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Differences in Meatquality by Varying Pre-Slaughter Conditions.

Introduction.

Transportation proves to be a severe stressor for the modern fattening pig in the Netherlands. Loading and transport itself have to get through with faster and faster, while the constitution of the fattening pig has become more unstable and stress-susceptible throughout the years (UNSHELM 1967, JUDGE et al, 1967).

This labile constitution does not only lead to an increasing percentage of the deathrate (LÖHR, 1967; LENDFERS, 1968) but also to an inferior meat-quality (BRISKEY, 1964; LENDFERS, 1968a). A high deathrate goes together with a bad meatquality, showing PSE quite often. By varying the ways of transport and the times spent in pens at the factories or slaughterhouses it is possible to influence the meat-quality.

Methods and material.

To determine the meatquality we used the method propagated by SYBESMA and VAN LOGTESTIJN (1967). With a portable Philips pH-meter, a rigormeter (SYBESMA, 1966) and an Ellab thermometer the pH, rigor and temperature were determined

in the M. semimembranatius at a certain moment after slaughter, which supplied information on the intensity of the post mortem processes. Said intensity depends on the condition of the animal due to the circumstances before slaughter and certain biochemical reactions in the tissues.

Distance.

In a factory in the north of Holland, Dutch Landrace pigs from the north (distance 20 - 80 km) and from the south of Holland (distance 220 - 300 km) were slaughtered every day.

In 1967 we found a difference in deathrate between the northern and the southern pigs in this factory (3,98 o/oo and 6,23 o/oo respectively). On a warm day - midday temperature of 25°C - there was a difference in meat quality as well; a larger number of pigs proved to be in complete state of rigor 35 minutes after slaughter (39 % in the southern pigs and 26 % in those from the north).

Table 1.

South group (n = 168)

rigor/pH 35	1	2	3	total
I.	37(22%)	14(8%)	-	51(30%)
II.	21(13%)	30(18%)	-	51(31%)
III.	15(9%)	34(20%)	17(10%)	66(39%)
total	73(44%)	78(46%)	17(10%)	168(100%)

North Group (n = 186)

I.	32(17%)	36(19%)	-	68(33%)
II.	29(16%)	38(20%)	2(1%)	69(37%)
III.	9(5%)	28(15%)	12(6%)	49(26%)
total	70(38%)	102(54%)	14(7%)	186(100%)

pH rubrics				rigor class		
1	: ⩾ pH 6,50			I	:	0 - 5
2	: ⩾ pH 6,00	pH	6,50	II	:	5 t/m 9
3	: < pH 6,00			III	:	⩾ 10

x^2 pH = 2,64 $\quad 0{,}20 < P < 30$

x^2 rigor= 2,74 $\quad 0{,}01 < P < 0{,}05$

A distinct, significant difference between the pH values of both groups did not appear however that day ($0{,}20 < P < 0{,}30$).

Pigs that had left the south in the early hours proved to show better quality than those that were transported during the heat of the day.

Our research into the difference of numbers of animals died during transport showed significantly less fatal cases in lorries, unloaded early in the day, compared to those which reached the factory by noon. During several days of measuring the pigs which had been unloaded and slaughtered early, were better in meat quality than those which arrived later in the day.

The weather seems to be one of the most important factors capable of influencing the meat quality and the number of fatal cases.

Such factors, like fasting before loading, loading them quietly into a lorry with sufficient room and ventilation capacity, period of rest after arrival, etc., are kept in Hand by man and may be varied at will; this however does not apply to the weather. SOMMER (1967), LENDFERS (1968), CEDERVALL (1968) and many others point at the influence of warm weather on the number of dead animals. Temperatures of 25°C also have an influence on the meatquality. pH- and rigor measurement in the slaughterline of the same factory 35 minutes post mortem showed the following results : (table 2).

Table 2.

High day temperature 25°C (n = 356)

rigor/pH 35	1	2	3	total
I.	69(19%)	51(14%)	-	120(33%)
II.	49(14%)	70(20%)	2(1%)	121(35%)
III.	24(7%)	62(17%)	29(8%)	115(32%)
total	142(40%)	183(51%)	31(9%)	356(100%)

Normal day temperature 15°C (n = 442)

I.	158(36%)	32(7%)	1(0,3%)	191(43%)
II.	96(22%)	54(12%)	-	150(34%)
III.	27(6%)	60(14%)	14(3%)	101(23%)
total	281(64%)	146(32%)	15(3%)	442(100%)

x^2 rigor = 11,08 $0{,}001 < P < 0{,}005$

x^2 pH 35 = 46,68 $P \leq 0{,}0005$

There is a significant difference in meat quality between NL-pigs on a warm and on a normal day.

Rest.

In one experiment two groups of pigs from the same area were transported with the same lorry and driver to an export slaughterhouse at a 3 1/2 hours interval; temperature appr. 15°C, distance 80 km.

The group that arrived last was slaughtered straight after arrival, the froup that got there first got a 3 1/2 hours rest in the slaughterhouse's pens. Loading degree was, in both cases, alike, the number of measured animals differed however. (table 3).

Table 3. Effect of rest on meat quality

n = 39 directly slaughtered

rigor/pH 35	1	2	3	total
I.	5(13%)	5(13%)	-	10(26%)
II.	-	8(20%)	3(8%)	11(28%)
III.	1(3%)	3(7%)	14(36%)	18(46%)
total	6(16%)	16(40%)	17(44%)	39(100%)

n = 43 3 1/2 hours rest

I.	13(30%)	15(35%)	-	28(65%)
II.	2(5%)	6(14%)	1(2%)	9(21%)
III.	-	5(12%)	1(2%)	6(14%)
total	15(35%)	26(60%)	2(4%)	43(100%)

We observe a distinct difference in the PSE category (III_3) (36 % and 2 %!).

Already in 1953 LUDVIGSEN stated that the percentage of animals showing degeneration decreased with 75 % when they were rested for 18 - 24 hours.

In another experiment rest in a badly ventilated pen during 7 1/2 hours (A) however showed poorer results in pigs from the same area and transported in the same lorry, compared to those that had only a 3 hours rest before slaughter (B).

35 min. after slaughter: (A) 18 % PSE
(B) 4 % PSE.

The animals mentioned above were non related individuals from different farms, reason why an experiment was carried out with animals of our experimental farm BANTHAM (related, disease-free animals, transported in the same lorry at midday temperature of 3°C over a distance of 50 km), (table 4).

Table 4. Rest and meat quality of related and disease-free animals

directly slaughtered n = 20

rigor/pH 35	1	2	3	total
I.	7/35%)	2(10%)	-	9(45%)
II.	4(20%)	2(10%)	-	6(30%)
III.	-	5(25%)	-	5(25%)
total	11(55%)	9(45%)	-	20(100%)

slaughtered after a 3 1/2 hrs rest n = 21

I.	14(67%)	3(14%)	-	17(81%)
II.	2(9%)	1(5%)	-	3(14%)
III.	-	1(5%)	-	1(5%)
total	16(76%)	5(24%)	-	21(100%)

average meat temperature 39,5°C

average slaughter blood glucose 124 mg %

average meat temperature 38,8°C

average slaughter blood glucose 108 mg %

Significant differences were found (0,02 P 0,05) in meat temperature and blood glucose and a substantial difference in rigor. Blood glucose was determined to HAGEDORN & JENSEN (1923).

Conclusions: Rest is only under suitable circumstances good for the meatquality.

Lorry and driver.

By employing a capable driver and using a good lorry the percentage of fatal cases may be lowered and the meat quality improved.

A well equipped lorry (C) with a good ventilation and 1,5 pig/m^2 and a lorry with a bad ventilation and 2,85 pig/m^2 (D) showed considerable differences in rigor- and pH-values

(table 5).

Table 5. Loading circumstances and meat quality

(C) good ventilation (n = 34)

rigor/pH 35	1	2	3	total
I.	8(24%)	16(47%)	-	24(70%)
II.	1(3%)	4(12%)	1(3%)	6(18%)
III.	1(3%)	1(3%)	2(6%)	4(12%)
total	10(39%)	21(62%)	3(9%)	34(100%)

(D) bad ventilation (n = 50)

I.	4(8%)	5(10%)	-	9(18%)
II.	4(8%)	12(24%)	-	16(32%)
III.	4(8%)	9(18%)	12(24%)	25(50%)
total	12(24%)	26(52%)	12(24%)	5P(100%)

State of rigor in the well ventilated and low-loadingsrate lorry was 12% against 50 % in the badly ventilated and high-loadingsrate one.

As to the PSE category (III_3) the figures were 6 % against 24 %.

A small number of lorries on which a hydraulic lift has been constructed are used in Holland now. Thus the pigs are lifted from the ground on to the bottom or topfloor without any difficulty. The animals will suffer less stress and the driver does not have to force his animals into the lorry. In these lorries the number of fatals was reduced quite strongly.

In lift-equipped lorry 1: 4 fatal cases on 8500 transported pigs during 9 months were found;

in lift-equipped lorry 2: 3 fatal cases on 6000 transported nimals during 6 months happened.

Lorry 1 is compared to a normally constructed one in the following diagrams. Loading degree of both lorries was the same and the animals came from the same area. To eliminate the influences of the animals' stay in the slaughterhouse pens they were slaughtered straight after arrival (table 6).

Table 6. New liftsystem and meat quality

new lorry 1 (n = 56)				
rigor/pH 35	1	2	3	total
I.	28(50%)	3(5%)	-	31(55%)
II.	10(18%)	7(13%)	-	17(31%)
III.	1(2%)	6(11%)	1(2%)	8(14%)
total	39(70%)	16(29%)	1(2%)	56(100%)
	distance 260 km			
controle lorry (n = 81)				
I.	22(27%)	7(9%)	1(1%)	30(37%)
II.	18(22%)	12(15%)	-	30(37%)
III.	5(6%)	13(16%)	3(4%)	21(26%)
total	45(55%)	32(40%)	4(5%)	81(100%)
	distance 230 km			

Importance of the driver.

During reckless loading and unloading the pigs are subjected to such a stress that some individuals will not even survive, while others will be in a non physiological condition at the moment of slaughter.

One driver/farmer (S) was examined.

When checking up at the farm of the driver/owner it proved necessary to lift the animals over the partitions into the passage of the fattening house. When resisting violently the

animals sometimes hit the floor of the passage rather painfully and were then driven into the lorry.

The meat quality results in a lorry with a bad driver are given against the figures of the whole day without (S), (table 7).

Table 7. Driver's influence on meat quality

driver/farmer (S) n = 46

rigor/pH 30	1	2	3	total
I.	2(4%)	1(2%)	-	3 (6%)
II.	9(20%)	9(20%)	2(4%)	20 (44%)
III.	7(15%)	2(4%)	14(30%)	23 (50%)
total	18(39%)	12(26%)	16(35%)	46 (100%)

day total without (S) n = 409

I.	57(14%)	49(12%)	5(1%)	111(27%)
II.	92(22%)	84(21%)	10(2%)	186(45%)
III.	20(5%)	52(13%)	40(10%)	112(27%)
total	169(41%)	185(45%)	55(13%)	409(100%)

There is a great difference in rigor and pH 30 min. between the pigs of driver/farmer (S) and the pigs of other drivers. The influence of the character of the driver starts already in the stable.

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