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The effect of transportation distance and preslaughter lairage time on the pigmeat quality

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SUMMARY: The aim of this work was to evaluate the effect of transportation distance from farm to abattoirs and preslaughter lairage time on the pigmeat quality. A total of 160 crossbred pigs were slaughtered with approximately 90 kg live weight. Were used four transportation distance and two preslaughter lairage times to form a 4x2 factorial trial. Muscle longissimus dorsi and semimembranosus pH and colour refletance measurement, slaughter weight and cool carcasses weight were examined. In the groups that had 80 or 115 km transportation distance and a lairage time of 6 hours, the average of pH1 were less than the other groups and thus PSE carcasses frequency was greater. The refletance measures, using FOP (Fibre optic probe) indicated that the PSE frequency tends to decrease with the increase of transportation distance. The DFD frequency was greater for the lairage time groups of 24 hours. The transportation distance were not enough to affect the DFD frequency.

INTRODUCTION: According FELÍCIO (1986), incidence of poor quality pork in Brasil is high and during its manufacture come about very important losses. Besides this, pork quality is being more and more careless with reflection on quality of final products. Stress susceptibility in swine has generated a concern to breeders and manufactures in most countries in which there are intensive breedings (FROYSTEIN, 1980). Stressed swines give rise to a typical pale, soft and exudative meat (PSE). Otherwise a prolonged stress of pigs before slaughter results in carcasses whose meat is known by a dry, firm and dark surface cut (DFD) (THE SNAGS ..., 1982; WINSTANLEY, 1986). PSE condition is due to a rapid fall of post mortem pH while the carcass temperature is high (ALLEN et alii, 1986; DETECTING ..., 1980; THE SNAGS ... 1982; YANG et alii, 1984). When muscular glycogen is depleted much time before slaughter, the post mortem pH value of carcass remains the same or nearly the same as was at the bleeding moment (WILSON, 1981). The pork quality is also explained by ambiental factors, transportation distance from the farm to slaughterhouse and lenght of rest period before slaughter (FROYSTEIN, 1980). There are conflicting evidences about the complete effect of transportation period on PSE and DFD incidence. Sometimes, extended periods of time for transportation are associated to a increase of PSE and also of DFD carcasses (WINSTANLEY, 1986). According FROYSTEIN (1980), despite slaughterhouse differences, preliminary estimates indicated that distances and lairage time influence in a great extent pork quality. Lairage time is the main factor influencing pH1 values and consequent incidence of exudative meats in swine (BENDALL, 1966), FROYSTEIN (1980) stated that there is a strong correlation between the time of transportation and rest period before slaughter on pork quality. NIELSEN (1979) found that the number of PSE carcasses diminished in relation to a increase in the lairage period. However, number of DFD pork increased with lenghthening of rest period before slaughter.

MATERIALS AND METHODS: Were used in this experiment, 160 right half carcasses deriving from crossbred pigs (castrates and gilts) reared in Excelsior farm, situated at Santa Cruz do Sul, RS and slaughtered with proximately 90kg live weight, during july, 1990. Four transportation distances(10, 45, 80 and 115 km) and two preslaughter lairage times (6 and 24 hours) were adopted to or a 4x2 factorial trial. The variables studied were muscle longissimus dorsi and semimembranosus pH and colour reflectance measurement by fiber optic probe at 45 minutes post mortem (respectively pH1L, pH1P, FOP1L and FOP1P) and after overnight cooling (respectively pH2L, pH2P, FOP2L and FOP2P), longissimus dorsi muscle (L.D.) pH and FOP measures were taked at the last rib and at the ham medial face, nearly of semimembranosus (S.M.) muscle origin, according, KEMPSTER et alii (1984), SOMERS et alii (1985) and LAMBOOY (1988). Were used a DIGIMED portable equipment with a ANALION v-627-C glass insertion eletrode for pH measurement and a MHII Fiber Optic Meat Probe - TBL - Fiber Optic Group Ltd, England, for FOP measurements.

RESULTS AND DISCUSSION: pH_1L and pH_1P averages of 80 and 115 km groups were inferior than the other groups (TABLE 1). Analysis of variance of L.D. pH_1 showed a significant effect ($P < 0,01$) of transportation distances (TABLE 2). Maybe it was due to stress of transport on the animals, giving rise to a rapid pH fall soon after bleeding while carcass was still warm.

TABLE 1. Means and deviation standand of longissimus and semimembranosus pH values from transportation distances vs. preslaughter lairage groups.

transportation distances (km)	preslaughter lairage (hours)							
	6				24			
	$pH_1L \pm SD$	$pH_1P \pm SD$	$pH_2L \pm SD$	$pH_2P \pm SD$	$pH_1L \pm SD$	$pH_1P \pm SD$	$pH_2L \pm SD$	$pH_2P \pm SD$
10	6,28±0,41	6,32±0,31	5,58±0,19	5,62±0,20	6,55±0,50	6,50±0,28	5,60±0,15	5,56±0,13
45	6,42±0,33	6,45±0,22	5,66±0,13	5,73±0,20	6,41±0,30	6,39±0,30	5,73±0,22	5,77±0,24
80	6,11±0,44	6,32±0,34	5,53±0,13	5,65±0,22	6,11±0,31	6,26±0,31	5,67±0,21	5,88±0,29
115	6,17±0,42	6,18±0,33	5,67±0,13	5,68±0,15	6,42±0,32	6,50±0,28	5,77±0,24	5,82±0,34

The groups that were transported for 10 and 45 km didn't produced stressed meat due a transportation period not very elongated. PSE carcasses were frequent in 80 and 115 km groups with 6 hours preslaughter lairage (TABLE 3) probably due a short period for their recovery originating a rapid fall of pH post mortem. The pH_2L (5,69) and pH_2P (5,77) were great than pH_2 values of groups that rested for 6 hours before slaughter (pH_2L 5,61 and pH_2P 5,67, respectively). Analysis of variance of pH_2 values showed a significant effect of preslaughter lairage ($P < 0,01$) (TABLE 2), showing that as longer was the lairage time greater were pH_2 values. The extended time of preslaughter lairage and fasting diet possibly muscle glycogen stores before bleeding originating a reduced pH fall after slaughter. In this work, distribution frequency of DFD carcasses had no

TABLE 2. Effects of transportation and fasting period in pork quality expressed as pH values, giving the least squares means.

Source of variation	pH_1L	pH_1P	pH_2L	pH_2P
Transportation distance (km)	0,804••	0,149^{NS}	0,188••	0,190•
Fasting time (hours)	0,688•	0,362•	0,273••	0,399••
Km x hours	0,241^{NS}	0,350••	0,027^{NS}	0,113^{NS}
Residue	0,162	0,0091	0,034	0,055

•• $P < 0,01$ • $P < 0,05$ NS - No significance

relationship with transportation distances (TABLE 3). Thus, 115 km wouldn't be sufficiently long to elevate the number of DFD cases. However, DFD carcasses were superior in number in groups that fasted for 24 hours in comparison to groups with 6 hours preslaughter lairage, according FROYNSTEIN (1980) and NIELSEN (1979). Effects of transportation distances and preslaughter lairage on FOP measures weren't observed in this work (TABLE 4). FOP_2 average (137,35) for 24 hours fasting was significantly superior to 6 hours fasting FOP_2 value (133,17) ($P < 0,001$) (TABLE 5). PSE carcasses percentage on a FOP value basis ($FOP_2 > 151$) in 24 hours fasting group was reduced with the increase of transportation distance. This fact is in opposite to the results of pH measures found in this work and that results found by NIELSEN (1979) and FROYNSTEIN (1980). DFD carcasses number according FOP_2 values ($FOP_2 < 119$) was greater in 24 hours fasting groups. Transportation distances didn't affect

TABLE 3. Frequency expressed as percentage, of pH values according transportation distances and preslanghter lairage time (PSE = $pH_1 < 6,0$ and DFO = $pH_2 \geq 6,0$).

Muscle	Class	Fasting time (hours)	Transportation distance (Km) 10	45	80	115
L.D.	PSE[1]	6	20	10	35	35
		24	10	5	35	5
	DFD_2	6	10	0	0	0
		24	0	15	5	10
S.M.	PSE[1]	6	10	5	5	30
		24	0	20	20	0
	DFD_2	6	5	5	5	5
		24	0	20	25	20

DFD frequency as the same way pH_2 values 6,0 did. Analysis of variance of pH and FOP values showed no significance to sex (gils and castrated), live weight (taked at slaughterhouse arrive) and cold carcass weight.

TABLE 4. Means and standard deviation of FOP_2 values according transportation distances and fasting

Transportation distances (km)	Fasting (hours) 6		24	
	$FOP_2L \pm SD$	$FOP_2P \pm SD$	$FOP_2L \pm SD$	$FOP_2 \pm SD$
10	143,37±15,43	135,32±10,02	135,80±14,53	145,25±7,85
45	135,65±15,29	129,47±9,65	147,75±13,66	135,87±10,18
80	143,82±18,06	133,80±14,08	131,55±12,64	130,77±14,32
115	135,97±10,14	134,12±9,18	135,92±11,37	137,52±8,44

TABLE 5. Effects of transportation and fasting period in pork quality expressed as FOP values, giving their least squares means.

Source of variation	FOP_1L	FOP_1P	FOP_2L	FOP_2P
Transportation distance (km)	726,65·	$66,75^{NS}$	$244,95^{NS}$	548,19··
Fasting time (hours)	$1,22^{NS}$	$21,75^{NS}$	$152,10^{NS}$	697,21·
Km x hours	929,19··	337,01··	1130,85··	301,50·
Residue	239,05	86,16	198,60	114,74

·· $P < 0,01$ · $P < 0,05$ NS - No significance

CONCLUSIONS: This experiment allowed the following conclusions:

1. As fasting period was reduced PSE frequency increased while DFD frequency diminished.
2. Transportation distances dind't affect DFD condition.
3. PSE carcasses were more frequent in the 80 and 115 km groups of animals with 6 hours preslaughter lairage.

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