INFLUENCE OF ENVIRONMENTAL TEMPERATURE, TRANSPORT DISTANCE AND RESTING AT THE ABATTOIR ON *post mortem* CHICKEN BREAST MEAT PH, R VALUE, COOKING LOSSES AND SHEAR VALUES

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BACKGROUND

An extensive rewiew on the effects of *ante mortem* factors on poultry meat quality is given by FLETCHER (1991). Pre-slaughter handling, including transportation, resting time at the abattoir and stunning, all affect the rate of *post mortem* biochemical changes (SAMS & MILLS, 1993). EHINGER & GSCHWINDT (1979) found lower pH values (5,87) 15min *post mortem* for chickens transported for 0h than for chickens transported for 1, 2 and 3 hours. Chickens transported for 4h were considered more tender than the others. HILLEBRAND et al. (1991) also suggested that turkey breast from stressed birds were more tender. LEE et al. (1976) reported small pH differences at 0 and 15min p.m. in chickens held at 38, 4, -20 and 20°C for 6 hours *ante mortem*. Measures of pH 24h p.m. revealed that birds held at 38°C presented lower pH. SIMPSON & GOODWIN (1974) reported low shear force values for chicken slaughtered all year round. However, LEE et al. (1976) registered higher pH values in the breast of chickens killed in the warmer months.

The Brasilian legislation (REGULAMENTO... 1952) requires 6h resting at the abattoir, often reduced to 2 hours, before chicken are slaughtered. No evidence has been found to confirm or deny that this resting period reduces birds stress.

OBJECTIVES

To establish the effects of transportation distance from farm to abattoir, resting time at the abattoir and environment temperature at slaughtering on: a) pH drop and R value rise in the *pectoralis major* at different times *post mortem*; b) cooking loss and shear force of breasts deboned 1 hour *post mortem*.

MATERIAL AND METHODS

In each trial Hubbard/Petersen chickens, mixed sex, 50-53 days old were selected at random, to weigh 2,5-2,9kg. **In trial 1**, conducted at environmental temperature of 30°C, 180 birds from birds transported for 40 or 160km and were divided into three groups submitted to resting time periods of 0, 2 and 4 hours. **In trial 2**, environmental temperature was 17°C, and 90 birds were taken from birds transported for 59 or 159km; resting periods were the same as in **trial 1**. Samples for pH and R value were colected at 15, 60min and 24h *post mortem* and immediately frozen in liquid nitrogen. Ph was determined according to BENDALL (1973). The R value was measured using the methodology proposed by HONIKEL & FISCHER (1977). For cooking and shear force measurement the chickens were breast deboned 60min *post mortem*, packed in polyethylene bags and stored for 72 hours at 4°C. Weigh loss on cooking was measured according to BILGILI et al. (1989). Shear value measurements were carried out on the cooked samples following the procedures of FRONING et al. (1988), using a Warner-Bratzler blade coupled to an Instron.

Statistical analysis: The structures of treatments was factorial where each bird was considered an experimental unit. **Analysis of variance** and the **Duncan Test** were conducted using the software **Statistica** (1995).

RESULTS AND DISCUSSION

The pH drop of the breast muscle at 15 min was influenced by the environment temperature and by the resting period but not by the transportation distances studied (**Table 1**).

TABLE 1. Environmental temperature, transportation distance and resting time effects on chicken breast muscle pH and R value .

		15min		60min		24h	
		pH	**R value**	**PH**	**R value**	**pH**	**R value**
Trial 1 (30°C)		5,98^{b}	1,12^{a}	5,94	1,17^{a}	5,88^{a}	1,39
Trial 2 (17°C)		6,08^{a}	1,04^{b}	5,93	1,09^{b}	5,70^{b}	1,40
Trial 1 (30°C)							
KM	40	5,97	1,16^{a}	5,94	1,17	5,91	1,38
	160	5,99	1,09^{b}	5,92	1,16	5,84	1,39
	0	5,98^{b}	1,21^{a}	5,99	1,14	5,93	1,39
RT (h)	2	6,07^{a}	1,06^{b}	5,90	1,15	5,83	1,39
	4	5,90^{c}	1,10^{b}	5,90	1,19	5,87	1,37
Trial 2 (17°C)							
KM	59	6,09	1,06	5,94	1,12^{a}	5,72	-
	159	6,08	1,03	5,93	1,06^{b}	5,72	-
	0	5,88^{b}	1,12^{a}	5,88	1,16^{a}	5,77	-
RT (h)	2	6,22^{a}	0,96^{b}	5,91	1,03^{b}	5,70	-
	4	6,14^{a}	1,05^{a}	6,00	1,08^{b}	5,68	-

$^{a\,c\,b}$ Mean with different letters are significantly different, Duncan Test ($\alpha = 0,05$)
KM = transport distance from farm to abattoir, km
RT = resting period at the abattoir, h

Sixty minutes *post mortem* none of the factors studied affected the breast muscle pH. After 24h *post mortem* stored at 4°C the breast of chickens slaughtered at 17°C had a significantly lower pH, 5,70 against 5,88 observed for birds killed at 30°C. This is an indication of glycolysis of a higher amount of glycogen in birds killed at 17°C. Higher pH values for resting times of 2 hours, at both environment temperatures, is an indication of higher levels of glycogen in the muscle immediately *post mortem* and therefore of less stress *ante mortem*. On these considerations a 2 hour resting period might be suitable to the birds recover from stress.

If as suggested by HONIKEL (1981) and SAMS et al (1993) that R values equal or higher than 1,10 are an indication that the chicken breast muscle is in *rigor* then from **Table 1** it can be inferred that birds killed at 30°C would be in *rigor mortis* 15min *post mortem*, while those killed at 17°C would enter *rigor* after 60min *post mortem*. No resting period at the abattoir would also cause the breast muscle to be in *rigor* 15min *post mortem*, at both environmental temperatures.

Cooking losses (**Table 2**) were only significantly affected by environmental temperature, being higher for chickens killed at 30°C. At the lower environmental temperature the transportation distance also affected the cooking losses with birds transported for the longer distance losing 27,8% weight against 26,6% for the shorter distance.

Shear values were only significantly affected by the resting time, when killing was conducted at 17°C. Birds without a resting period showed lower shear values of an average 4,42kgf/g against 6,00 and 5,52kgf/g for resting periods of 2 and 4 hours. The other factors studied did not affect the shear values.

TABLE 2. Environmental temperature, transportion distance and resting period effect on cooking weigh loss (CWL) and shear value.

		n	CWL (%)	n	Shear value (kgf/g)
Trial 1 (30°C)		58	28,7[a]	101	5,77
Trial 2 (17°C)		22	27,2[b]	53	5,47
Trial 1 (30°C)					
KM	40	29	29,2	49	5,48
	160	29	28,2	52	6,00
TD	0	20	28,6	28	6,00
	2	20	29,1	31	5,62
	4	18	28,4	48	5,58
Trial 2 (17°C)					
KM	59	11	27,8[a]	20	5,62
	159	11	26,6[b]	23	5,01
TD	0	6	27,0	19	4,42[b]
	2	9	27,0	20	6,00[a]
	4	7	27,6	14	5,52[a]

[a c b] = Mean with different letters are significantly different, Duncan Test ($\alpha = 0,05$)
n = Number of breast sample, each breast 6-8 repetition.
KM= transport distance from farm to abattoir, km
RT = resting period at the abattoir, h

CONCLUSIONS

1. Glycolysis rate in the chicken *pectoralis major* was very fast for all treatments.
2. Glycolisis rate was faster in birds killed at 30°C than at 17°C.
3. Breast muscle cooking losses were only affected by the environment temperature at slaughter
4. Shear value were only affected by the resting period at the lower environment temperature, the lowest value corresponding to the lowest pH value observed at 15min *post mortem*.

LITERATURE

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