INFLUENCE OF PIG BODY MASS ON MEAT AND CARCASS QUALITY OF BLACK SLAVONIAN PIG

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ABSTRACT

The research was conducted on pig carcasses and meat of 16 Black Slavonian pigs, fattened to approximately 130 kg body mass (group A), and 16 pigs of the same breed fattened to approximately 110 kg body mass (group B). Pigs were kept in the semi-outdoor system, with the same housing and feeding conditions. Dissection of right cooled pig carcasses (+4°C) was conducted according to the modified method of Weniger et al. (1963). Meat quality was determined on the sample from M. longissimus dorsi, taken between the 13th and 14th rib. Body mass of pigs prior to slaughter (110.17 kg and 130.37 kg) significantly influenced the quality of Black Slavonian pig carcasses, but not the quality of their meat. Pigs with higher body mass (130.37 kg) had carcasses of different conformation (significantly higher relative share of yawl and abdominal-rib part and a lower relative share of less worth parts and shoulder) and composition (a lower relative share of meat on shoulder and a higher relative share of meat on abdominal-rib part) in relation to pigs with lower body mass (110.17 kg). The meat contents in carcasses was almost equal (47.06 % and 47.16 %) in both analyzed groups of pigs. In terms of meat quality, that was usual, no significant differences (p>0.05) were determined between the analyzed groups of pigs.

Key words: *Black Slavonian Pig, body mass, meat and carcass quality*

INTRODUCTION

Quality of pig meat and carcass is influenced, in addition to genetic factors (Gu et al., 1992; Affentranger et al., 1996; Senčić et al., 1998; Miller et al., 2000), also by numerous paragenetic factors (Therkildsen et al., 2001; James et al., 2002; Chiba et al., 2002), among which there is also the final body mass of fattened pigs (Prandini et al., 1996; Cisneros et al., 1996; Candek-Potokar et al., 1998; Weatherup et al., 1998; Ellis i Bertol., 2001; Senčić et al., 2005). Optimum final body mass of fattened pigs depends on requirements of consumers, needs of the processing industry, production efficiency, but also on genetic potential of pigs for meat production. Pigs of some genotypes, like Black Slavonian pig from the group of breeds of meat and lard type, accumulate fat tissue in the body even at lower body mass, while extremely meat-type genotypes accumulate fat tissue at higher body mass. Black Slavonian pig belongs to endangered breeds (888 ♀ i 62 ♂, CLC, 2007). Considering this, it should be evaluated in terms of keeping system, nutrition and optimum body mass at slaughter. The purpose of this paper is to determine how body mass influences the slaughterhouse quality of Black Slavonian pig.

MATERIAL AND METHODS

The research was conducted on pig carcasses and meat of 16 Black Slavonian pigs, fattened to approximately 130 kg body mass (group A), and 16 pigs of the same breed fattened to approximately 110 kg body mass (group B). Pigs were kept in the semi-outdoor system, with the same housing and feeding conditions.

Pigs were fed fodder mixture with 14.0 % crude protein and 13.37 MJ ME/kg in the period from 30 to 60 kg body mass, and with fodder mixture with 11,84 % crude protein and 13.34 MJ ME/kg in the period from 60 kg body mass to the end of fattening, as well as with cut green alphalpha, that was fed, as fodder, *ad libitum*.

Dissection of right cooled pig carcasses (+4°C) was conducted according to the modified method of Weniger et al. (1963). According to this modification, the total quantity of muscle tissue does not include muscle tissue of head, which was not dissected. pH1 value of meat was determined 45 minutes post mortem, and pH2 value 24

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Table 1. Conformation of pig carcasses in relation to body mass

Indicators	Statistical values	Groups of pigs		Significant different
		A (n=16)	B (n=16)	
Body mass of pig, kg	$\bar{x}$	110,17	130,37	**
	s	5,38	6,84	
Cold carcass mass, kg	$\bar{x}$	42,87	51,08	**
	s	3,46	3,87	
Less valuable parts, %	$\bar{x}$	9,78	8,86	**
	s	0,77	0,73	
Yawl, %	$\bar{x}$	1,43	2,00	**
	s	0,27	0,39	
Fat, %	$\bar{x}$	2,83	2,78	NS
	s	0,57	0,54	
Neck, %	$\bar{x}$	13,76	3,34	NS
	s	1,61	2,04	
Back part, %	$\bar{x}$	14,91	14,73	NS
	s	3,06	1,18	
Shoulder, %	$\bar{x}$	11,82	11,07	*
	s	0,88	0,81	
Ham, %	$\bar{x}$	27,13	26,55	NS
	s	1,40	1,42	
Abdominal-rib part, %	$\bar{x}$	18,31	20,64	**
		2,70	1,08	

*p<0,05

**p<0,01

NS-no significant

hours post mortem, by means of contact pH-meter Mettler Toledo. Meat quality was determined on the sample from M. longissimus dorsi, taken between the 13th and 14th rib. Water holding capacity was determined according to Grau and Ham (1952), and meat colour („L“ value) was determined by means of chromometer Minolta CR-410. Statistic processing of research results was done according to Stat. Soft. Inc. (2001).

RESULTS AND DISCUSSION

Data in the Table 1 indicate that there are significant differences in conformation of carcasses of Black Slavonian pig in terms of their body mass prior to slaughter. Pigs with larger body mass produced carcasses with a higher relative share of yawl and abdominal-rib part, while pigs with lower body mass produced carcasses with a significantly higher share (P<0.05) of shoulder and a significantly very higher (P<0.01) share of less valuable parts. Considering the share of hams, no significant differences (P>0.05) were determined between the analyzed groups of pigs, although heavier pigs produced carcasses with a somewhat lower relative share of hams. Cisneros et al. (1996) reported that the growth of slaughterhouse body mass was followed by increased percentage of fat in carcasses, while the share of hams, shoulders and abdominal-rib part was decreasing.

Composition of pig carcasses (Table 2) also differed to some extent between pigs from different weight groups. Although no significant differences (P>0.05) were determined in terms of meat contents in carcasses, pigs of higher body mass had a very significantly (P<0.01) bigger relative share of abdominal-rib part meat in carcasses, as well as a smaller relative share of ham meat in carcasses, but this was not statistically significant (P>0.05). In researches of crossbreds of Great Yorkshire, Swedish Landrace and Pietren fattened to 90.30 kg, 100.40 kg., 110.30 kg., 120.50 kg and 130.20 kg body mass, Senčić et al. (2005) determined that as final body mass of fattened pigs was increasing, a relative share of ham meat in carcasses was decreasing to a statistically significant extent, as well as a relative share of back and shoulder meat, but not statistically significant (P>0.05).

In terms of pig meat quality (Table 3), no significant differences (P>0.05) were determined between the analyzed indicators, related to pig body mass. The values of analyzed indicators of meat quality were in normal range. A high level of crude fat was determined in both of the analyzed pig groups, but the differences between the groups were not statistically significant (p>005). High level of fat, 5,95%, in meat of Black Slavonian pigs kept in the semi-outdoor production system, and 5,90% in the outdoor production system had been earlier determined by Senčić *et al*. (2001 and 2008). Uremović *et al*. (2001) had also determined that the meat of Black Slavonian pigs, kept in the indoor production system up to 106 kg body mass, has lower level of water and protein, and higher level of fat (5.96%) than the meat of the noble pig breeds. The fat level in meat of the noble breeds ranges from 0.5-3.5% (Čandek-Potokar *et al*. 1998; Zanardi *et al*. 1998; Flores *et al*. 1999). It is thought that the content of intramuscular fat in meat should not be lower than 2-3%, in order to maintain good tastiness of meat. High level of fat, favourable pH and a good water binding capacity is what makes the meat of Black Slavonian pig very suitable for production of dry-cured products (*kulen*, ham).

▼ **Table 2.** Composition of pig carcasses in relation to body mass

Indicators	Statistical values	Groups of pigs		Significant different
		A (n=16)	B (n=16)	
Mass of right cooled pig carcasses, kg	$\bar{x}$	42,87	51,08	**
	s	3,46	3,87	
Share of meat in carcasses,%	$\bar{x}$	47,06	47,16	NS
	s	2,28	2,25	
Share of neck meat, %	$\bar{x}$	7,86	8,02	NS
	s	1,70	1,13	
Share of back part meat, %	$\bar{x}$	6,49	6,34	NS
	s	1,65	0,93	
Share of shoulder meat, %	$\bar{x}$	6,74	6,25	**
	s	0,35	0,58	
Share of ham meat, %	$\bar{x}$	16,16	15,62	NS
	s	1,35	1,38	
Share of abdominal-rib part meat, %	$\bar{x}$	9,81	10,93	**
		1,25	0,64	

**p<0,01
NS-no significant

Sutton et al. (1997) also determined that slaughterhouse body mass also has no influence on pH value of meat, measured 45 minutes and 24 hours post mortem, and on colour and marbling of meat. Cisneros et al. (1996) determined that the final pH value of meat was decreasing while slaughterhouse body mass was increasing from 100 to 160 kg. Čandek-Potokar et al. (1998) reported that increase in the slaughterhouse body mass of pigs resulted in higher contents of intramuscular fat in meat, with lower loss of meat juice and lower intensity of meat colour. Senčić et al. (2005) determined that increase in the pig body mass was followed by increased pH value of meat, increased water holding capacity and marbling of meat, and decreased colour intensity.

CONCLUSION

Body mass of pigs prior to slaughter (110.17 kg and 130.37 kg) significantly influenced the quality of Black Slavonian pig carcasses, but not the quality of their meat. Pigs with higher body mass (130, 37 kg) had carcasses of different conformation (significantly higher relative share of yawl and abdominal-rib part and a lower relative share of less worth parts and shoulder) and composition (a lower relative share of meat on shoulder and a higher relative share of meat on abdominal-rib part) in relation to pigs with lower body mass (110.17 kg). The meat contents in carcasses was almost equal (47.06 % and 47.16 %) in both analyzed groups of pigs. In terms of meat quality, that was usual, no significant differences (p>0.05) were determined between the analyzed groups of pigs.

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ZUSSAMENFASSUNG

DER EINFLUSS DER KÖRPERMASSE AUF DIE QUALITÄT VON HÄLFTEN UND FLEISCH DES SCHWARZEN SLAWONISCHEN SCHWEINES

Die Untersuchung wurde auf Schweinehälften und Fleisch von 16 schwarzen slawonischen Schweinen durchgeführt, gemästet bis etwa 130 kg Körpermasse (Gruppe A) und 16 Schweinen derselben Rasse gemästet bis etwa 110 kg Körpermasse (Gruppe B). Die Schweine wurden im halboffenen System gehalten, in denselben Bedingungen hinsichtlich Unterkunft und Fütterung. Die Dissektion der gekühlten (+4°C) rechten Schweinehälften wurde gemäß der modifizierten Methode nach Weniger und Mitarbeiter (1963) durchgeführt. Die Fleischqualität wurde auf Grund des Musters des langen Schultermuskels (M. longissimus dorsi) festgestellt, herausgenommen zwischen der 13. und 14. Rippe. Die Körpermassen der Schweine vor dem Schlachten (110,17 kg und 130,37 kg) hatten einen bedeutenden Einfluss auf die Qualität der Hälften jedoch nicht auf das Fleisch von schwarzen slawonischen Schweinen. Die Schweine größerer Körpermasse (130,37 kg) hatten die Hälften verschiedener Konformation (bedeutend größerer Anteil des Unterkinns und des Bauch-Rippen-Teils und einen relativ kleineren Anteil der weniger werten Teile und des Vorderschinkens) und der Zusammensetzung (relativ kleinerer Anteil des Vorderschinkenfleisches und relativ größerer Anteil des Bauch-Rippen-Fleisches) in Bezug auf die Schweine kleinerer Körpermasse (110,17 kg). Der Anteil des Fleisches in den Hälften war ungefähr gleich (47,06 % und 47,16 %) bei den beiden analysierten Schweinegruppen.

Table 3. Quality of pig meat in relation to body mass

Indicators	Statistical values	Groups of pigs		Sigificant different
		A (n=16)	B (n=16)	
pH1	$\bar{x}$	6,36	6,23	NS
	s	0,22	0,27	
pH2	$\bar{x}$	5,57	5,61	NS
	s	0,11	0,20	
Water holding capacity, cm^2	$\bar{x}$	5,14	4,65	NS
	s	1,11	1,64	
Colour („L“ value)	$\bar{x}$	51,38	51,15	NS
	s	3,16	2,41	
Crude proteins, %	$\bar{x}$	20,59	21,47	NS
	s	0,70	0,72	
Crude fats, %	$\bar{x}$	6,77	6,89	NS
	s	2,75	2,81	
Ash, %	$\bar{x}$	1,00	1,02	NS
	s	0,04	0,04	
Water, %	$\bar{x}$	71,64	70,62	NS
	s	1,50	1,21	

NS-no significant

Hinsichtlich der Fleischqualität, die normal war, wurden keine bedeutenden Unterschiede bei den analysierten Schweinegruppen festgestellt (p>0,05).

Schlüsselwörter: *schwarzes slawonisches Schwein, Körpermasse, Qulität der Hälften und des Fleisches*

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THE MONITORING OF PORK AND BEEF CHILLING PROCESS

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SUMMARY

The aim of the chilling of carcasses is to decrease the temperature in the deepest parts of muscles as fast as possible while maintaining its weight as high as possible. However, some losses of the weight are desirable because dried surfaces are more resistant to the microbial spoilage. Monitoring of pork and beef chilling process at the slaughterhouses in period 2006 – 2007 was performed in our experiment. Temperature was measured in the muscles, in the chilling rooms and also duration of the process was taken into account. Finally, in two cases (13.3 %) of pork carcasses temperature exceeded required +7 °C in deep part of muscles at the end of process.

***Key words**: chilling process, pork, beef*

INTRODUCTION

The lowering of carcass temperature initiates a complex of processes of meat preservation, which can suppress different forms of meat decomposition. The chilling of carcasses at the slaughterhouse is a knowing necessity and many of technological operations depend on cool environment. The process of meat chilling can be divided into two phases, chilling of carcasses from body temperature to refrigerated temperature and meat storage under chilling conditions (Matyáš, 1995).

The goal of the chilling of meat is to decrease the temperature in the deepest parts of muscles from temperature of 39 – 42°C as soon as possible while maintaining its weight as high as possible. Some losses of the weight are necessary and even desirable because dried surfaces are more resistant to the microbial spoilage (Bystrický, 1997).

The chilling standards of the meat and meat storage in chilling rooms markedly influence total qualitative standard of meat industry production, namely of meat and final meat products (Turek, 1992).

Food business operators must ensure that the storage and transport of meat of domestic ungulates take place in accordance with the requirements of Regulation (EC) No 853/2004 (Anon., 2004)..

Unless other specific provisions provide otherwise, post-mortem inspection must be followed immediately by chilling in the slaughterhouse to ensure a temperature throughout the meat of not more than 3°C for offal and 7°C for other meat along a chilling curve that ensures a continuous decrease of the temperature.

Meat may also be boned and cut prior to reaching the temperature listed above when the cutting room is on the same site as the slaughter premises. In this case, the meat must be transferred to the cutting room either directly from the slaughter premises or after a waiting period in a chilling or refrigerating room. As soon as it is cut and, where appropriate, packaged, the meat must be chilled to the temperature of not more than 7°C.

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