THE INCIDENCE OF HIGH INTERNAL REFLECTANCE 45 MINUTES PM WITH DIFFERENT STUNNING METHODS

A-J. VON ZWEIGBERGK, K. LUNDSTRÖM & I. HANSSON

Division of Meat Science, Dept. of Animal Breeding and Genetics, Swedish University of Agricultural Sciences, S-750 07 Uppsala, Sweden

INTRODUCTION

The stunning of slaughtering pigs is a question of animal welfare, labour safety and meat quality. The stunning method can affect the meat quality with respect to PSE and DFD, muscular haemorrhages and bone fractures.

In Sweden one of the great differences among slaughterhouses in the handling of slaughtering pigs is the stunning method. The stunning methods used are carbon dioxide (CO_2) and low voltage electricity on the floor or in a restrainer. Approximately half of the 3.7 millions pigs annually slaughtered are stunned with carbon dioxide. The purpose of this study was to compare the incidence of high internal reflectance, measured with the Hennessy Grading Probe at the time of grading, at slaughterhouses using different stunning methods.

MATERIAL AND METHODS

A Hennessy Grading Probe equipped with a quality function (GP2-Q, Hennessy Grading System, Auckland, New Zealand) was used at 11 different slaughterhouses, 5 using CO_2 and 6 using electricity (90 - 160 V, 0.8 - 1.0 A) for stunning. The number of carcasses measured at the different slaughterhouses varied between 1,500 and 16,800, with a total of nearly 98,000 carcasses.

The internal reflectance was recorded simultaneously with the grading for meat content (40 - 50 minutes post mortem). The measurements were made at two sites along the M. longissimus dorsi; at the tip of the last rib and between the 3rd and 4th (3/4) last rib.

At one slaughterhouse 638 randomly chosen carcasses were remeasured after chilling (24 h post mortem).

RESULTS

The muscles were considered to be PSE if the mean internal reflectance was above the mode + 2 SD in a randomly chosen test material with 600 carcasses. With that definition the average incidence of early PSE at the five slaughterhouses using carbon dioxide for stunning was 1.7 % (0.8 - 3.0 %). At the two slaughterhouses using electricity and restrainer for stunning, the average incidence was 6.9 % (6.9 and 7.0 %). The highest incidence, 8.0 %, and the highest variation between slaughterhouses (1.6-17.0 %), was found at the four slaughterhouses where the stunning was made with electricity on the floor. The number of carcasses measured and the incidence of early PSE at the different slaughterhouses are shown in Table 1 and Figure 1.

After finding the extremely high incidence of early PSE (17 %) at one of the slaughterhouses stunning with electricity on the floor, measures were taken to improve the meat quality. Changes were made, such as a shorter scalding time, which resulted in a marked decrease in the incidence of early PSE, from 17.0 % to 1.5 %.

The correlation between internal reflectance at the time of grading and measurements the day after slaughter was 0.20 ($n=638$; $p < 0.001$). This relationship is illustrated in Figure 2.

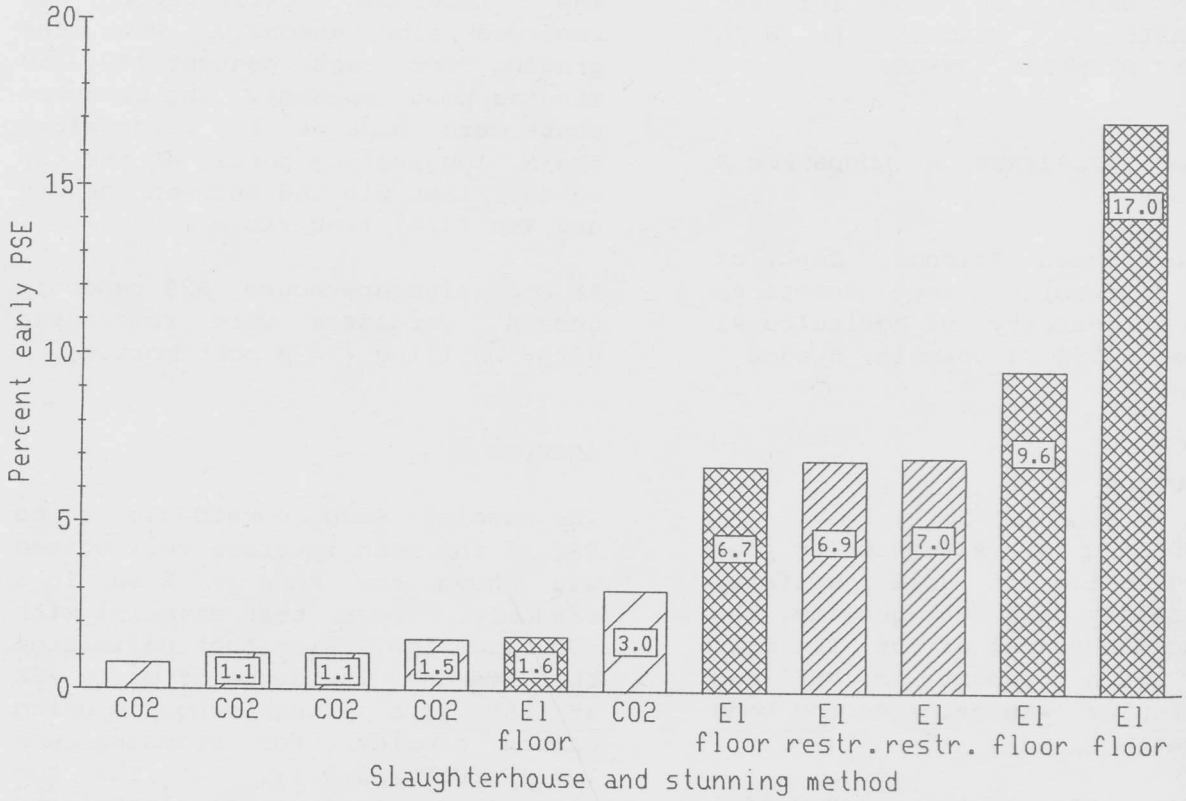

Figure 1. Incidence of high internal reflectance at the time of grading (early PSE) at slaughterhouses using different stunning methods.

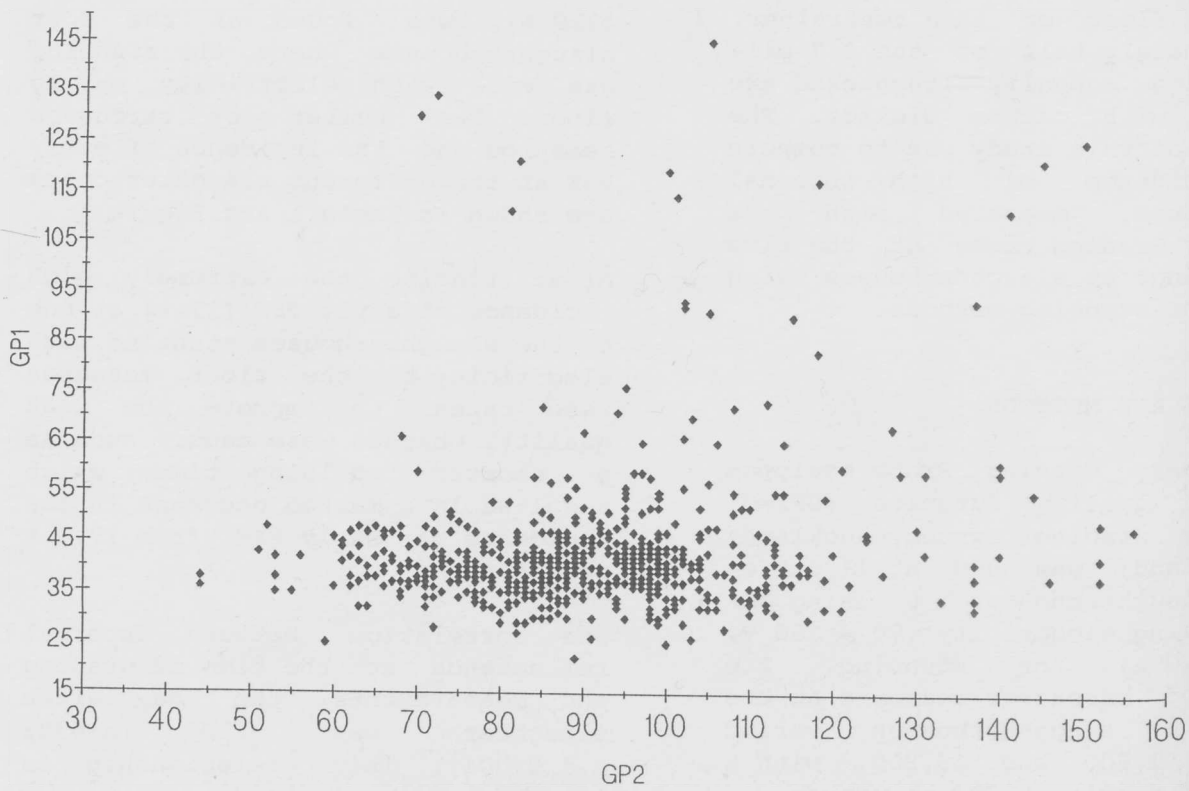

Figure 2. Relationship between Hennessy Grading Probe values measured 45 minutes PM (GP1) and 24 h PM (GP2).

Table 1. The numbers of carcasses measured at the different slaughterhouses and the incidence of high internal reflectance (early PSE) at the time of grading

Stunning method	n	Early PSE (%)	Daily variation
CO_2	9,142	1.1	0.6- 2.2
CO_2	11,473	1.1	0.4- 2.2
CO_2	16,818	1.5	0.6- 2.8
CO_2	4,287	0.8	0.3- 1.2
CO_2	15,914	3.0	1.5- 4.9
El. restr.	16,642	6.9	3.5-16.3
El. restr.	5,263	7.0	2.8-14.3
El. floor	5,056	1.6	0.0- 4.3
El. floor	6,986	6.7	1.4-11.8
El. floor	4,245	17.0	1.0-26.1
El. floor	1,493	9.6	9.3- 9.9

DISCUSSION

There are large environmental differences between the slaughterhouses in the handling of slaughtering pigs that has to be taken into consideration in studies like this. It is difficult to separate the effect of stunning method and other factors influencing meat quality under commercial conditions. We found a very high daily variation in the incidence of early PSE within each slaughterhouse, probably independent of variation in stunning. Although, measurements have been taken on a larger number of carcasses than normally is realistic in an experiment, and despite the environmental variation, the results indicate that stunning with carbon dioxide is superior to stunning with low voltage electricity when regarding meat quality. Similar results under commercial conditions were found by McLoughlin (1965) when measuring pH 45 minutes PM. He observed appreciably more low pH values among electrically stunned pigs than among pigs stunned by carbon dioxide. Barton-Gade (1984) found that electrically stunned pigs showed a faster rigor development (stunning in a restrainer slightly faster than stunning on the floor) and were more often PSE 45 minutes after slaughter in comparison with carbon dioxide stunned pigs. In contrast to this, van der Wal (1978) reported the opposite result and Overstreet et al. (1975) failed to detect any significant differences.

The ultimate meat quality is not fully developed at the time of grading. The relationship between internal reflectance at grading and the day after slaughter, was quite low in this material. Higher correlations have been reported by Lundström et al. (1987; r=0.65) and van der Wal et al. (1986; r=0.46). A wide variation in this relationship has also been observed when internal reflectance has been measured with the Fibre Optic Probe (FOP) (Somers et al., 1985, r=0.66; Tarrant & Long, 1986, r=0.28; van der Wal et al., 1986, r=0.3-0.5; Eikelenboom & Nanni Costa, 1988, r=0.84).

Depending on chilling methods used and the incidence of PSE, variations in relationships between early and ultimate internal reflectance can be expected when measured at different slaughterhouses. The time between exsanguination and grading differ between slaughterhouses which may influence the incidence of PSE when the same limit in internal reflectance between normal and PSE quality has been used. The grading took place between 40 and 50 minutes post mortem at the slaughterhouses included in this study, and in this interval the increase in internal reflectance in carcasses of normal quality is very small (A-C. Sjöblom, 1989, pers. comm.)

Measurements made simultaneously with grading is a useful way to identify environmental factors causing PSE. The reduction in the incidence of early PSE described at one slaughterhouse can be taken as a

good example. While only a portion of the carcasses with high ultimate internal reflectance can be found at the time of grading this mode of application can not be used to predict the final meat quality.

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