The effect of feedstuff composition, sex and day of slaughter on pork quality

G. EIKELENBOOM and A.H. BOLINK

DLO-Research Institute for Animal Production "Schoonoord", P.O. Box 501, 3700 AM Zeist, The Netherlands

SUMMARY

A total of 64 crossbred pigs, consisting of gilts and castrates, were used to determine the effects of diets with different feedstuff composition on meat quality. An experimental feed containing cerials (35 % barley, 10 % wheat), was compared with a (standard) control feed (37 % tapioca and 8 % sunflower meal extr.). Pigs were slaughtered in two batches, with one week interval. Pigs from the first batch were, by mistake, slaughtered immediately after arrival at the abattoir. Pigs from the second batch were subjected to the standard resting period of 2 hrs in lairage.

No significant differences in colour and driploss of longissimus dorsi muscle were found between feeding groups, but heating loss was significantly higher for the experimental feed. A lower ultimate pH was found in longissimus, semimembranosus and adductor muscle of gilts in comparison with castrates, resulting in higher heating losses. Highly significant differences in all meat quality traits indicative for PSE, were found between the two batches. These differences were even larger than those found previously between groups of pigs with different halothane-phenotypes. Pigs from the first batch, which did not rest before slaughter, showed inferior meat quality. Probably due to variation in duration of resting period in lairage, effect of day of slaughter appeared of much more importance for meat quality than the effect of feedstuff composition or sex.

INTRODUCTION

There is an increased interest in the meat industry in the effect of feedstuff composition on pork quality. Questions are raised about possible negative effects of feeds containing much tapioca and byproducts from the food industry. Also, with the development towards branding meat for marketing, there is a growing interest in feeds containing more cereals, assuming that they may improve quality. Recently two feeding experiments were conducted, in which both types of feeds were fed and their effects on production traits, carcass quality, meat quality and meat palatibility were investigated (EIKELENBOOM et al, 1990).

In production experiments, pigs are usually slaughtered in batches when they have reached slaughterweight. However, in doing so frequently effects of day of slaughter on meat quality traits are found (EIKELENBOOM and NANNI COSTA, 1988). In many research reports these effects are not taken in consideration. A relatively large effect of day slaughter was also found in one of the feeding experiments mentioned before. Usually an explanation for these effects is not obvious (EIKELENBOOM and NANNI COSTA, 1988), but this appeared not the case in this feeding experiment.

This paper presents the results of the latter experiment, in order to illustrate the relative importance of the effects of feed stuff composition, sex and day of slaughter on meat quality (colour and waterbinding). For a full report of the feeding experiments, the reader is referred to EIKELENBOOM et al. (1990).

MATERIAL AND METHODS

A total of 64 crossbred pigs, from the crossing Dutch Yorkshire x (Dutch Yorkshire x Dutch Landrace), were at approximately 25 kg liveweight equally distributed, based on sex (gilt or castrate) and liveweight, among treatment groups. All pigs were housed individually and received from 40 kg onwards ad libitum the experimental or control feed. The experimental feed contained 35 % barley, 10.2 % wheat, 7.8 % wheat middlings and 4.3 % soy bean meal (solv. extr.), but no tapioca. The (standard) control feed contained 37.3 % tapioca, 12.9 % soy bean meal (solv. extr.) and 8.4 % sunflower meal (solv. extr.). The calculated energy value of both feeds was 1.03.

Pigs were slaughtered in a commercial abattoir in two batches, with one week interval between the batches. The batches were balanced for sex and almost balanced for treatment groups. The duration of transport was 30 minutes. In order to standardize preslaughter treatment a resting period of 2 hours in lairage was designed for both feeding experiments. However, in the first batch of the feeding experiment reported here, pigs were slaughtered by mistake immediately after arrival at the abattoir. In the second batch the standard resting period of two hours was employed.

At 24 hrs post mortem, pH of the semimembranosus and adductor muscle was measured and samples of the longissimus dorsi (2-5th lumbar vertebrae) were collected. The following meat quality measurements were made at the laboratory: pH, Hunter L*;, a*- and b*-values (D65 lightsource, 30 mm aperture), percent drip- (during 48 hrs) and heating- (1 hr at 75 °C) loss. Also a visual judgement of meat colour was given using the Japanese colour standard (1 = severe PSE; 2 = slight PSE; 3 = normal, etc.).

Data were analysed using analysis of variance models. Models included main effects and interactions for feedstuff composition, sex and day of slaughter (batch). The models were processed with Genstat 5 and REML.

RESULTS AND DISCUSSION

The results of the meat quality measurements are presented in this paper. For results on production and carcass quality traits, as well as palatibility tests, the reader is referred to EIKELENBOOM et al. (1990).

In Table 1 the means of meat quality traits are presented for treatment groups (feedstuff composition), sex (gilts vs. castrates) and day of slaughter (batch). No significant interactions were found in this experiment for any of these effects on meat quality traits.

No significant difference in colour and driploss was found between experimental and control feed groups. Although ultimate pH was not significantly different, a higher heating loss was observed for the experimental group. Judged from the results from this and the other feeding experiment (EIKELENBOOM et al., 1990), in which the same feed composition was used under restricted feeding, there appeared no clear consistent effect of feedstuff composition on meat quality. BEJERHOLM et al. (1989) compared the effects on meat quality of a diet containing cerials (30 % barley, 29 % wheat), in comparison with a diet containing tapioca (35 %) and byproducts. They also did not find an effect on meat quality.

Significant differences between the sexes were found in ultimate pH, which is in agreement with previous results (EIKELENBOOM et al., 1989). The lower ultimate pH of gilts resulted in a higher heating loss, but no significant differences in driploss were found between the sexes.

The pigs were slaughtered in two batches, with one week interval. Highly significant differences in all meat quality traits indicative for PSE were found between the two batches. Pigs from the first batch, which were slaughtered by mistake immediately upon arrival at the abattoir, posessed much lower meat quality than the pigs from the second batch, which had two hours rest in lairage. The differences in colour and waterbinding charac-

WARRISS, P.D. (1987): In: Evaluation and control of meat quality in pigs, p. 245-264. Proc. CEC seminar, Dublin, 21-22 november 1985. Martinus Nijhoff Publishers.

Table I. Results of meat quality measurements.

	Feed		Sex		Day of slaughter	
	experimental	control	gilts	castrates	1	2
pH 24 (ADD)	6.12	6.21	6.09	6.24**	6.04	6.29***
pH 24 (SM)	5.69	5.76	5.68	5.77*	5.62	5.88***
pH 24 (LD)	5.58	5.63	5.55	5.66***	5.55	5.66***
Hunter L*	55.7	56.9	56.3	56.4	60.0	52.6***
Hunter a*	6.5	6.3	6.6	6.2	6.3	6.5
Hunter b*	14.6	14.7	14.7	14.7	15.7	13.7***
Colour score (Jap.)	2.59	2.51	2.56	2.53	2.09	3.01***
Drip loss (%)	3.02	3.20	3.35	2.87	4.21	2.02***
Heating loss (%)	31.7	30.8*	31.8	30.8*	32.1	30.4***

* $P < 0.5$
** $P < 0.01$
*** $P < 0.001$

teristics between the two batches are even larger than those observed earlier between halothane positive and negative pigs in a Landrace strain (EIKELENBOOM and NANNI COSTA, 1988). This illustrates the relatively large effect day of slaughter may have, particularly when preslaughter conditions are not carefully standardized and controlled.

In the Netherlands a resting period of 2-4 hrs before slaughter is recommended. This was based on earlier research by VERDIJK (1974) in a population containing a considerable proportion of stress susceptible Landrace pigs at that time (EIKELENBOOM, 1985) and using pH_1 as an indicator of meat quality. WARRISS (1987) concluded in his review of literature on the effects of transport and lairage on meat quality, that in some pigs, particularly those of a fairly stress-resistant nature, lairage seems to have little material influence on meat quality unless prolonged when an increase in DFD meat may occur. This would also be true if pigs are not stressed on arrival at the slaughterhouse. In this case, immediate slaughter may produce the best results (WARRISS, 1987).

The pigs used in the present experiment were from a crossing between the Dutch Yorkshire and Dutch Landrace breed. The incidence of halothane reactors in the Dutch Yorkshire breed (EIKELENBOOM et al., 1978) has been consistently very low, while the selection against the gene in Dutch Landrace has been most effective in reducing the gene frequency (EIKELENBOOM, 1985). Therefore, it is likely that the experimental pigs have almost entirely consisted of halothane-negative animals. Although it is difficult to assess, the stress imposed upon the pigs is likely to have been relatively mild. The duration of transport was only 30 minutes, while for loading and unloading hydraulic lift systems were used. Also the pigs were handled gently by the transporter and other persons.

Assuming that the large effects of day of slaughter found in this experiment, are mainly due to differences in duration of lairage (0 vs. 2 hrs), these results do not support the conclusions of WARRISS (1987). In contrast, they suggest that a resting period in lairage before slaughter is of utmost importance for meat quality in stress-resistant (halothane-negative) pigs, even when it is supposed that they are not very much stressed upon arrival at the slaughterhouse.

In conclusion, the experiment presented here suggest that, probably due to variation in duration of resting period in lairage, the effect of day of slaughter on meat quality was of much more importance than any effect of feedstuff composition or sex.

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