

Brief Communication

INFLUENCE OF PHYSICAL TRAINING AND PRE-SLAUGHTER EXERCISE ON FLUID RETENTION, COLOUR AND ADENOSINE TRIPHOSPHATE OF PORK MUSCLE*)

Wateriness and a pale colour seriously impair the quality of pork and have given rise to an extensive literature (cf. 1). No reports have appeared, however, on the effects of physical training of the pigs.

Fifty Swedish Landrace pigs, weighing about 30 kg, were started in an experiment. They had free access to wellbalanced commercial food and to water. Twenty-five pigs were trained twice a week by running on a horizontal ergometer at 2 m/sec for 10 min. Light pigs and heavy, trained pigs do this easily, whereas heavy, untrained pigs become exhausted. The other pigs were left in their pens throughout the experimental period. The pigs were slaughtered when they weighed 90—110 kg. One trained and one untrained pig were exercised ("stressed") on the ergometer until one of them (nearly always the untrained pig) showed symptoms of fatigue, such as dyspnoea and unwillingness to move. This took 2—3 min. The pigs were then immediately shot in the brain. On the same occasion, one trained and one untrained pig were shot close to their pens, excitement and physical stress being avoided. The pigs were exsanguinated by slitting their throats. The left hind leg, including the ham, was cut off and taken to a refrigerator room at 4°C for adenosine triphosphate (ATP) determinations. The carcasses were taken to the slaughter-house for processing. The experiment was ended when groups of 4 pigs of approximately equal size could no longer be obtained from the lot. Some values are missing due to technical mishaps.

Specimens for determination of colour (2) and expressible water (3) were obtained at the slaughter-house from the medial part of the right ham 3 hrs. after the pigs had been killed. ATP was determined in specimens from the medial part of the left ham (4).

It is apparent from Table 1 that pre-slaughter exercise (TS and US pigs) promotes the loss of fluid and pale colour of the pork. This is in agreement with earlier observations (5, 6). Pork of trained pigs (T and TS) retains its fluid-holding capacity better than pork of untrained pigs (U and US).

The meat inspecting officer at the slaughter-house was unaware of to which treatment the individual pigs had been exposed.

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Table 1. Expressible water and optical density (mean \pm s.d. of mean) in trained, unstressed (T), untrained, unstressed (U), trained stressed (TS) and untrained, stressed (US) pigs.

Group	Expressible water (v/w %)	Optical density ¹⁾	No. of pigs
T	1.30 \pm 0.35	0.933 \pm 0.062	11
U	8.35 \pm 1.10	0.622 \pm 0.080	9
TS	5.75 \pm 1.45	0.769 \pm 0.077	10
US	13.25 \pm 1.85	0.435 \pm 0.062	8

Significance of differences between means (Student's t test)

*** P < 0.001, ** P < 0.01, * P < 0.05

T-U	***	**
T-TS	**	
T-US	***	***
U-TS		
U-US	*	
TS-US	**	**

Analysis of variance shows significant differences in optical density between T+TS and U+US (**), and between T+U and TS+US (*).

¹⁾ Colour reference standard (2) was included in each of 10 films used. Mean value was 1.594 with 0.082 (coefficient of variation 5.17 %).

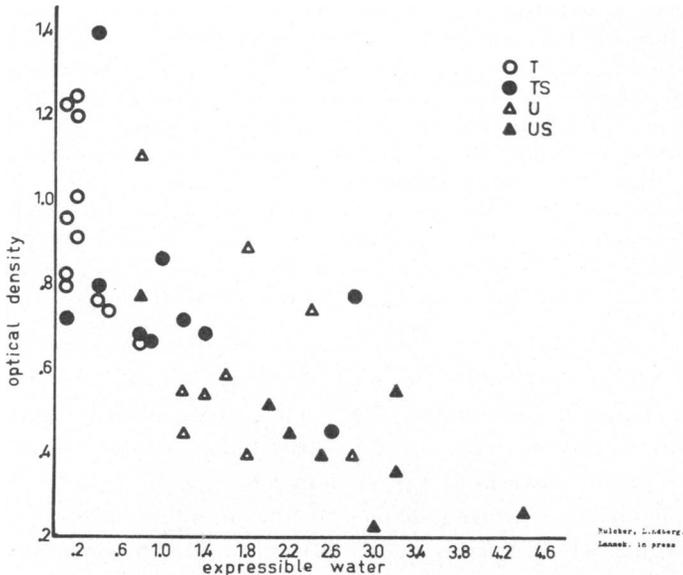


Figure 1. Optical density and expressible water (ml expressed from 20 g muscle).

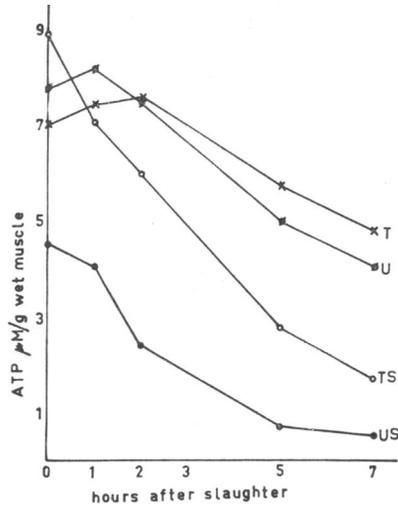


Figure 2. ATP content (mean values) of the left ham muscle (no. of pigs 9 T, 7 U, 8 TS and 6 US).

He condemned the hams of 8/8 US, 3/9 U, 2/10 TS, and 0/11 T pigs because of wateriness and pale colour. The inspection was done by subjective scoring only.

Fig. 1 shows the negative correlation between fluid loss and colour intensity.

In the non-stressed groups T and U, the ATP content remained largely unchanged for 2 hrs. (Fig. 2). Thereafter, it disappeared somewhat faster in the U group. TS pigs had a high initial ATP level, but US pigs had lost nearly half their ATP already at slaughter (8.91 ± 0.75 as against 4.52 ± 0.97 $\mu\text{M/g}$ muscle). The latter event probably reflects a low rate of oxidative phosphorylation during the pre-slaughter exercise. In both groups, the ATP fell sharply from the moment of death. This is remarkable, since the pre-slaughter stress must have been fairly negligible in the TS pigs. It has been suggested (6, 7) that pale, exudative pork muscle is associated with rapid depletion of ATP. The protective effect of physical training may be due to a high ATP level during the early post-mortem phase.

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