INFLUENCE OF LAIRAGE TEMPERATURE AND TIME ON POSTURAL ATTITUDE OF PIGS

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INTRODUCTION

The observation of animal behaviour, as a methodology to determine the stress level have been discussed on several studies and can be realised by notation of the occurrence of normal activity patterns (Ewbank & Bryant, 1972) or vices (Moss, 1978). Despite the publication of some works describing the behaviour and pig's social life (conflict/order) during fattening (Meese & Ewbank, 1971; Fraser, 1974; referred by Moss, 1978; Boon, 1981), just few information exist in relation to the lairage period. Moss (1978) studied the lairage behaviour attitude that better correlate with the stress level in pigs from different production groups, as well as the time necessary to settle down after transport, and concluded that the number of animals participating in aggressive encounters is effective to determine the stress of the population.
Works carried out by Augustini & Fisher (1982) showed that the environmental temperature greatly determine the stress level during transport and lairage, inducing changes on the final meat quality status (Warriss, 1991, Santos *et al.*, 1996). According to Randall (1983), the animal body temperature is fundamentally affected by environmental temperature having the relative humidity a small influence on it. Attending to the large annual variation of environmental temperature (±5° to ±39°C) in Portugal, the aim of this study was to quantify the postural attitudes observed in pig groups submitted to different lairage temperatures and resting times and their relationship with the carcass and final meat quality.

MATERIALS AND METHODS

The experimental material consisted on lots of 30 pigs (Belgium LandracexLarge White-PietranxDurocxHampshire), performing 708 animals, from the same farmer and submitted to a fasting period of about 24h before loading and transport to slaughter house (±50 minutes). During transport, fattening social groups were maintained. After unloading two social groups, were mixed together and immediately transferred to an environmental controlled room, built on one lairage pen (2m wide, 10m long and 2,5m high) at 20°C and 35°C. During each lairage condition, the animal behaviour was recorded using a video camera CCD-Sony (SPT-M102CE) connected to a videotape Panasonic (NV-SD40 VHS) without interruption during the first half hour and then, during 15 minutes followed by pauses of same duration. Pig's postural attitudes were recorded as follows: A_n- pig-floor attitude (A_1- pigs lying down; A_2- pigs standing) and B_n- pig-pig attitude (B_1- pigs not touching; B_2- pigs touching; B_3- pigs huddling; B_4- aggression between pigs: number of animals showing aggressive interaction). From the combination of A_n with B_n were obtained different behaviour indexes (A_nB_n), which can be calculated through the ratio of pigs assigned in different attitudes to the total number of pigs, expressed in percentage.
In our experiments, different indexes were stablished: A_1B_2 (pigs lying down touching), A_1B_3 (pigs huddling), A_1 (pigs lying down), A_2 (pigs standing), A_2B_4 (pigs with aggressive attitude or fighting index). Every index was calculated each five minutes of a record period. In graphics each value represents the mean of, at least, 3 experiments.

Carcass and meat quality evaluation - Subjective assessment of skin damage on the different regions (front - head and shoulder; middle - loin and ribs; hind - ham) of carcasses approximately 45 min. *post-mortem* followed a 4 point scale defined by Danish researchers (Barton-Gade, 1993). The different parts of the carcass denoting a score ≤2 and ≥3 were classified respectively as acceptable and not acceptable. At this point of the carcass preparation chain the pH_1 in the *Semimembranosus* (SM) and *Longissimus dorsi* (LD) (Knick 655 pH-meter, electrode Ingold Lot 406-M6-DXK 57/25), were also measured.
Statistical treatment of data - The relationship between the animal behaviour submitted to different temperatures and resting times were analysed by simple linear regression. The influence of environmental temperature and resting time on the incidence of carcasses classified as acceptable and not acceptable was evaluated by the chi-squared test using a contingency table 2x2 (Norman & Bailey, 1981).

RESULTS AND DISCUSSION

Changes on the activity pattern of pigs held in lairage at 20°C or 35°C during ±30 minutes are depicted in Fig 1a-b. Irrespective of the environmental temperature, the results showed that pigs denoted, immediately after penning, an exploratory activity, moving around, smelling walls and floor and the other individuals. After the first five minutes, pigs at 35°C started to settled down and in the end of lairage time more than 50% of the population was resting, most of them touching each other but not huddling. This behaviour could correspond to an attempt to minimise the physical discomfort caused by the hot environment and the consequent effect on internal body temperature and blood pH (Judge *et al.*, 1972). Unlikely, the initial activity pattern of pigs at 20°C was kept almost unchanged along the lairage time, showing in the end of the period not more than 5% of individuals on a resting position. Unexpectedly, the number of pigs involved in fightings was not different between groups (Fig. 2). In both, the aggression index presented a positive relationship with time but, in average, the number of encounters was low not overpassing 2-3 animals per trial. At the end of lairage period (last 5 min) only about 7% of pigs were fighting. In respect to the incidence of carcasses showing a skin damage score ≥3 (unacceptable), no significant differences were observed between the two lairage temperature groups on front (head and shoulder) or hind (ham) areas of the carcass (Fig 3).

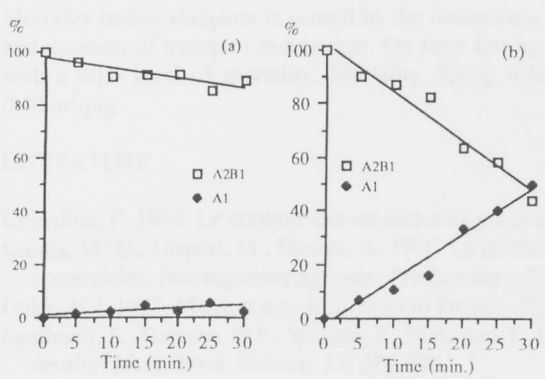

Figure 1: Pig's behaviour (A_1 and A_2) when held in lairage at 20°C (n=149) (a) and 35°C (n=120) (b) during a resting time of 30 min.

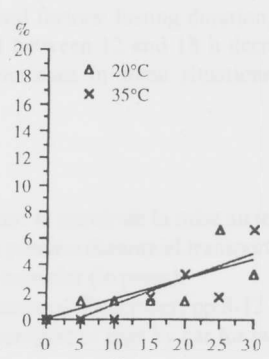

Figure 2: Pig's aggressive behaviour at 20°C and 35°C during a resting time of 30 min.

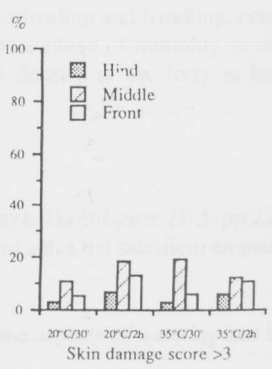

Figure 3: Region carcass distribution with a skin damage score ≥3.

The higher incidence of damaged loins on those pigs held at 35°C could, perhaps, be more related with differences in pig's handling during loading, vehicle transport, unloading, and during the transport to the stunning device. It was frequently observed that pigs penned at 35°C reacted slowly to handling and so, they could be often punished to move faster along the corridors. According to Boon (1981) and Randall (1993), the upper critical temperature corresponds to the temperature above which the pigs are unable to maintain their body temperature. When it raises, pigs suffer stress (Warriss, 1991). In fact, *post mortem* deep ham temperature data (Santos *et al.*, 1996) clearly showed that this parameter was significantly higher when pigs were held at 35°C. However, comparatively to the assays ran out at 20C, the possible higher stress level of pigs held at 35°C did not promote a significant change on pH_1 of LD and SM muscles this could be due to the short time spent in lairage.

Regarding the experiments with lairage times between 2-3 hours, the influence of environmental temperature on their activity pattern, namely on the number of resting animals (A_1) (Fig 4), concerned basically to the quickness of adoption of such postural attitude. In fact, after two hours in lairage, the number of resting pigs is similar at 20°C or at 35°C (±80% of the population). However, in the later temperature condition that resting score is already reached after the first hour of lairage whereas at 20°C, at the same time, only 35% to 40% is on that postural attitude.

It's interesting to note that the resting relationship among pigs (A_1B_2 and A_1B_3 indexes) is generally different at 20°C and 35°C (Fig 5a-b). While in the first condition and in agreement with the lower critical temperature for pigs with similar live weight (23°C) referred by Randall (1993), the animals formed huddle groups in each top of the pen, at 35°C they kept resting apart from each other. It was also observed that in such temperature condition, pigs increased the breathing rate as a result of a higher internal body temperature (Randall, 1983). Surprisingly, a small number of pigs (less than 20% of the population) was still adopting a huddle attitude during the experiments ran out at 35°C, when a important area was available in the pen. In such a way the huddling behaviour can not just be understood as a defence reaction against a cold environment (Boon, 1981) but should also be watched as a kind of social behaviour.

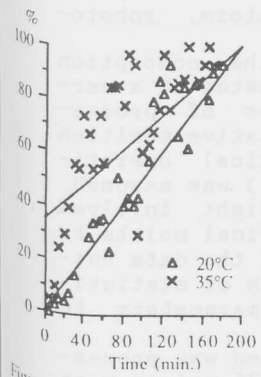

Figure 4: Frequency of resting pigs held at 20°C and 35°C during 2-3h.

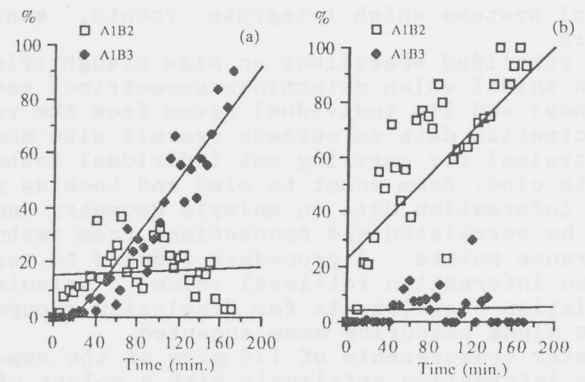

Figure 5: A_1B_2 and A_1B_3 index's incidence in pigs held at 20°C (n=267) (a) and 35°C (n=172) (b) during a resting time of 2-3h.

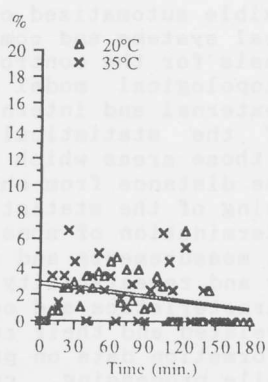

Figure 6: Pig's aggressive behaviour held at 20°C and 35°C and 2-3h of resting time.

Regarding the fighting index (Fig 6), it was observed that, irrespective of lairage temperature, the number of pigs involved was, in average low (less then 7% of the population). After about 2 hours of lairage, the fightings almost stopped.

The number of carcasses with a skin damage score ≥3 on front ($p<0.05$ at 20°C) and hind regions increased with lairage time for both temperatures (Fig 3). Since the relative number of pigs involved in fights was not found to be different at the two lairage times (maximum 7% of the population) the higher skin damage incidence at 2-3 hours should be related with the longer occurrence of the encounters. According to Warriss & Brown (1985) there is a direct relationship between skin bruise appearance and stress, proved through a higher level of cortisol in blood. Otherwise, Moss (1980) states that physical activity associated with fighting may be expected to lower muscle glycogen levels. In fact, irrespective of the lairage temperature, the mean value of pH1 from LD and SM was higher when pigs were held in pens during 2-3h, being the difference significant ($p<0.01$) at 35°C). Appart the increasing on the incidence of DFD carcasses, the frequency of those seriously affected by the PSE status was also higher in the assays carried out at 35°C (Santos *et al.*, 1996).

So, and despite the resting attitude of most population in the assays at 35°C, to increase the lairage time in such ambient conditions is not beneficial neither to the animal welfare nor to the final meat quality.

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