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Study of some factors affecting the incidence of veining defect in thighs destined to dry-cured process of Parma ham

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SUMMARY – The veining defect is usually localized under the skin on the medial side of the thigh. The defect appears some hours after pig death, becomes particularly visible during ham trimming and is still evident after the dry-curing process. The assessment of the veining defect is made by a photographic scale which leads to a more precise and constant evaluation at trimming. Results of this study show an increase of veining incidence with carcass leanness. Moreover, the frequency of veining defect is affected by the stunning method of pigs and by the time that the thighs are not refrigerated after being separated from the carcass (pre-chilling time). The frequency of this defect increases with CO_2 compared to the electronarcosis stunning, and with prolongued pre-chilling time.

Keywords: Heavy pig, Parma dry-cured ham, defects, veining.

RESUME – *"Étude de certains facteurs qui influencent l'incidence du défaut de "veinosité" dans les cuisses destinées au séchage pour faire du jambon de Parme". Le défaut de "veinosité" est habituellement localisé sous la peau du côté interne de la cuisse. Le défaut apparaît quelques heures après la mort du porc, devient particulièrement évident pendant le parage du jambon et est encore évident après la fin de l'affinage en jambon sec. L'évaluation du défaut de "veinosité" est faite par comparaison à un standard photographique qui conduit à une évaluation plus précise et plus constante au parage. Les résultats de cette étude montrent une augmentation d'incidence de la veinosité avec la maigreur de la carcasse. En outre, la fréquence du défaut de "veinosité" est affectée par la méthode d'étourdissement des porcs et par le délai avant que les cuisses ne soient mises en chambre froide après avoir été séparées de la carcasse. La fréquence du défaut est augmentée par la narcose au CO_2 par rapport à l'anesthésie électrique et par l'augmentation du délai avant réfrigération.*

Mots-clés : *Porc lourd, jambon sec de Parme, défaut, veinosité.*

Introduction

The production of Parma ham requires raw materials that possess characteristics that satisfy the requirements of the processing industry. The thighs, therefore, undergo a subjective evaluation by inspectors at the moment of dressing in order to identify any defects or imperfections that could compromise the qualitative characteristics and acceptability of the aged ham. The presence of serious visible defects results in the disposal of a significant number of thighs from the "DPO" (Denomination of Protected Origin) circuit, which consequentially causes notable economic losses for operators in the sector. In recent years, the incidence of defects in the fresh thighs has risen. Among these defects is superficial veining, which has become a worrisome condition (Lo Fiego *et al*., 2003; Russo *et al*., 2003). It appears as a subcutaneous venous lattice that affects the medial surface of the thigh and, in more serious cases, can cover the entire surface (Fig. 1). This defect is not visible on the living animal or on the freshly slaughtered carcass. Instead, it begins to appear several hours after slaughter and is particularly noticeable during the dressing process and lasts throughout the subsequent stages of processing and after ageing (Fig. 2).

As the causes of this defect are not known, a series of studies has been undertaken in order to examine the effects of several factors that could influence both its presence and seriousness. The factors here investigated are the stunning method used at slaughter, the lairage duration and the elapsed time between the removal of the thigh from the carcass and its placement in refrigeration. In addition, a subjective evaluation method has been developed to evaluate the incidence of the defect with the aim to furnish correct figures about its frequency and gravity.

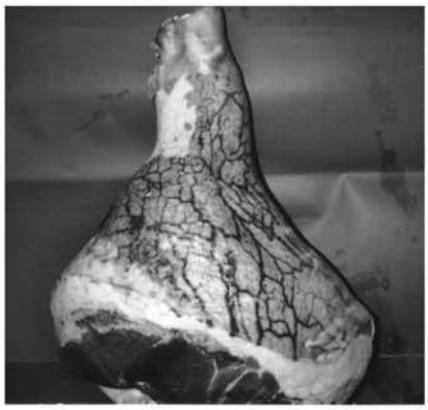

Fig. 1. The veining defect.

Fig. 2. The veining defect on dry-cured ham after 14 months of ageing.

Materials and methods

The first part of the study was devoted to elaborate a subjective evaluation method supported by a photographic scale. A scale of 4 classes was adopted in which 1 = defect absent or hardly perceptible (no defect or barely observable); 2 = slight defect (light); 3 = obvious defect (evident); 4 = serious defect (heavy) (Fig. 3). This method was evaluated on 20,453 thighs. The second part concerned the evaluation of the effect of the stunning method on the incidence of the defect. A number of 305 heavy pigs, all coming from the same farm and slaughtered in the same plant on 8 different days, have been submitted to two stunning methods: 146 have been put under electrical stunning (at 250 V, 1.25 A, 50 Hz) while 159 of them have been subject to CO_2 stunning (82% of CO_2 on air). The subjective evaluation of veining defect was carried out using a photograph scale of 4 classes previous described. The third part taken into consideration the effects of the lairage duration and the pre-chilling time on the incidence of the veining defect. Five-hundred-eighty-six left thighs coming from corresponding heavy pigs supplied from a farm and slaughtered in a plant on 4 different days were examined for veining defect. All pigs were stunned by CO_2 (82% of CO2 on air). For each consignment, involving about 146 pigs, half of animals was slaughtered immediately after the arrival at the plant while the other half was rested for 24 hours in slaughter pens. Hot left hams provided by both groups of pigs were randomly submitted to 3 different pre-chilling time corresponding to 15 min, 30 min and 60 min. The method used for evaluate the veining defect was the same previous described.

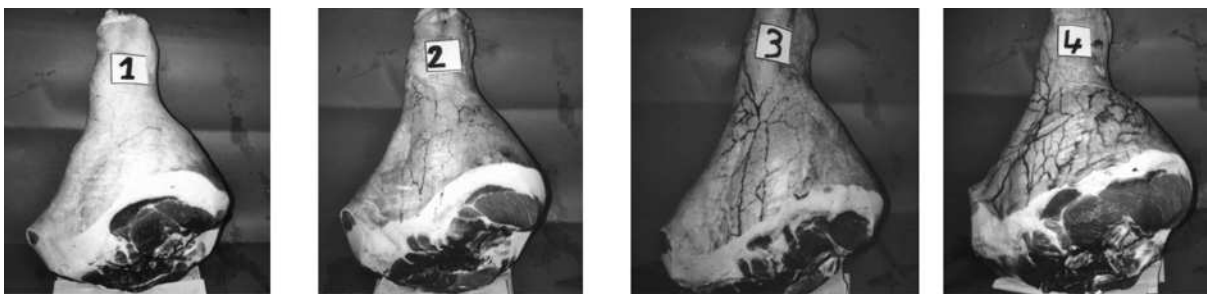

Fig. 3. The photographic scale with the four classes of veining score.

Results and discussion

The distribution of the right and the left thighs, together with that of total thighs distribution in the four classes of veining are reported in Table 1. Only 44.3% of thighs examined demonstrated Class 1 veining, meaning they showed no defect. Instead, 50.4% were in Class 2, with a slight defect which did not compromise the commercial viability of the ham as it is well tolerated by the entire productive

sector. Another 4.6% of the thighs were in Class 3 while 0.7% were in Class 4. The former, though removed from the "DPO" circuit by regulation, could re-enter the circuit should there be a great request for raw materials from the market. However, they would risk not being branded subsequent to the ageing process. Hams with a classification of 4 are always discarded from the ageing process.

Table 1. Incidence of the veining defect (%)

Veining classes	Means ± SD†		
	Right hams (No. 10264)	Left hams (No. 10189)	Total hams (No. 20453)
1	42.0 ± 19.5	46.6 ± 19.5	44.3 ± 17.5
2	52.9 ± 17.2	47.8 ± 16.0	50.4 ± 14.5
3	4.4 ± 4.7	4.7 ± 4.9	4.6 ± 4.5
4	0.6 ± 1.6	0.9 ± 1.6	0.7 ± 1.5

† Means calculated from 90 batches on the basis of the mean value of each batch.

The relationship between the veining defect and the carcass leanness is shown in Table 2. The incidence of hams without defect (Class 1) decreased with the increase of carcass leanness. When the percentage of carcass lean is over 47%, the incidence of Classes 3 and 4 of the defect increased by 165-200%. This result can explain the remarkable increase of the veining defect in the last years corresponding to the increase of the carcass leanness in the heavy pig due to the breeding for this character and to the use of very lean commercial hybrids.

Table 2. Effect of carcass leanness on the incidence of the veining defect in the hams

Veining class	Leanness carcass percentage (%)			Statistical significance	Last square error
	≤ 47% (No. batches 32)	> 47 ≤ 49 (No. batches 39)	>49 (No. batches 19)		(87 DF)
1	54.1	41.1	34.5	**	254.157
2	43.4	52.3	58.1	**	182.496
3	2.3	5.7	6.1	**	17.736
4	0.2	0.9	1.3	*	2.251
3+4	2.5	6.6	7.4	**	30.126

* = P<0.05; ** = P<0.01.

The stunning has the aim to make unconscious the pig before the exsanguination. The comparison between two stunning methods usually applied on pigs has shown that CO_2 stunning increases the subcutaneous veining defect. The negative effect of CO_2 stunning on the veining defect is evident in Table 3, which shows the distribution of hams into the different classes of veining. In particular, it is possible to observe an appreciable reduction of frequency in the raw hams of Classes 1 and 2, while in Classes 3 and 4 frequency is doubled under this method of stunning.

The effect of the resting time before slaughter and the pre-chilling time of hams on the veining defect score is reported in Table 4. The rest of pig for 24 hours did not affect the veining score while the latter raised correspondingly to the increase of the pre-chilling time, ranging from 1.61 after 15 min to 1.78 after 30 min and to 1.83 after 60 min. As consequence of this treatment, the incidence of hams into the classes 1 and 2, which are considered as suitable for PDO Parma ham production, decreased while the incidence of hams scored 3 and 4 increased (Fig. 4). The latter was 11.80% after 15 min, 19.38% after 30 min and 21.54% after 60 min of pre-chilling time. These results shown that the increase of time spend out of the chilling room did not improve the coming out of blood by the thigh vessels and, as consequence, did not reduce the appearance of the subcutaneous network of veins at the trimming.

Table 3. Distribution (%) of hams into the different classes of veining defect in relation to the stunning method†

Veining classes	Electrical stunning (No. 292)	CO_2 stunning (No. 318)
1	57.5	43.1
2	33.9	40.2
3	6.8	15.1
4	1.7	1.6
1+2	91.4	83.3
3+4	8.6	16.7

† $\chi 2$ significant stunning effect per $P<0.001$.

Table 4. Effects of resting time of pigs (hours) and pre-chilling time of hams (min) on the averages of veining score defect

	Resting time before slaughter (hours)		Pre-chilling time of hams† (min)		
	0	24	15	30	60
No of hams	303	283	195	196	195
Veining score	1.75 ± 0.77	1.73 ± 0.83	1.61 ± 0.70	1.78 ± 0.78	1.83 ± 0.89

† Kruskal-Wallis Test: $P \leq 0.05$.

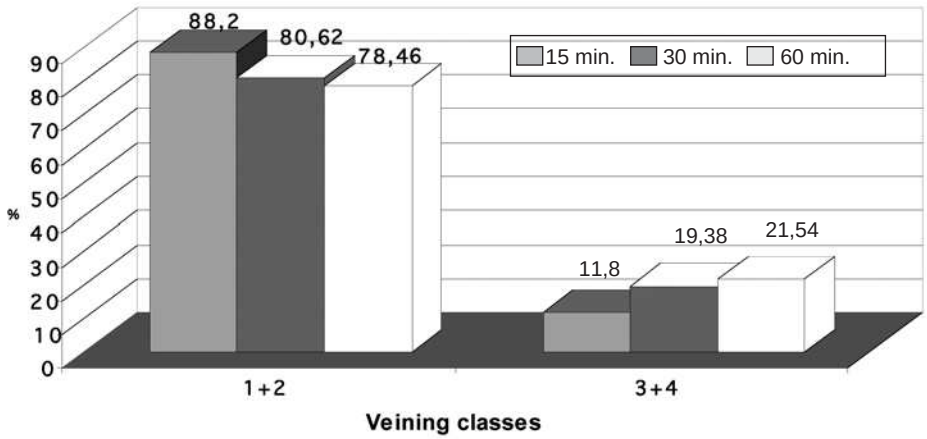

Fig. 4. Ham's distribution (%) into the veining classes on the basis of pre-chilling time (min).

Conclusion

In the last 20 years, the incidence of veining defect on pigs raw hams has progressively risen, up to reach worrying levels. Only recently the scientific research started to investigate on this defect highlighting a relationship between the carcass leanness and the evidence of the subcutaneous network of veins, the latter increased also according to the prolongation of pre-chilling time and with the use of CO_2 stunning method. Even if these studies characterised some treatments which can affect the incidence of the veining defect, there is a need, however, to further investigations on the causes of this defect.

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