Acta Agraria Kaposváriensis (2014) Vol 18 Supplement 1, 188-193.
Kaposvári Egyetem, Agrár- és Környezettudományi Kar, Kaposvár
Kaposvár University, Faculty of Agricultural and Environmental Sciences, Kaposvár

The effect of lairage time and carcass traits of pigs on the appearance of subcutaneous veining defect in hams

S. Žgur
University of Ljubljana, Biotechnical Faculty, Department of Animal Science, Groblje 3, SI-1230 Domžale, Slovenia

ABSTRACT

The incidence of veining defect was quantified on 1,919 pigs slaughtered in three consecutive days in one commercial slaughterhouse in Slovenia. Veining defect was evaluated after rapid chilling with subjective method proposed by Russo et al. (2003). Hams were graded into four classes, from none to heavy defect. Around 30% hams belonged to class 1, 60% to class 2 and 6% to class 3. There was practically no ham in class 4. Prolonged lairage time (more than 3 h) increased the incidence of veining defect. Hanging carcass on one foot during exsanguination also increased veining defect compared to the counterpart. Carcass weight increase from 60 to 100 kg also increased the incidence of veining defect, while further increase of carcass weight had no effect on veining defect. With increased muscle thickness, decreased fat thickness and increased lean meat percentage the incidence of veining defect also increased.
(Keywords: pigs, lairage time, carcass traits, veining defect)

INTRODUCTION

Dry-cured ham "Kraški pršut" is one of the most well-known and appreciated meat products in Slovenia. To achieve high quality product it is important to use only hams with certain characteristics (*Čandek-Potokar and Škrlep*, 2012). Visual appearance is very important and only hams without any visual defects are appropriate. Veining defect is one of the visual defects representing a clearly visible network of subcutaneous blood vessels (*Russo et al*. 2003). The reasons for this defect are poorly understood. *Russo et al.* (2003) reported increased incidence of veinig defect with increased lean meat percentage and prolonged lairage time in Italian heavy pigs. On the other hand Nanni-*Costa et al*. (2005) found no difference in the incidence of veining defect in pigs resting 0 or 24 h before slaughter. *Lo Fiego et al.* (2005) reported the effect of stunning method on the incidence of veining defect. CO_2 stunned pigs exhibited more pronounced veining defect than the electrically stunned ones. If this effect becomes more pronounced, such hams cannot be used for dry-cured ham.

The aim of this study was to get the first insight into the incidence of this defect in pigs slaughtered in Slovenia and to investigate the effect of lairage time and some carcass traits (carcass weight, muscular and fat thickness) on the incidence of subcutaneous veining defect.

MATERIAL AND METHODS

In three consecutive days 1.919 pigs from 17 different farms, slaughtered in the same slaughterhouse were used to evaluate lairage time and carcass traits on the appearance of veining defect. After unloading, pigs spent different time in lairage and were divided into four classes (class 1 lairage time ≤30 min; class 2 lairage time >30 ≤60 min; class 3 lairage time >60≤180 min; and class 4 lairage time > 180 min. Pigs have been subjected to CO_2 stunning (80% CO_2), hung on the left foot and exsanguinated. About 30 min after exsanguination carcasses were graded according to SEUROP system based on carcass weight, muscle and fat thickness (*Pravilnik*, 2004). Muscle thickness is defined as a distance in mm between the cranial edge of *m. gluteus medius* and the dorsal edge of *canalis vertebralis* measured at the carcass split line, whereas the thinnest part in mm of fat thickness is measured at the level of *m. gluteus medius* at the carcass split line. After grading rapid chilling began and lasted for 140 min. In this period the carcasses were first exposed to -2 °C, then -15 °C, -12 °C and -8 °C. At the end of rapid chilling the left and right hams were subjectively examined for veining defect, using the evaluation scale of 4 classes (1=no defect or barely observable, 2=light, 3= evident, 4= heavy) according to *Russo et al*. (2003). Data were processed by the NPAR1WAY procedure and WILCOXON test of *SAS* (2003) using a non-parametric model which included lairage time, left or right ham, carcass weight, muscle thickness or fat thickness as a single factor. The frequency distribution of hams into four classes was calculated for each treatment. According to carcass weight, muscle thickness and fat thickness the animals were divided into seven classes (carcass weight: class 1 CW≤60 kg; class 2 CW>60≤70 kg; class 3 CW>70 ≤80 kg; class 4 CW>80≤90 kg; class 5 CW>90 ≤100 kg; class 6 CW>100 ≤110 kg; class 7 CW>110 kg) and four classes (muscle thickness M: class 1 M≤60 mm; class 2 M>60 ≤70 mm; class 3 M>70≤80 mm and class 4 M>80 mm and fat thickness F: class 1 F≤10 mm; class 2 F>10 ≤15 mm; class 3 F>15≤20 mm; class 4 F>20 mm and lean meat percentage LM%: class S LM%≥ 60%; class E LM%≥55<60%; class U LM%≥50< 55% and class R LM%≥50<45 %).)

RESULTS AND DISCUSSION

In *Table 1* the average incidence of veining defect is presented. Most of the hams were classified into the second class with light observable defect (63.4%), followed by class 1 with no or barely observable defect (30.4%) and class 3 with evident veining defect (6.2%). *Russo et al.* (2003) found slightly higher percentage of hams in class 1, lower percentage in class 2 and similar percentage in class 3. Also *Lo Fiego et al*. (2003) found similar percentage of hams in class 1 and 2 at electrically stunned pigs. The most important difference is between class 2 and 3, as hams classified in class 3 are not suitable for dry-cured ham (*Russo et al*., 2003).

Table 1

Distribution of hams (%) into different classes of veining defect

Total number of hams	Veining defect			
n	Class 1	Class 2	Class 3	Class 4
3838	30.4	63.4	6.2	0.0

Lairage time had a significant effect on the incidence on veining defect, with prolonged lairage time the veining defect increased too (*Table 2*). The percentage of hams graded in class one decreased whereas the percentage of hams in class 2 and 3 increased. Especially when pigs stayed in lairage longer than 180 min, the percentage of hams in class 3 more than doubled. This is in contrast with the results of *Nanni Costa et al.* (2005), who did not find any difference in veining defect in Italian heavy pigs slaughtered immediately or after 24 h.

Table 2

Distribution of hams (%) into different classes of veining defect in relation to lairage time*

		Veining defect			
Lairage time	**n**	**Class 1**	**Class 2**	**Class 3**	**Class 4**
≤30 min	1633	38.1	58.0	3.9	0
>30 ≤60 min	874	27.1	67.8	5.0	0
>60 ≤180 min	976	25.0	67.4	7.5	0.1
>180 min	329	13.4	69.6	17.0	0

* X^2 Significant effect of lairage time p value < 0.0001

The incidence of veining defect also increased with increased carcass weight to 100 kg (*Table 3*). Afterward the percentage of hams in class 1 did not change, whereas the percentage of hams in class 3 even decreased slightly due to the increased percentage of hams in class 2.

Table 3

Distribution of hams (%) into different classes of veining defect in relation to carcass weight*

		Veining defect			
Carcass weight	**n**	**Class 1**	**Class 2**	**Class 3**	**Class 4**
≤60 kg	46	34.8	65.2	0	0
>60 ≤70 kg	320	39.4	57.8	2.8	0
>70 ≤80 kg	844	32.6	63.3	4.1	0
>80 ≤90 kg	1349	29.9	63.7	6.4	0
>90 ≤100 kg	892	26.0	65.1	8.7	0.1
>100 ≤110 kg	311	26.4	65.3	8.4	0
>110 kg	50	26.0	68.0	6.0	0

* X^2 Significant effect of carcass weight p value < 0.0001

Muscle thickness significantly affected the incidence of veining defect (*Table 4*). With increased muscle thickness the percentage of hams in class 1 decreased whereas the percentage of hams in class 2 and 3 increased. When the muscle thickness increased from 60–70 mm to more than 80 mm, the percentage of hams in class 3 more than triplicated.

Table 4

Distribution of hams (%) into different classes of veining defect in relation to muscle thickness*

		Veining defect			
Muscle thickness	**n**	**Class 1**	**Class 2**	**Class 3**	**Class 4**
≤ 60 mm	101	47.5	49.5	3.0	0
> 60 ≤ 70 mm	1174	34.1	62.7	3.2	0
> 70 ≤ 80 mm	2053	27.9	65.0	7.1	0
> 80 mm	484	26.2	63.4	10.3	0

* X^2 Significant effect of muscle thickness p value <0.0001

Fat thickness had also a significant effect on the incidence of veining effect (*Table 5*). It was at least pronounced when fat thickness exceeded 20 mm and the percentage of hams in class 3 almost halved.

Table 5

Distribution of hams (%) into different classes of veining defect in relation to fat thickness*

		Veining defect			
Fat thickness	**n**	**Class 1**	**Class 2**	**Class 3**	**Class 4**
≤10 mm	656	34.3	59.0	6.7	0
>10≤15 mm	1852	30.5	62.8	6.6	0
>15≤20 mm	951	26.3	67.5	6.1	0.1
>20 mm	353	30.3	66.3	3.4	0

* X^2 Significant effect of fat thickness p value < 0.025

The muscle and fat thickness and carcass weight are used to calculate the lean meat percentage in Slovenia. Increased muscle thickness and decreased fat thickness is correlated with increased lean meat percentage in pig carcass. The effect of lean meat percentage on the incidence of veining defect is well seen in *Table 6*. As lean meat percentage increased, the incidence of veining defect increased too. There was no veining defect present in class R, whereas in class U and E 2.5. and 6.3 pigs exhibited evident veining defect. *Russo et al.* (2003) reported higher incidence of veining defect in pigs with higher lean meat percentage in the carcass. Classes 3 and 4 almost doubled when the lean meat percentage in the carcass increased from less than 47% to more than 49 % in Italian heavy pigs.

During exsanguination the pigs were hung on left foot. From *Table 7* it is clear that the incidence of veining defect was higher on left ham. So it seems the additional tension that the left ham was exposed during the exsanguination had also an effect on the incidence of veining defect.

Table 6

Distribution of hams (%) into different classes of veining defect in relation to SEUROP classification*

SEUROP class	n	Veining defect			
		Class 1	Class 2	Class 3	Class 4
S	1850	31.1	61.8	7.1	0
E	1549	28.7	65.0	6.3	0.1
U	357	28.3	69.2	2.5	0
R	36	52.8	47.2	0	0

* X^2 Significant effect of EUROP classification p value < 0.0097

Table 7

Distribution of hams (%) into different classes of veining defect in relation to left/right ham*

		Veining defect			
	n	Class 1	Class 2	Class 3	Class 4
Left**	1892	28.5	64.4	7.1	0.0
Right	1892	31.7	62.9	5.3	0.0

* X^2 Significant effect of left/right ham p value < 0.0095
** hung on left foot

CONCLUSIONS

From this first survey of the incidence of veining defect in Slovenian pig population it is clear that this problem has a similar extent as in Italian pigs. Keeping lairage time shorter than 3 h can contribute to lower incidence of veining defect. With increased lean meat percentage in carcass and also in ham, the quality of hams for dry-cured ham decreased, so the balance between this two groups of traits should be preserved.

REFERENCES

Čandek-Potokar, M., Škrlep, M. (2012). Factors in pig production that impact the quality of dry-cured ham: a review. Animal, 6. 2. 327-338.

Lo Fiego, D.P., Nani Costa, L., Tassone, F., Russo, V. (2003). Effect of different stunning methods of pigs on subcutaneous veining defect and meat quality of raw ham. Italian Journal of Animal Science, 2. 1. 375-372.

Nani Costa, L., Lo Fiego, D.P., Tassone, F., Russo, V. (2005). Effect of resting time of pigs and pre-chiling time of things on the veining defect of parma dry-cured ham. Veterinary Research Communications, 29. 2. 370-377.

Pravilnik o kategorizaciji, ocenjevanju mesnatosti in razvrščanju klavnih trupov prašičev. (2004). Uradni list RS, št. 22/2004 z dne 10. 3. 2004.

Russo, V., Lo Fiego D.P., Nanni Costa, L. Tassone, F. (2003). Indagnie sul deffetto di venatura delle cosce di suino destinate alla produzione del prosciutto di Parma. Suinocultura, 44. 77-82.

Corresponding author:

Silvester Žgur
University of Ljubljana, Biotechnical Faculty, Department of Animal Science
SI-1230 Domžale, Groblje 3., Slovenia
Phone: ++386-1-3203-822
E-mail: silvo.zgur@bf.uni-lj.si