

Wiederholtes Vorkommen von PSE und DFD Schweinemuskeln in der SAP Voivodina

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In dieser Arbeit werden die Prüfungsergebnisse des Temperatur- und Farbenmessens, pH_1 45 Min. post mortem und des Farbenmessens, pH_{24} 24 Stunden post mortem m. semimembraneus auf 8.000 weissen fleischigen Schweinen gezeigt, die in 14 Monate geschlachtet worden sind. Das Prüfungsziel war das wiederholte Vorkommen von Änderungen festzustellen.

Wenn pH_1 als Kriterium zum Feststellen von PSE genommen wird, hat es sich gezeigt, dass auf die Änderungen 8,49% von 8.243 geprüften Muskeln entfällt. Auf Grund des Kriteriums pH_{24} zum Feststellen der DFD Schweinemuskeln, ergiebt sich, dass auf die Änderungen 8,18% von 7.903 geprüften Muskeln entfällt.

Durch Beobachten einer Muskelnzahl wurde festgestellt, dass sie trotz des Kriteriums $pH_1 \geq 6,0$ sogar 6,4, nass und bleich sind. Nach 24 Stunden post mortem haben diese Muskeln ausgeprägte Eigenschaften der PSE Muskeln gezeigt. Umgekehrt manche Muskeln rötlicher Farbe und $pH_1 \leq 5,9$ haben auch 24 Stunden post mortem ein relativ hohes pH_1 und das Aussehen einer normalen Muskel gehabt.

In der Arbeit wird auch Möglichkeit erörtert, dass die pH_1 Farbenwerte genutzt werden, die zu anderer Zeit post mortem als Wertmessenheiten zum Feststellen dieser Muskeländerungen gemessen worden sind.

The incidence of PSE and DFD muscles in pigs in SA Province of Voivodina

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Results obtained by measurements of T_1 , pH_1 , pH_{24} , colour₁ and colour₂₄ of m. semimembraneus of about 8.000 commercial white meaty pigs slaughtered during 14 months, are presented in this paper.

Using $pH_1 \leq 5,9$ as a predictor it has been found that 8,49% of 8.243 examined muscles have been of PSE status. On the basis of $pH_{24} \geq 6,3$ as a predictor of the DFD 8,18% of 7.903 examined muscles have been found to be changed in this sense.

However, evaluating given number of muscles it was detected that some of them have been pale and exudative in spite of the fact that they have been of $pH_1 \geq 6,0$, and some of them even 6,4. These muscles have been found of the PSE status 24 hr post mortem. On the contrary, some muscles have been of pinkish colour but had $pH_1 \leq 5,9$ and they remained 24 hr post mortem of relatively high pH and normal status. In this paper are evaluated, also, pH values and colour measured later post mortem as facultative predictors of the PSE-DFD status.

La fréquence de l'apparition des muscles PSE et DFD des porcs en PSA de Voivodine

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Dans ce travail on a montré les résultats de mesurages de la T/température/, de pH et de la couleur 45 minutes post mortem et de pH et de la couleur 24 heures post mortem de la semimembranaceus vers 8.000 porcs blancs du type charcutier destinés au commerce, tués/abattus/ au cours de 14 mois. Le but de ces recherches a été de fixer la fréquence.

En utilisant ce critérium pour la détermination de PSE $pH_1 \leq 5,9$ on a constaté que ces changements apparaissent dans 8,49 % de 8.243 muscles examinés.

À la base du critérium $pH_{24} \geq 6,3$ pour la constatation de DFD des muscles, on a fixé que ces changements sont exprimés dans 8,18% de 7.903 muscles étudiés.

Cependant, en contemplant un certain nombre de muscles on a constaté que, malgré que leur $pH_1 \geq 6,00$ et même 6,4 - ils sont d'une couleur pâle et humides.

Après 24 heures post mortem ces muscles ont montré le trait expressif des muscles PSE. Et au contraire, certains muscles d'une couleur rose et avec $pH_1 \leq 5,9$ ont gardé même 24 heures post mortem pH relativement haut et la couleur et l'air d'un muscle normal. Dans ce travail on considère aussi la possibilité d'utiliser la valeur pH et la couleur, mesurés dans un autre temps post mortem, comme indicateurs de la détermination de ces changements des muscles.

Частота появления ПСЭ и ДФД мускулов свиней в САК Воеводине

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В этой работе показаны результаты исследований измерений Т (температуры), pH и цвета 45 минут post mortem и pH и цвета 24 часа post mortem в semimembranaceus около 8.000 коммерчески белых мясистых свиней зарезанных в течение 14 месяцев. Целью работы являлось установление частоты.

Используя как критерий для установления ПСЭ $pH_1 \leq 5,9$ установлено, что эти изменения обнаруживаются в 8,49% из 8.243 исследованных мускулов. На основании критерия $pH_{24} \geq 6,3$ для установления ДФД мускулов констатировано, что эти изменения выражаются в 8,18% из 7.903 исследованных мускулов.

Однако, наблюдением некоторого числа мускулов установлено, что, хотя их $pH_1 \geq 6,0$ и даже 6,4, они были бледного цвета и влажные. После одних суток 24 h p.m. эти мускулы показывали выразительный признак ПСЭ мускулов. И наоборот, некоторые мускулы розового цвета и их $pH_1 \leq 5,9$ остались и сутки 24 h p.m. сравнительно высокого pH и цвета и вида нормального мускула. В работе рассматривается и возможность использования pH стоимости и цвета измеренных в другое время post mortem как индикатора для установления этих изменений мускулов.

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Introduction

PSE and DFD muscles of pigs are lower technological values. That is the reason due to which these phenomena are investigated with the aim to determine the frequency of incidence and the possibilities for prevention. On the frequency of incidence of PSE muscles there are numerous data in literature and they are very different. According to these data the differences vary from 2% /Taylor, 1965/ to 88,9% /Briskey, 1964/. On the incidence of DFD muscles there are less data, and the data on the incidence of this phenomenon considerably vary. Scheper /1976/ reported that it was found the difference from 1% to 15%. The conditions which produce these differences in incidence of PSE and DFD phenomena are manifold. However, the consequences reflect in great damages. According to the calculation of Hall /1972/ the losses in meat industry in USA caused by incidence of PSE muscle amount yearly from 230 to 320 million dollars. In our country, in one slaughter-house, it was set aside 7% muscle of ham because of PSE changes during one year, and this meat was used for production of lower quality products. In order to obtain the more reliable data on the importance of PSE and DFD muscles in our country it is decided to investigate the frequency of incidence of these changes in greater number of pigs.

Material and Methods

In present work it was investigated over 8,000 white commercial pigs slaughtered in three slaughterhouses on the territory of the Province of Voivodina. The investigations were performed during four seasons, that is in periods which are, according to climate conditions, typical for spring, summer, autumn and winter, although they do not always coincide with the calendar classification of the year into seasons.

The investigated pigs of 100 to 110 kg weight were slaughtered in common way (electrically stunned and bled), and all measurements were performed on the slaughtering line. On proximate part of m. semimembranaceus of left halves from which was removed the fatty tissue, temperature, pH and colour were measured 45 min post mortem, and pH and colour were also measured 24 hours post mortem.

Since the measurements were performed in slaughter-houses it was not always possible to measure all investigated characteristics on each muscle. In Table 1, are shown the numbers of individual measurements performed by seasons.

The numbers of performed measurements in m. semimembranaceus of pigs

Table 1.

Season	pH ₁	pH ₂₄	Colour ₁	Colour ₂₄
Spring	2.166	2.162	2.166	1.939
Summer	2.024	1.921	1.407	1.261
Autumn	2.261	2.267	2.245	2.245
Winter	1.792	1.553	1.792	1.658
Total	8.243	7.903	7.610	7.103

Temperature was measured by thermometer GILTON, TASTOTHERM P 200. pH was measured by contract pH-meter, GRONERT, type TM 5. Colour of muscle was measured on flat surface of fresh cut of muscle by Göfo photocolourimeter, ERNST SCHUTT.

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Results and discussion

The results of investigations suggest that the distribution of pH_1 in 8,229 m. semimembraneus /Fig. 1a/ is mainly regular and that measured values are from 5,0 to 7,5. Most frequently is measured pH_1 6,4 /13,51%/. In most muscles, that is in 61,89% investigated cases it was measured pH_1 in the range from 6,2 to 6,6. The extreme values were nearly determined: pH_1 5,0; 5,1 and 7,5 in one sample, respectively, 5,2 in five and 5,3 in four muscles.

If the PSE status of muscle is determined according to the criterion of $pH_1 \leq 5,9$, then this phenomenon is determined in 8,49% investigated muscles as shown by these investigations. pH_{24} in 7,903 investigated m. semimembraneus is distributed in greater range, that is from 4,4 to 7,6 /Fig. 1b/. In most investigated muscles it was measured pH_{24} 5,5 /18,09%/. and in the range from 5,3 to 5,8 in 74,78%. Extremely low pH_{24} 4,4; 4,5 and 4,6 were measured in one muscle, respectively, pH_{24} 4,8 in two muscles, 4,9 in one and 5,0 in

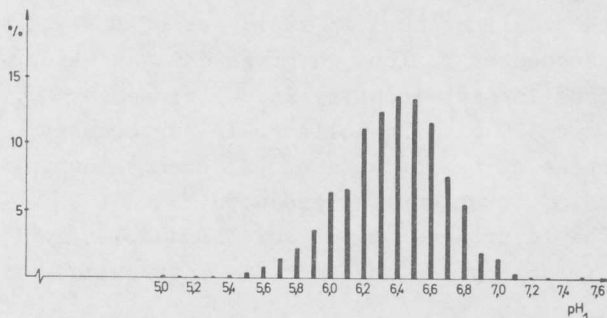


Fig. 1.a - The pattern of pH_1 m. semimembraneus of 8,229 carcasses of pigs investigated during one year

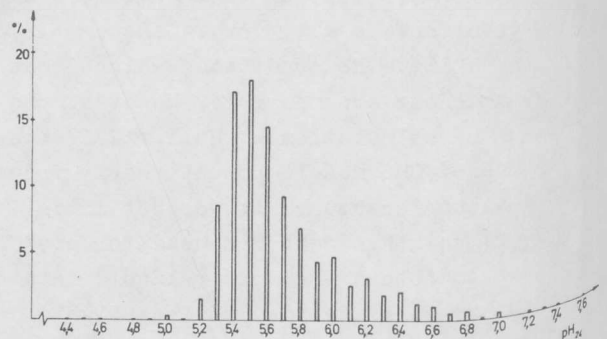


Fig. 1.b - The pattern of pH_{24} m. semimembraneus of 7,903 carcasses of pigs investigated during one year

twenty seven muscles. pH_{24} 5,2 and 5,3 were measured in relatively great number of muscles: former in 131 and latter even in 685 /8,67%/. Specially high pH_{24} 7,6 was measured in one muscle.

Determining DFD status of muscle according to the criterion of $pH_{24} \geq 6,3$ it has been found in 8,18% of examined muscles affected by such changes.

If the incidence of these changes is expressed by seasons /Table 2/, then it can be seen that the differences between the seasons are very great. So, in spring and autumn PSE and DFD status appear in considerably higher percentages than in summer and winter. Spring period is the most unfavourable because the incidence of PSE muscles is found in 10,71% cases and of DFD even in 20,21% cases; in autumn period these changes were registered in 10,18%, respectively in 9,30% muscles. In spring period were registered the lowest pH_{24} /4,4; 4,6 etc./ at unfavourable weather conditions: temperature 12°C and changeable

The frequency of incidence of PSE and DFD muscle determined by seasons on the base of pH and colour

Season	Table 2.					
	P S E $pH_1 \leq 5,9$	D F D $pH_{24} \geq 6,3$	Normal	P S E Colour ₁ ≤ 66	D F D Colour ₂₄ ≥ 72	Normal
Spring	10,71	20,21	69,08	10,39	4,95	84,66
Summer	6,74	0,41	92,85	1,49	6,26	92,25
Autumn	10,17	9,30	80,53	15,20	12,29	72,51
Winter	5,74	0,51	93,75	3,85	5,79	90,36
Year	8,49	8,18	83,33	8,63	8,59	82,78

weather with rain. In the same slaughterhouse was registered the highest pH_{24} 7,6 in which is worked under very unfavourable conditions, where daily temperature was about 10°C and weather was changeable. However, in one muscle was measured pH_{24} 4,5 in summer during stable sunny weather at daily temperature of 27°C in the slaughterhouse in which is worked under the best conditions.

The pattern of colour₁ and colour₂₄ of investigated m. semimembraneus are shown in Fig. 2a and 2b. Measuring 45 min post mortem, once it was measured the lightest colour of muscle 52 Göfo units and the darkest 88 Göfo units. The most muscles had colour of 74 Göfo units /19,55%/. Colour₂₄ in investigated muscles is more regularly distributed then colour₁ and, normally, it is also lighter. These values vary from 42 to 84 Göfo units. In most muscles it was measured the colour of 64 Göfo units /17,36%/. If PSE status of muscle is determined according to the criterion of colour₁ ≤ 66 Göfo units

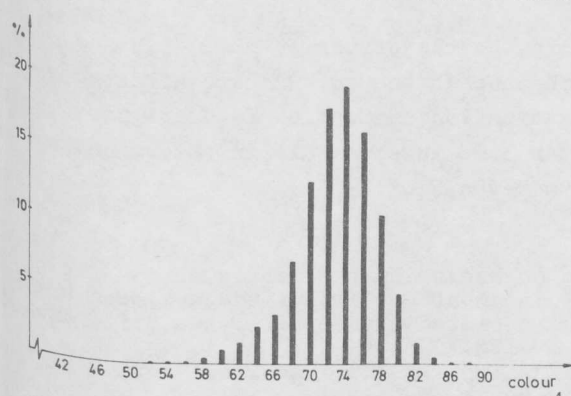


Fig. 2.a - The pattern of colour₁ m. semimembraneus of 7,610 carcasses of pigs investigated during one year

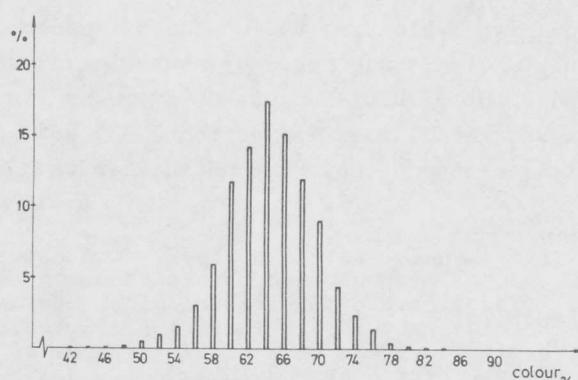


Fig. 2.b - The pattern of colour₂₄ m. semimembraneus of 7,103 carcasses of pigs investigated during one year

then these changes were found in 8,63% investigated muscles. If DFD status of muscle is determined according to the criterion of colour₂₄ ≥ 72 , then this phenomenon is registered in 8,65% investigated samples. Percentages of incidence of PSE and DFD status are similar to those found on the base of measuring pH_1 and pH_{24} , but the distribution by seasons is different /Table 2/, and especially for the frequency of DFD muscle incidence. Therefore, DFD status, for example, according to the criterion of pH_{24} was registered in spring in 20,21% investigated muscles, and on the base of colour in only 4,95 muscle. Greater differences appear in summer as well as in winter period.

Extreme changes of colour were found in spring period, i.e., the lightest colour₁ 52 Göfo units and colour₂₄ 42 Göfo units in slaughterhouse with unfavourable working conditions, and the darkest in the slaughterhouse with the most favourable conditions for work. However, observing muscle during the investigations it was noticed that some of them were not evaluated as PSE on the base of measuring pH and colour 45 min post mortem, but 24 hours post mortem they were markedly pale and exudative. After that, these changes were observed in spring period in two slaughterhouses on totally 1260 muscles of left halves and in winter in one slaughterhouse on 500 muscles also of left halves. By these analysis it was found that from 1260 muscles with $pH_1 \leq 5,9$, 24 hours post mortem was visually evaluated 7,38%, and from 500 muscle 3,6% as muscle with distinctly pale colour and exudative structure. From totally 1760 investigated muscles 111 or 6,31% had $pH_1 \leq 5,9$ and 24 hours post mortem had been distinctly of pale colour and structure. In this case also in spring period was determined about two times more pale and exudative muscles than in winter period. In these determinations it was found several times that visually determined colour do not coincidence with the finding obtained by measuring with Göfo device. If the data obtained by visual investigations are added to those obtained by measuring pH_1 then the percentage of incidence of PSE muscles would be considerably higher. However,

in several cases it was noticed that muscles with $pH_1 \leq 5,9$ were not, 24 hours post mortem pale and exudative. This phenomenon was not systematically registered. But according to the data from literature, such status can appear in greater number, even to 38% of investigated muscle /Barton-Gade, 1977/.

From previously lll registered muscles with $pH_1 \leq 5,9$ and 24 hours post mortem pale and exudative, 55 or 49,55% was 45 min post mortem with distinct signs of rigor mortis. Three from these 55 muscles had pH_1 7,0.

T_1 in four of these muscles was 38° or $38,5^\circ C$, and in others 39° to $41,5^\circ C$. From these 55 muscles, 14 or 23,5% had colour₁ ≤ 66 Göfo units while others have been of normal colour. In 26 from these lll muscles it was measured higher pH_{24} than pH_1 . In 2 muscles with rigor mortis, which appeared 45 min post mortem, there were measured T_1 $41^\circ C$ and pH_{24} 7,0.

Summary. Evaluating the status of muscle according to the criterion $pH_1 \leq 5,9$ and $pH_{24} \geq 6,3$ it was found by measuring m. semimembranaceus that 8,49% were affected by PSE and 8,18% by DFD changes. However, by visual examination of muscles 24 hours post mortem it was found in spring period 7,38% and in winter 3,6% muscles pale in colour and exudative, although they have pH_1 higher than 5,9 /two even 7,0/.

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