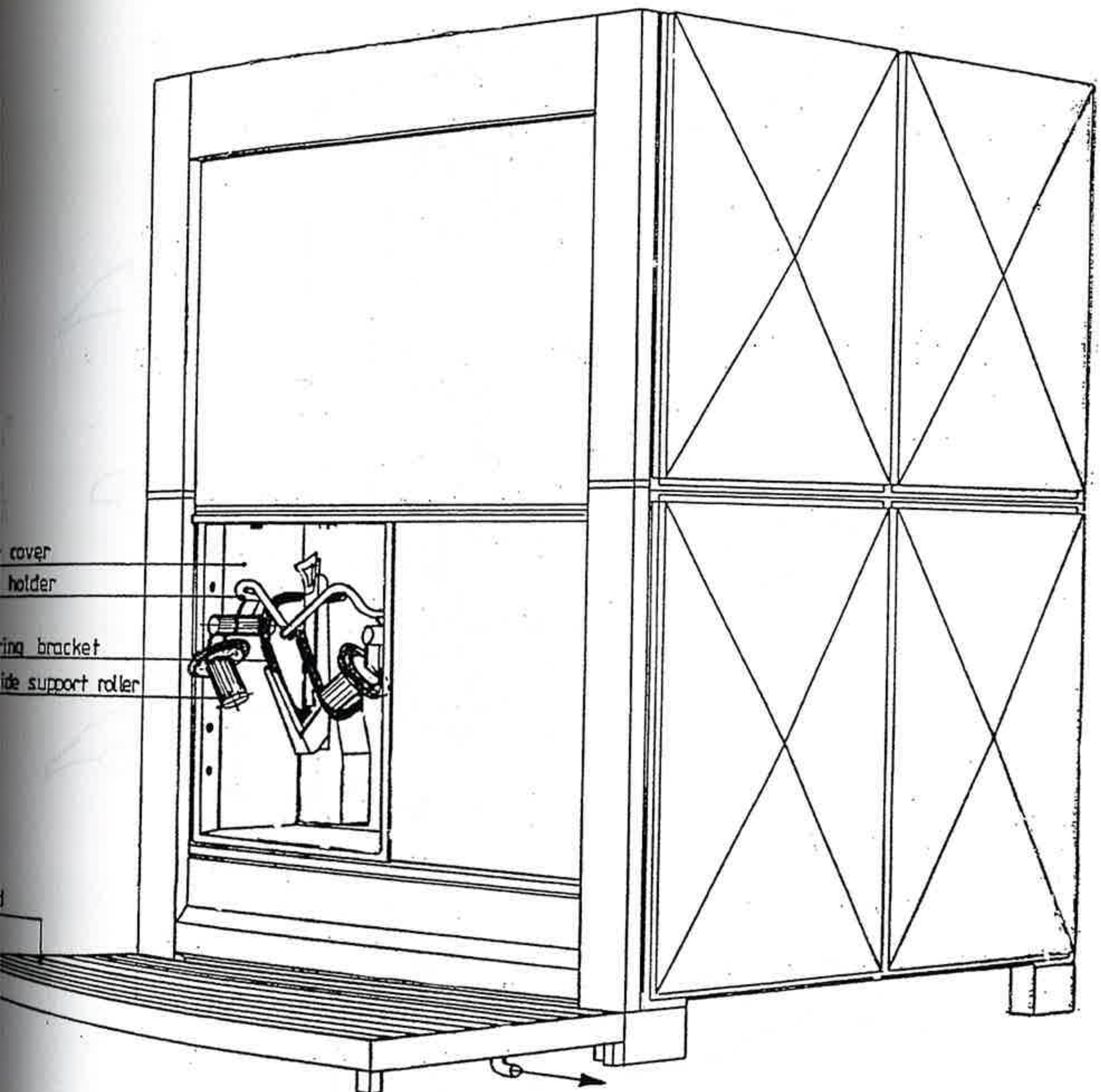


Fig. 7

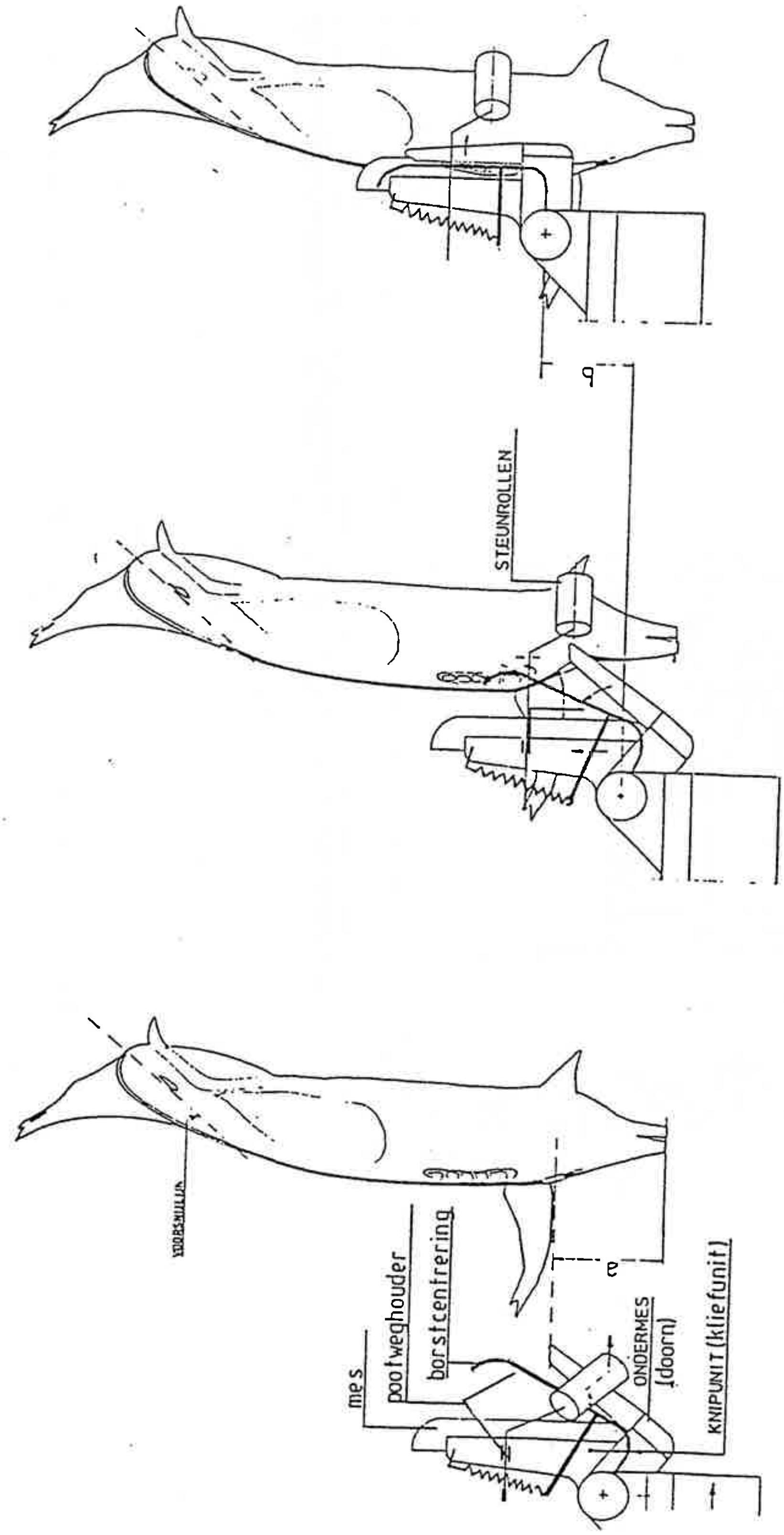
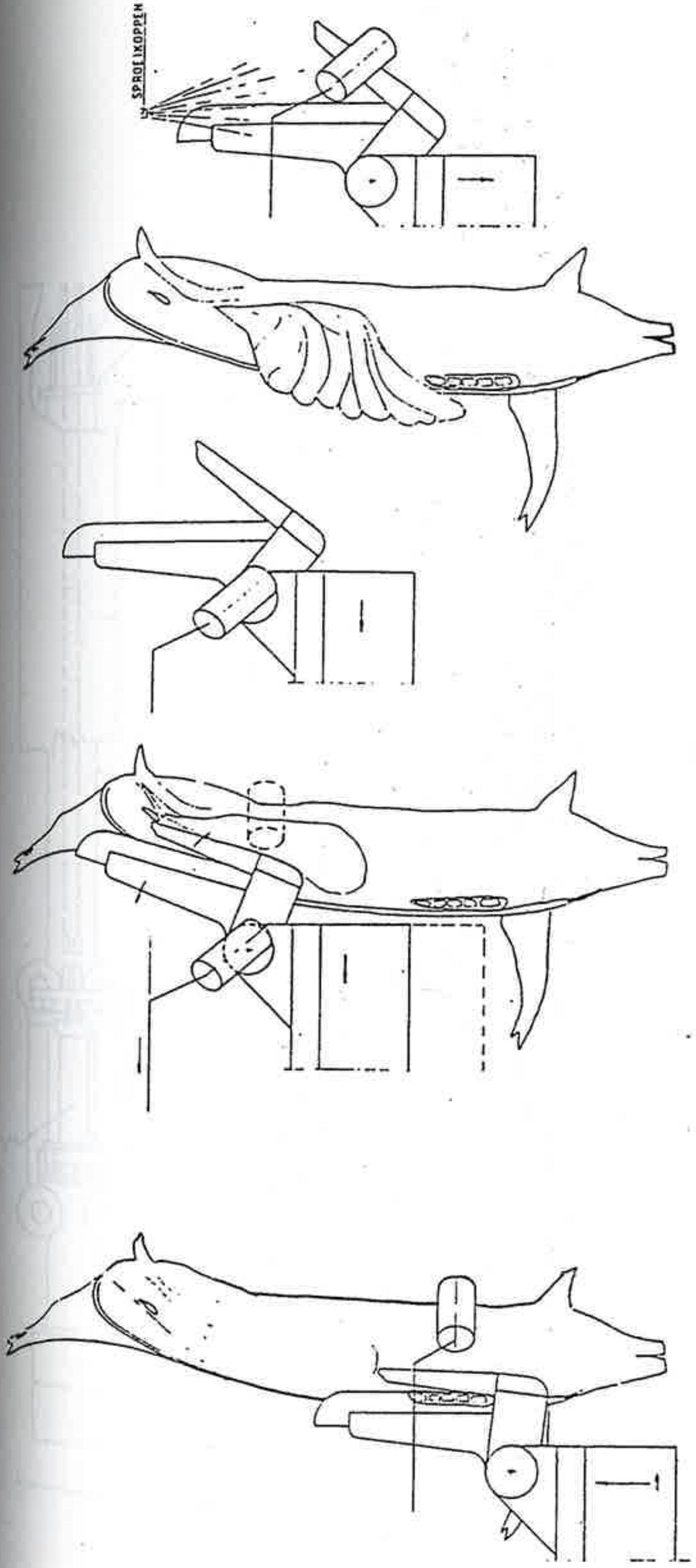
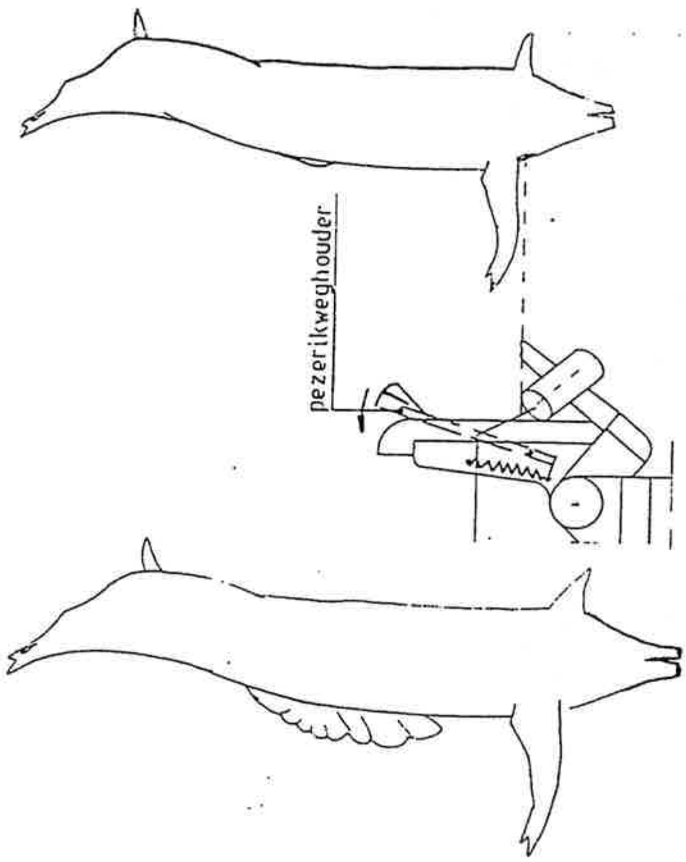

STEUNROLLEN
b
a
mes
pootweghouder
borstcentrering
ONDERMES
(doorn)
KNIPUNIT (kliefunit)

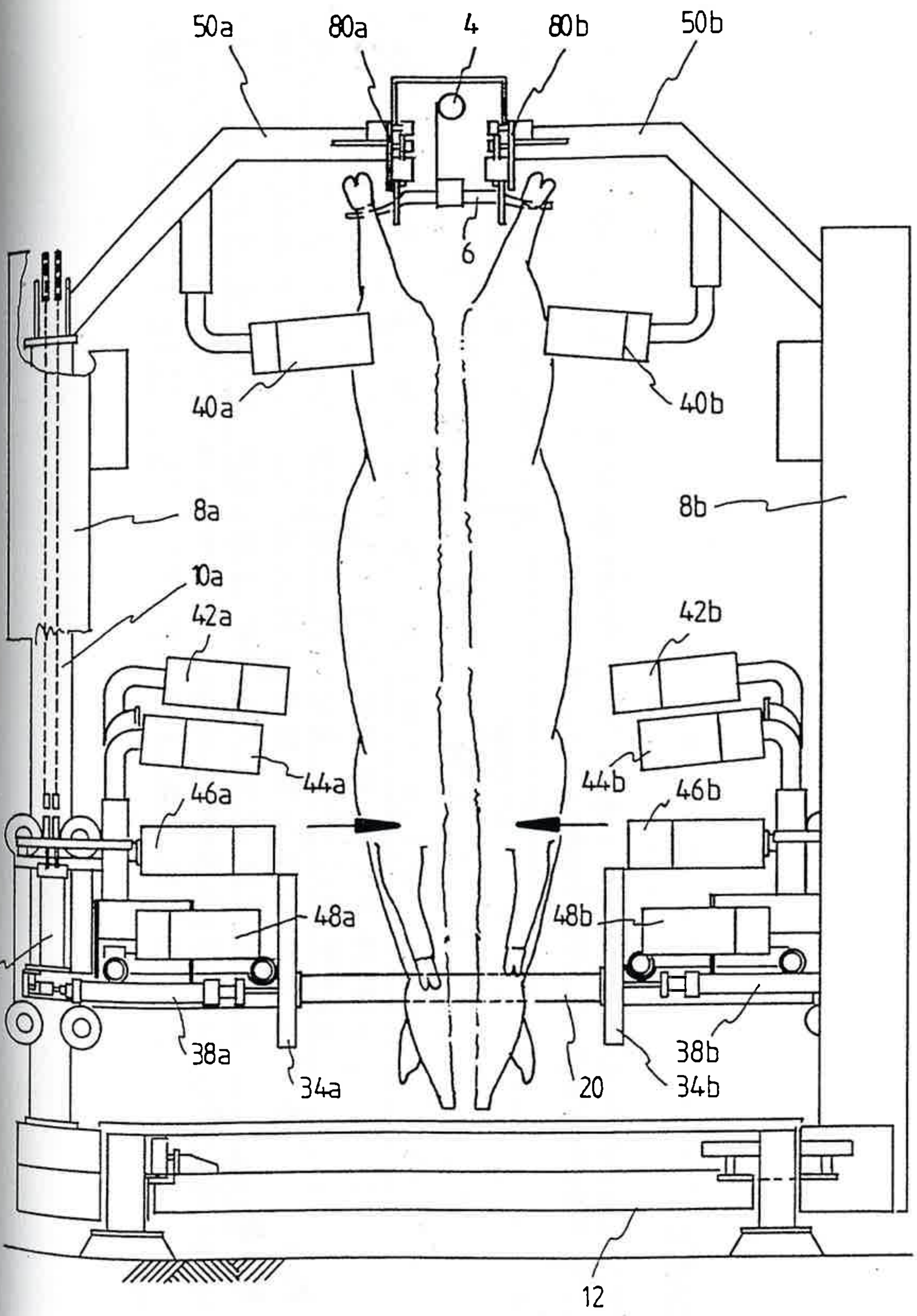
Fig. 8a



(Fig. 8)b



(Fig. 8)c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80b
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8b
10a
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42b
44a
44b
46a
46b
22
48a
48b
24
38a
34a
20
38b
34b
12

Fig. 9

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	19.93a	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	29.07a	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	51.00ab	50.47ab	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	10	14	18	6	10	14	18
		L + F	L + F	L + F	L + F	L + F	L + F	L + F	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 ($P < 0.05$)

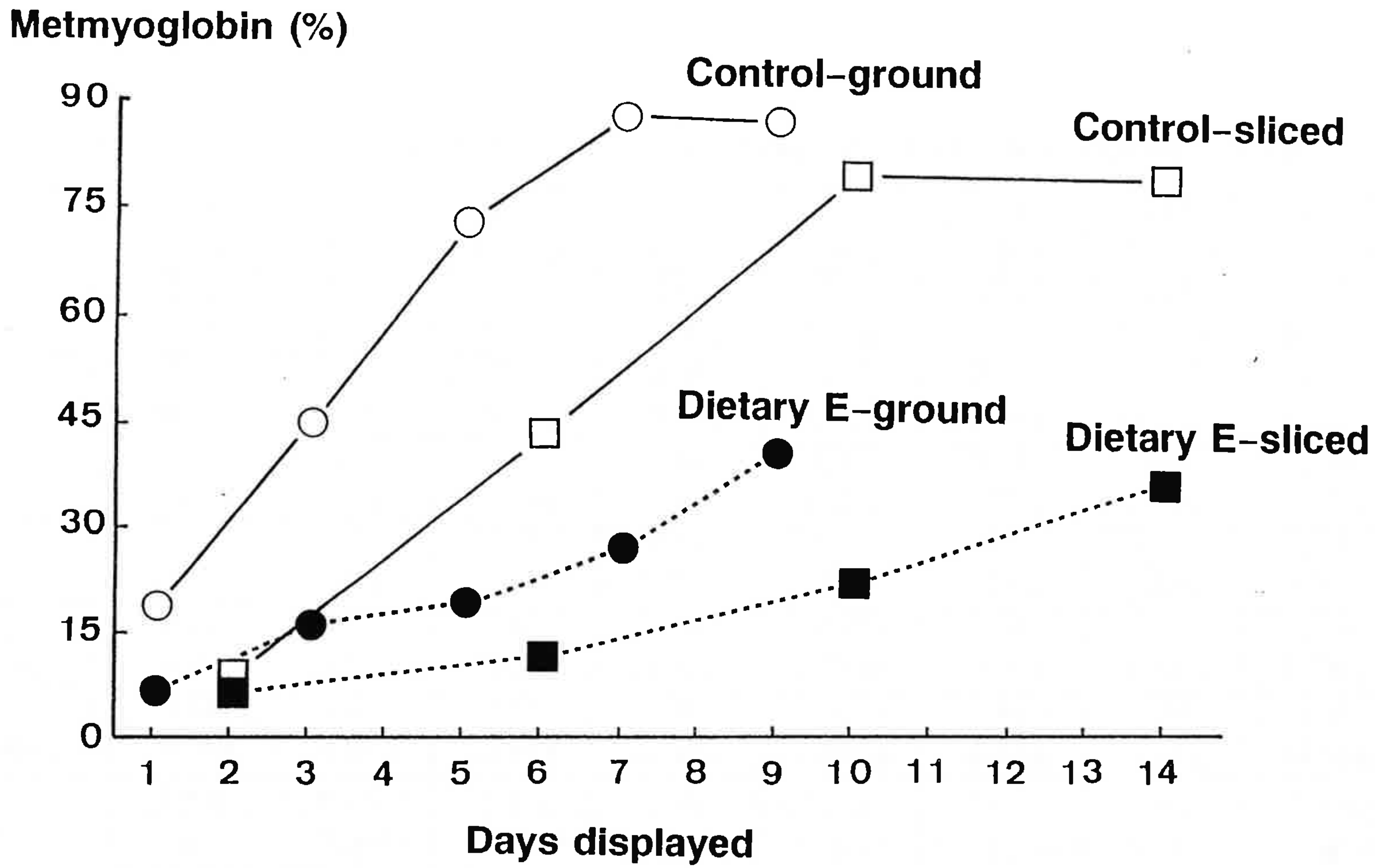

Fig. 1. Relationship of dietary vitamin E supplementation x days displayed on surface metmyoglobin percentages in ground and sliced beef longissimus. Control–ground = control ground beef; Control–sliced = control sliced beef; Dietary E–ground = ground beef with dietary vitamin E supplementation; Dietary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

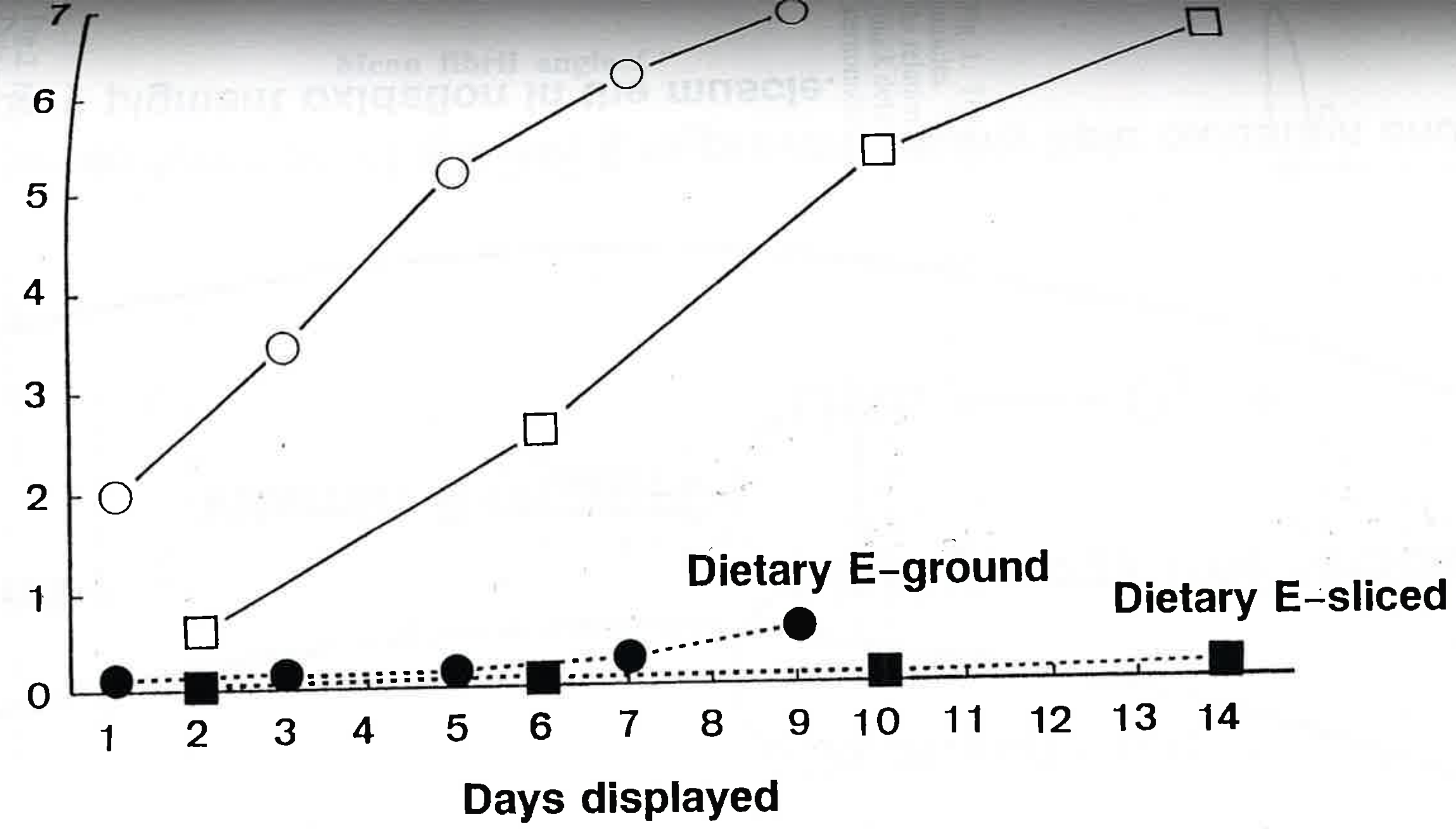

Fig. 2. Relationship of dietary vitamin E supplementation x days displayed on TBARS values in ground and sliced beef longissimus. Control–ground = control ground beef; Control–sliced = control sliced beef; Dietary E–ground = ground beef with dietary vitamin E supplementation; Dietary E–sliced = sliced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

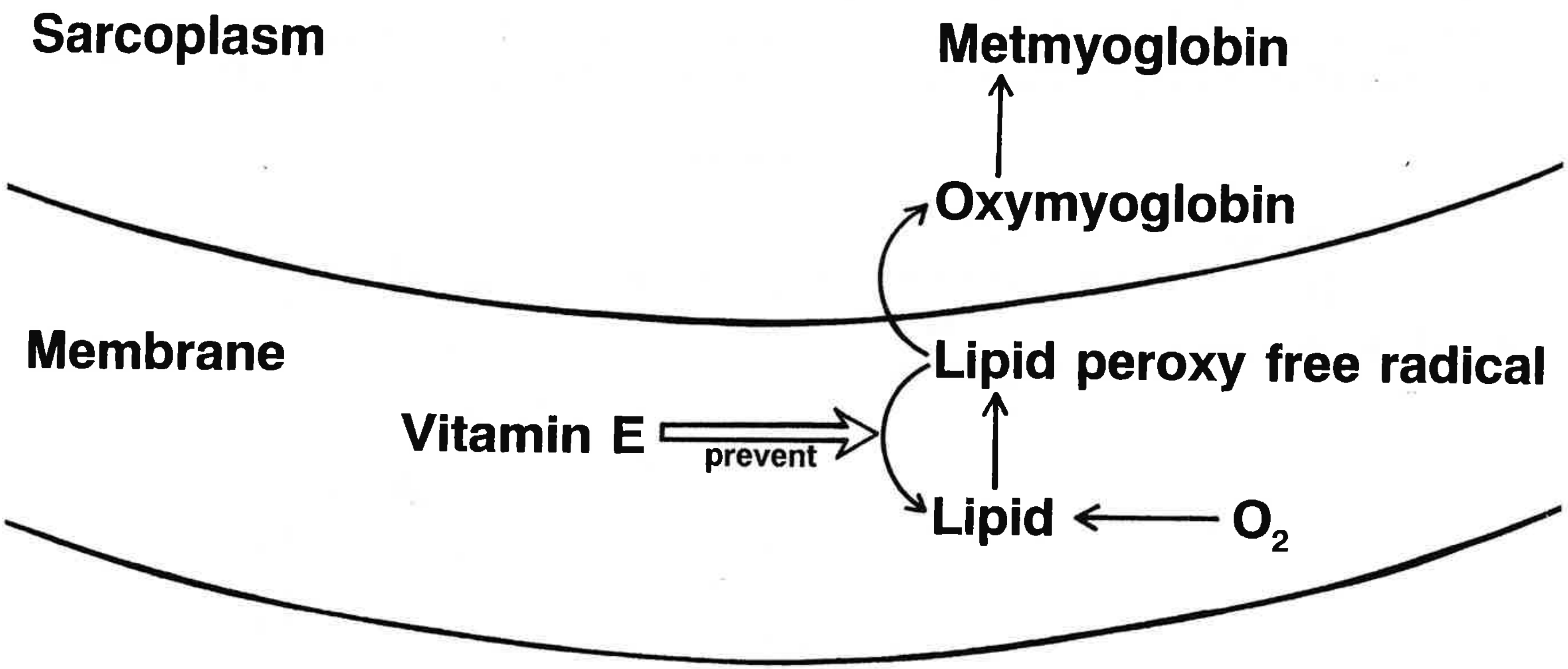

Fig. 3. Proposed function of vitamin E to prevent mainly lipid oxidation and secondary pigment oxidation in the muscle.

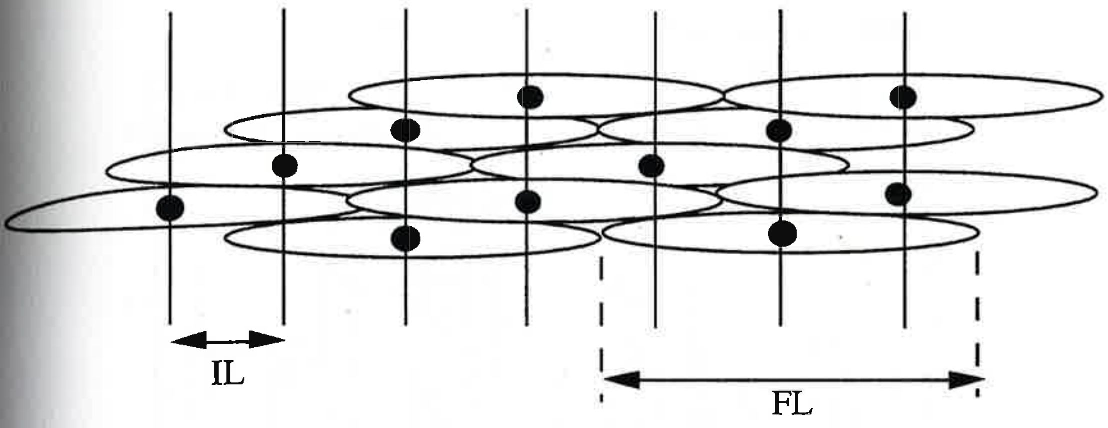

Fig. 1. The staggered overlap arrangement of discontinuous fibres in series fibred muscles. The degree of longitudinal overlap between adjacent fibres (OD) is given by the relationship OD= 1-(IL/FL), where IL is the spacing between motor end plates (black dots) and FL is the fibre length (Trotter, 1993).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

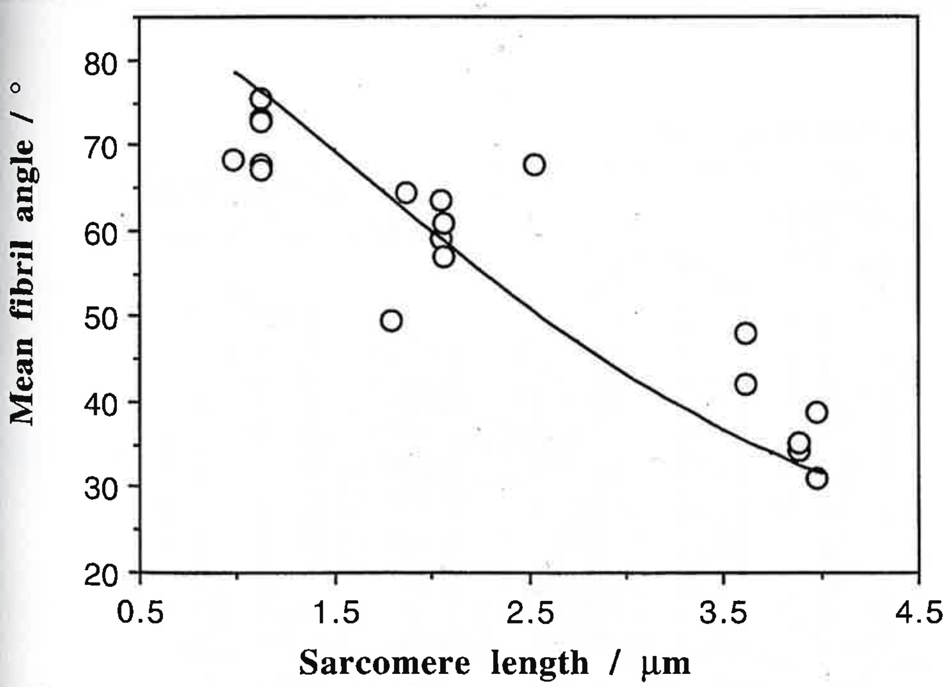

Fig.2. Mean of collagen fibril orientation in endomysium v. muscle sarcomere length. Data points shown are numerically-weighted means from analysed orientation distributions (from Purslow & Trotter, 1994). The line shown is the predicted mean orientation v sarcomere length from the model fitted to perimysial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