IX^th CONFERENCE OF EUROPEAN MEAT RESEARCH WORKERS
Budapest, September 4-11, 1963

32

INSTITUTE FOR FOOD OF ANIMAL ORIGINE
STATE UNIVERSITY UTRECHT

A comparative investigation of the pH values in muscles of slaughter-animals

by J.G. van Logtestijn and J.H.J. van Gils

Introduction.

For the last thirty years many research-workers have been engaged in the investigation of the post-mortal changes in the meat of slaughter-animals.

Normally these changes involve a decrease in the pH value in which process many factors are active, like the fatigue and stress factors.

A pH value that is too high as well as a pH value that is too low render the meat no longer or less suitable for consumption or for the working into meat-products like canned ham and raw sausages.

Within the framework of a more extensive investigation we wished to find out with an adequately great number of slaughter-animals, how the pH value developed after the death and what pH values can be found with apparently normal healthy and approved slaughter-animals.

Some data are known about this phenomenon in the literature but in general they only relate to small numbers and then mostly to sick animals or to animals slaughtered for emergency reasons.

In this connection mention should be made of the investigations of the Dutchmen Fooy (1930), Schoon (1931) and Postma (1932 and 1934); Scholemann (1936), Wewer (1937), Callow, Bate-Smith a.o. (1933-1937); Schön and Stosieck (1958), Lawrie (1960), Briskey and Wismer-Pedersen (1961).

Material and methods.

The change in pH value during 24 hours after the slaughtering was checked with 40 fat calves, 48 cows and 80 pigs, always in the m. gracilis.

At fixed moments the pH value was measured by means of a portable pH meter of the make PHILIPS or ELECTROPACT with ELECTROPACT spear-point electrodes.

Further 24 hours after the slaughtering the pH value was measured of 93 fat calves, 125 cows, 200 pigs of 75 - 100 kgs and 42 older sows of 100 - 300 kg, all apparently healthy and at any rate approved animals.

The slaughter-animals remained in the slaughtering hall for about 15 - 45 minutes after the slaughtering, then they were transported to the cold store (temp. about 1 - 2° C).

All measurements were made in the abattoir of Utrecht.

Results of the measurements.

All data obtained have been laid down in the following tables. We realize that this way of recording may be misleading in some cases, yet it has been done as conveniently as possible.

To clarify matters it is pointed out that not at each moment indicated all cows and calves could be measured, but only the numbers mentioned at the bottom of the tables.

In a following publication more detailed data will be given.

Review and conclusions.

The data obtained by the measurements have all been laid down in tables in such a way that easy interpretation is possible.

1. Briskey and Wismer-Pedersen (1960) checked by means of recorders the pH pattern in 20 Danish Landrace carcasses

"The continuous recordings from these carcasses depicted at least four distinct types of post-mortem pH patterns:

1. a slow gradual decrease to an ultimate pH of 5.7 - 6.3
2. a gradual decrease to about 5.7 at 8 h., with an ultimate pH of 5.3 - - 5.7
3. a relatively rapid decrease to about 5.5 at 3 h., with an ultimate pH of 5.3 - 5.6
4. a sharp, significant decrease to a pH of 5.1 at 1½ h. and a subsequent elevation to 5.3 - 5.6"

We as well found great differences in the decrease in pH, not only with pigs but also with cows. From table 3 it appears that 22 of the 80 pigs investigated showed a pH of 6.0 or lower already after 2 hours, after 8 hours the number was 39, after 14 hours 41, after 24 hours 44.

We regularly found the first three types in our group of pigs, however with all kinds of intermediate stages, the fourth type did not turn up in our investigations.

With the calves and the cows the type no. 1 prevails, type no. 2 occurs much less, type no. 3 exceptionally only with calves and type np. 4 does not at all occur with our research material.

Actually it is not well possible with our investigation material to make a strict division in types of post-mortem pH patterns, there are too many intermediate stages.

However it stands out clearly that with normal cows and fat calves there is practically always a strong and gradual decrease in pH value; with pigs there is certainly more difference in the pattern.

2. Practically all cows and calves investigated showed after 24 hours a pH of 6.1 or lower.

79 of the 93 fat calves, 109 of the 125 cows, showed then a pH of 5.4 - 5.8.

With pigs this pattern was more varied:
3 of the 200 pigs investigated had a pH of 5.3; the meat of these animals was weak, pale and moist.
75 pigs had a pH of 6.2 or higher.
With older pigs on the other hand the picture was different; only 9 of 42 pigs had a pH of 6.2 or higher.

3. Table 4 gives the impression that the influence of transport are not so important as it is generally understood. Of primary importance seems to be the condition in which the animals are delivered for transport. The

conspicuous differences between the seven couples should be explained by differences in food and housing.

4. From the tables it appears that only after at least 24 hours it is possible to measure the ultimate pH. Yet in practice it is justified to arrive at a rough estimation of the ultimate pH already after 8 - 10 hours, when this should be necessary owing to the circumstances (e.g. production planning in a factory).

5. The fact that so many pigs have a high pH 24 hours after the slaughtering illustrates once more the necessity to pay more attention and research to this question.
For the butcher and the manufacturer greater interests are at stake than they themselves realize.

Summary.

In the m. gracliis of 40 calves, 48 grown-up cows and 80 pigs the pH value was measured at various moments during 24 hours after the moment of slaughtering.

Besides in the same muscle, 24 hours after the slaughtering, the pH value was measured of 93 fat calves, 125 cows, 200 pigs of 75 - 100 kgs and 42 older pigs of 100 - 300 kgs.

In six tables a survey is given of the pH values found at the various moments after the slaughtering.

Literature:

Briskey E.J. and Wismer-Pedersen J., Journ.of Food Sci.26, 297 (1961)
Callow E.H., Bate-Smith E.C. Rep.Food Inv.Board 1936, 1937, 1938, 1949.
Fooy J.P., Thesis Utrecht 1930.
Lawrie R.A., J.Comp.Path. 70, 273 (1960)
Postma C., Tdschr.Diergeneesk. 59, 1278 (1932) en 61, 1182 (1934)
Scholemann J., Vet.med.Thesis Hannover 1936.
Schön L. and Stosieck M., Die Fleischwirtschaft 10, 678 (1958)
Schoon J.G., Thesis Utrecht 1931.
Wewer M., Thesis Hannover 1937.

Tabel 1

pH-pattern in the m. gracilis of 40 fat calves, during 24 h. after slaughtering

pH ↓	time in hours → 0	2	4	6	8	10	12	14	16	18	20	22	24
7.3													
7.2													
.	4	3											
7.0	5	5											
.	4	6											
6.8	7	6		4									
.	2	3	4	4	1								
6.6		4	3	4	1								
.		3	3	6	3								
6.4		2	3	5	6								
.		1		2	4		2						
6.2		3		4	5		1						
.		3	2		4								
6.0			3	1	2		6						2
.		1	2				3						2
5.8			2		2		2						5
.					1		3						11
5.6							1						8
.					1								8
5.4													4
Total number	22	40	22	30	--	30	--	--	--	--	--	18	40

Tabel 2

pH-pattern in the m. gracilis of 48 beef-cattle, during 24 h. after slaughtering

pH ↓	time in hours → 0	2	4	6	8	10	12	14	16	18	20	22	24
7.3	3												
7.2	2	2											
.	5	2		1									
7.0	7	4	4	1									
.	6	9		2									
6.8	6	5	9	4	2	2							
.	4	5	1	3	6	4							
6.6	2	2	1	2	5	4	3						
.	3	1	3	3	2	2	3	3					
6.4				3	4	3	4	4					
.				1	6	2	3	6	2				
6.2					2	1	2	9					1
.					2		4	6	4				
6.0					1			6	3				3
.							1	3	4				4
5.8								1	7				13
.									4				7
.6									3				9
.									3				4
.4													2
	38	30	18	20	--	30	18	20	--	--	38	--	--	--	30	--	--	--	--	--	--	--	--	--	43

Table 3

pH-pattern in the m. gracilis of 80 pigs, during 24 h. after slaughtering

time in hours → 0	2	4	6	8	10	12	14	16	18	20	22	24
2		1	1	1	1							
3	3	2	1	1	1		1					1
4	3	3	2	2	2		2					2
5	4	1	3	3	3		3					2
6	7	6	2	3	2		2					3
10	10	7	5	3	3		2					2
10	12	14	7	5	5		3					3
7	7	9	7	8	8		8					5
10	6	8	8	7	8		9					8
7	6	6	10	8	9		9					8
5	5	4	6	10	9		8					8
1	7	8	6	8	7		10					9
	3	3	10	6	8		6					8
	6	5	7	8	9		9					12
	1	3	4	6	4		6					7
			1	1	1		2					2
70	80	80	80	80	80		80					80

Table 4

From a village at a distance of about 40 kms from the abattoir seven couples of pigs were supplied by truck. All pigs were loaded shortly after each other and immediately transported to the abattoir and there they were slaughtered at once. The whole process took less than 3 hours. All pigs were approved of. 24 Hours after the slaughtering the following pH values were found in the muscle gracilis/per couple.

number of couple → 1	2	3	4	5	6	7
	1		1		2	
	1				2	
	2		2		1	
			1	1	1	
	1		1		2	
	1		2		2	
		1	3	1		
2			1	1	1	
1		1		2		1
1				2		1
2		2		1		1
1		3		2		1
				1		5
						2
1				1		1
8	6	7	11	12	11	12

Table 5

pH values in the m. gracilis of normal slaughter-animals, 24 h. after slaughtering

pH ↓	fat calves	beefcattle	pigs 75 - 100 kgs	sows 100 - 300 kgs
7.0	-	-	1	-
·	-	-	5	-
6.8	-	-	8	-
·	-	-	3	-
6.6	-	-	7	1
·	-	-	11	-
6.4	1	-	14	2
·	1	-	11	2
6.2	-	1	15	4
·	5	2	17	3
6.0	9	3	16	2
·	8	10	17	5
5.8	10	20	20	6
·	12	25	27	7
5.6	15	26	18	9
·	17	20	4	-
5.4	15	18	3	1
5.3	-	-	3	-
Total number	93	125	200	42

Table 6

The most frequent types of pH-pattern in the 3 groups of slaughter-animals

Sort of animal	Occurring after →	5-10 min.	1 h.	2 h.	3 h.	4 h.	5 h.	6 h.	7 h.	10 h.	14 h.	24 h.	4 h
fat calf	no 1	7.0	7.0	-	6.75	-	6.6	-	-	6.-	-	5.75	5.5
	" 2	7.1	7.0	6.75	6.55	-	6.4	-	-	-	-	5.8	5.5
	" 3	7.0	6.75	6.65	6.3	-	5.5	-	-	-	-	5.4	5.4
beef cattle	no 1	7.3	7.05	-	6.8	-	6.7	-	6.55	6.3	6.15	6.0	5.6
	" 2	6.7	6.55	-	6.4	-	6.15	-	6.1	6.0	5.9	5.7	5.5
	" 3	6.9	6.7	-	6.55	-	6.2	-	6.1	5.9	5.7	5.55	5.5
pig	no. 1	6.95	6.8	-	-	6.5	-	6.4	6.2	6.05	5.95	5.8	5.65
	" 2	6.7	6.7	-	-	6.4	-	6.2	6.0	5.85	5.7	5.7	5.7
	" 3	6.15	5.7	-	-	5.65	-	5.6	5.6	5.6	5.6	5.6	5.6

INSTITUTE FOR FOOD OF ANIMAL ORIGINE
STATE UNIVERSITY UTRECHT

A comparative investigation of the pH values in muscles of slaughter-animals

by J.G. van Logtestijn and J.H.J. van Gils

Résumé.

Dans le m.gracilis de 40 veaux graisses, 48 vaches adultes et 80 porcs le pH valeur fut mesuré à des moments divers pendant 24 heures après le moment d'abbatage.

Aussi bien dans le même muscle, 24 heures après l'abbatage, le pH-valeur fut mesuré de 93 veaux graisses, 125 vaches, 200 porcs de 75 - 100 kgs et 42 plus vieux porcs de 100 - 300 kgs.

Dans six tableaux les auteurs ont donné un résumé aux moments divers après l'abbatage.

Zusammenfassung.

In dem M.gracilis von 40 Mastkälbern, 48 erwachsenen Kühen und 80 Schweinen wurde der pH-Wert gemessen auf verschiedene Momenten während 24 Stunden nach dem Moment des Schlachtens.

Ausserdem wurde in denselben Muskel, 24 Stunden nach dem Schlachten, der pH-Wert gemessen von 93 Mastkälbern, 125 Kühen, 200 Schweinen von 75 - 100 kg und 42 älteren Schweinen von 100 - 300 kg.

In sechs Tabellen wurde ein Übersicht gegeben von den pH-Werten auf den verschiedenen Momenten nach dem Schlachten.
