

CARCASS AND MEAT QUALITY IN PIGS FROM DIFFERENT CLASSES IN THE EUROPEAN GRADING SYSTEM

KAKVOĆA TRUPOVA I MESA SVINJA RAZLIČITIH KLASA U EUROPSKOM SUSTAVU KLASIFIKACIJE

Gordana Kralik, V. Margeta, I. Bogut

Original scientific paper – Izvorni znanstveni članak
UDC: 636.4.:637.071.072.073.074.
Received – Primljeno: 10. february - veljače 2002.

SUMMARY

Scientists continuously pay special attention to carcass and meat quality. Shares of particular tissues, and especially high share of muscular tissue can cause lower meat quality. Fewson (1987) and Kralik et al. (1990, 1991) point out negative correlation between share of muscular tissue in the carcass and pH1 of m. longissimus dorsi (mld). Kralik et al. (2001), Senčić et al. (1997), as well as Petričević et al. (2001) emphasize that, besides evaluation of pig carcasses according to the share of muscular tissue, it is also necessary to explore contribution of individual parts in the carcass regarding its usage value, as well as to explore meat characteristics, such as pH1, pH2, W.H.C. and colour. Above mentioned authors have found out that the qualitative meat characteristics depend highly upon commercial class. The purpose of our research was to determine, on the basis of carcass division into classes, shares of ham, loin, belly-rib part, shoulder and neck, as well as qualitative characteristics of m. longissimus dorsi.

In the research 150 pig carcasses were used originating from three-way crossbreeds (LW x SL) x GL, which have been divided, regarding their muscular tissue share, into the following commercial classes according to European Grading System: S (60% and more muscular tissue), E (55-60%), U (50-55%), R (45-50%) and O (40-45%). Share of muscular tissue, fatty tissue and bones were determined by dissection, previous cutting carcass into its main parts according to Weniger et al. (1963). pH1 values were established within 45 minutes post mortem, and pH2 24 hours post mortem. Water holding capacity (W.H.C.) was established after 24-hour process of cooling by the compression method according to Grau-Hamm (1952). Meat colour was determined photometrically on the MLD section by the Göfo device. Data processing was completed on the statistical program SAS, 6.12. version.

Sorting carcasses into classes according to their leanness showed that the S class had the highest share of muscular tissue (61.98%), followed by

Ph. D. Dr. h. c. Gordana Kralik, Full Professor and dipl. ing. Vladimir Margeta, Josip Juraj Strossmayer University of Osijek, Faculty of Agriculture, Osijek, Croatia, Dr. sc. Ivan Bogut, Associated Professor, University of Mostar, Faculty of Agriculture, Mostar, BiH.

classes: E (58.71%), U (54.28%), R (48.80%) and O (42.83%). Differences in the relative share of the muscular tissue between S and E, U, R and O, between class E and classes U and O, as well as between classes U and R and O and between class R and class O were statistically very important ($P < 0.01$). The same concerns the differences between shares of fatty tissue in particular classes. Share of fatty tissue was the lowest in class S (20.45%), followed by classes with higher shares: E (23.03%), U (27.29%), R (34.05%) and O (40.37%).

By cutting pig carcasses into particular parts (ham, loin, belly-rib part, shoulder and neck) it was found out that the differences in share of main parts among particular classes were in most cases statistically significant ($P < 0.01$) and they contributed to higher classes (S, E and U). Shares of ham in carcass according to classes were: 30.34%, 29.48%, 28.63%, 27.91% and 26.15%.

Muscular tissue of analysed samples had normal quality. pH1 values of muscular tissue fluctuated from 5.97 to 6.15, and pH2 values from 5.65 to 5.85. W.H.C values were in accordance with the fluctuation of pH1 values, being more favourable in classes of carcasses with lower leanness. The highest colour intensity was established in class S, and the lowest in class U (65.97 and 58.20, respectively). Qualitative characteristics of muscular tissue were more favourable in carcasses with lower leanness than in carcasses with higher leanness.

INTRODUCTION

Scientists continuously pay special attention to carcass and meat quality. Shares of particular tissues, and especially high share of muscular tissue can cause lower meat quality. Fewson (1987) and Kralik et al. (1990, 1991) point out negative correlation between share of muscular tissue in the carcass and pH1 of *m. longissimus dorsi* (MLD). Kralik et al. (2001), Senčić et al. (1997), as well as Petričević et al. (2001) emphasize that, besides evaluation of pig carcasses according to the share of muscular tissue, it is also necessary to explore contribution of individual parts in the carcass regarding its usage value, as well as to explore meat characteristics, such as pH1, pH2, W.H.C. and colour. Above mentioned authors have found out that the qualitative meat characteristics depend highly upon commercial class. The purpose of our research was to determine, on the basis of carcass division into classes, shares of ham, loin, belly-rib part, shoulder and neck, as well as qualitative characteristics of *m. longissimus dorsi*.

MATERIAL AND METHODS

In the research 150 pig carcasses were used originating from three-way crossbreeds (LW x SL) x GL, which have been divided, regarding their muscular tissue share, into the following commercial classes according to European Grading System: S (60% and more muscular tissue), E (55-60%), U (50-55%), R (45-50%) and O (40-45%). Share of muscular tissue, fatty tissue and bones were determined by dissection, by previous by cutting of carcass into its main parts according to Weniger et al. (1963). pH1 values were established within 45 minutes post mortem, and pH2 24 hours post mortem. Water holding capacity (W.H.C.) was established after 24-hour process of cooling by the compression method according to Grau-Hamm (1952). Meat colour was determined photometrically on the MLD section by the Göfo device. Data processing was completed on the statistical program SAS, 6.12. version.

RESULTS AND DISCUSSION

The carcass weight, the shares of ham, loin, belly-rib part, shoulder and neck in the classified carcasses, as well as the shares of muscular and fatty tissue and bones are shown in Table 1. Statistically significant differences in the weight of carcasses have not been established. The highest share of ham in the carcasses was found in class S (30.34%) and the lowest share in class O (26.15%).

Differences in the relative share of ham in the carcasses between classes E and R, and O classes, as well as between classes U and R and R and O classes were highly significant ($P < 0.01$). There were no significant differences in ham share in the carcasses of particular class ($P > 0.05$). Portions of shoulders and neck differed significantly between S and O, E and O, as well as between U and O class ($P < 0.01$).

Table 1. Shares of main parts and tissues in carcasses according to European Grading System

Tablica 1. Udjeli osnovnih dijelova i tkiva u trupovima prema europskom sustavu klasifikacije

Indicator - Pokazatelj	Commercial classes - Trgovačke klase					Average Prosjeak (n=150)	
	S (n=30)	E (n=30)	U (n=30)	R (n=30)	O (n=30)		
Carcasses weight Težina trupova (kg)	\bar{x}	77.95	77.62	77.46	80.39	82.33	80.72
	s	6.14	5.91	6.83	9.77	9.85	9.29
Ham - But (%)	\bar{x}	30.34	29.48	28.63	27.91	26.15	28.50
		**URO	**RO	**O*R	**O		
	s	0.98	1.11	1.44	1.42	1.21	1.89
	\bar{x}	16.54	16.54	16.97	16.20	17.20	16.69
Loin - Leđa (%)	s	1.46	1.80	1.69	2.05	1.66	1.76
	\bar{x}	17.20	18.14	18.60	19.50	20.77	18.86
Belly-rib part Trbušno-rebarni dio (%)		**R,O	**R,O	*R,O			
	s	1.47	1.46	1.85	2.02	1.58	2.07
Shoulder - Leđa (%)	\bar{x}	15.84	15.18	14.74	14.29	12.97	14.61
		*R**O	*R**O	**O			
	s	1.39	1.08	1.22	1.15	0.95	1.50
	\bar{x}	8.58	8.23	8.37	8.23	7.80	8.24
Neck - Vrat (%)		*R**O	*R**O	**O			
	s	0.94	1.10	0.80	1.13	1.08	1.03
Muscular tissue Mišićno tkivo (%)	\bar{x}	61.98	58.71	54.28	48.80	42.83	53.32
		**E,U,R,O	**U,O	**R,O	**O		
	s	1.12	1.01	0.55	0.81	1.33	6.95
	\bar{x}	20.45	23.03	27.29	34.05	40.37	29.04
Fatty tissue Masno tkivo (%)		**E,U,R,O	**U,R,O	**R,O	**O		
	s	2.10	1.61	1.71	1.97	4.05	7.72
Bones - Kostii (%)	\bar{x}	10.30	10.83	10.68	9.81	8.24	9.97
		*R**O	**R,O	*R**O			
	s	1.10	1.20	1.01	1.24	1.00	1.44

* $P < 0.05$; ** $P < 0.01$

Table 2. Qualitative traits of muscular tissue according to European Grading System
Tablica 2. Kvalitativna svojstva mišićnog tkiva prema europskom sustavu klasifikacije

Indicator - Pokazatelj		Commercial classes - Trgovačke klase					Average Prosjeak (n=150)
		S (n=30)	E (n=30)	U (n=30)	R (n=30)	O (n=30)	
pH ₁	\bar{x}	5.99	5.97	6.12	6.08	6.15	6.06
	s	0.34	0.37	0.36	0.30	0.25	0.33
pH ₂	\bar{x}	5.68	5.65	5.66	5.71	5.85	5.71
	s	0.21	0.17	0.12	0.16	0.30	0.21
W.H.C. - Sp.v.v. (cm ²)	\bar{x}	9.23	8.80	8.75	8.74	8.70	8.84
	s	1.95	1.91	1.61	1.90	1.67	1.80
Color (Göfo value) Boja (Göfo vrijednost)	\bar{x}	60.43	61.07	58.20	59.77	65.97	61.09
		**O	**O	**O	**O		
	s	8.93	7.91	10.20	5.39	6.07	8.23

**P<0.01

Sorting carcasses into classes according to their leanness showed that class S had the highest share of muscular tissue (61.98%). The following classes were: E (58.71%), U (54.28%), R (48.80%) and O (42.83%). Differences in the relative share of the muscular tissue between S and E, U, R and O, between E class and classes U and O, as well as between classes U and R and O and between class R and class O were statistically very important (P<0.01). The same concerns the differences between shares of fatty tissue in particular classes. Share of fatty tissue was the lowest in class S (20.45%), followed by classes with higher shares: E (23.03%), U (27.29%), R (34.05%) and O (40.37%). The research results show that there is a negative relation between portions of muscular and fatty tissue in the pig carcasses. Portions of bones in the carcasses did not differ significantly between S, E and U classes (10.30%, 10.83% and 10.68%, respectively), but they were considerably lower in R and O classes (9.81% and 8.24%). Approximately the same values for particular tissues and their portions in mentioned classes are cited by Senčić et al. (1997, 1998) as well as by Petričević et al. (1999, 2001).

Table 2 shows qualitative characteristics of MLD. Values of muscular tissue 45 minutes post

mortem (pH₁), showing the speed of glycolytic processes, were 5.96 in class S, with the growth tendency of 6.15 in class O. We did not establish statistically significant differences in pH₁ values of MLD, nor did we find statistically significant differences among average pH₂ values (P>0.05). Average pH₂ values of MLD were within the normal limits, except for class O (5.85). Petričević et al. (2001), as well as Kralik et al. (1990, 2001) cited approximately the same values for pH₁ and pH₂ in the MLD of meaty pig breeds. More significant fall of pH₁ values than ours was noticed by Živković et al. (1992) and Senčić et al. (1996).

Water holding capacity was the lowest in class S MLD (9.23 cm²), and the best in class O (8.70 cm²). However, this characteristic did not differ statistically among classes (P>0.05). Established approximate values were closer to those cited by Kralik et al. (1990, 2001), as well as Senčić et al. (1996). Muscular tissue colour (Göfo value) was of similar intensity in classes S, E, U and R (60.43, 61.07, 58.20 and 59.70), but aberration was set in class O (65.97). Differences in the intensity of MLD colour among classes of pig carcasses were statistically significant, which is in accordance with the results of our previous research (Kralik et al., 2001).

CONCLUSION

With classification of pig carcasses according to the leanness in classes S, E, U, R and O and with the analysis of muscular and fatty tissue portion, as well as bones portion, it was established that there was a statistically significant difference ($P < 0.01$) among particular classes.

By cutting pig carcasses into particular parts (ham, loin, belly-rib part, shoulder and neck) it was found that the differences in the share of main parts among particular classes were in most cases statistically significant ($P < 0.01$) and they contributed to higher classes (S, E and U). Shares of ham in carcass according to classes were: 30.34%, 29.48%, 28.63%, 27.91% and 26.15%.

Muscular tissue of analysed samples had normal quality. pH1 values of muscular tissue fluctuated from 5.97 to 6.15, and pH2 values from 5.65 to 5.85. W.H.C values were in accordance with the fluctuation of pH1 values, being more favourable in classes of carcasses of lower leanness. The highest colour intensity was established in class S, and the lowest in class U (65.97 and 58.20, respectively). Qualitative characteristics of muscular tissue were more favourable in carcasses of lower leanness than in carcasses of higher leanness.

REFERENCES

1. Fewson, D. (1987): Muscular proportionen und Typfragen in der Schweinezucht. Zuchtungskunde, 59, 6, 416-429.
2. Grau, R., R. Hamm (1952): Eine einfache Methode zur Bestimmung der Wasserbindung im Fleisch. Die Fleischwirtschaft, 4, 295-297.
3. Kralik, G., A. Petričević, I. Jurić (1990): Meatness of swine carcasses and qualitative property of meat. 36th International Congress of Meat Science and Technology, Congress Proceedings, 81-84, Havana - Cuba.
4. Kralik, G., A. Petričević, Jadranka Klaić, K. Plac, B. Petrović (1991.): Rezultati prvog testa u projektu stvaranja domaćeg tipa mesnate svinje. 1. Prinos mesa u polovicama. Stočarstvo, 45(3-4), 103-108.
5. Kralik, G., A. Petričević, Z. Škrtić, G. Kušec (2001): More on the relation between meat percentage and meat quality traits in swine carcasses. Zbornik Biotehniške fakultete v Ljubljani, Supl. 31, 199-211.
6. Petričević, A., G. Kralik, G. Kušec, Ž. Bukvić (1999): Share, distribution and quality of meat in carcasses of pigs of different genotype. 45th International Congress of Meat Science and Technology, 01.-06. 08. 1999., Yokohama, Japan, Congress Proceedings, Vol.II, 492-493.
7. Petričević, A., G. Kralik, Z. Tolušić, Z. Škrtić, G. Kušec (2001): Percentage and distribution of tissues in pig carcasses in relation to (S)EUROP classes. Zbornik Biotehniške fakultete v Ljubljani, Supl. 31, 205-211.
8. Senčić, Đ., G. Kralik, A. Petričević (1996.): Utjecaj genotipa na kakvoću svinjskog mesa. Poljoprivreda, 2 (1-2):41-46.
9. Senčić, Đ., G. Kralik, I. Jurić, A. Petričević, Z. Antunović (1997): Pig Slaughter Values According to the S-Europ Commercial Classes (Level of Meatness). Poljoprivredna znanstvena smotra, 62 (1-2):174-181.
10. Senčić, Đ., G. Kralik, B. Antunović, Z. Antunović, A. Petričević, A. Perković (1998): Influence of genotype on slaughtering pig value according to S-EUROP standard. Zbornik Biotehniške fakultete v Ljubljani, 111-115.
11. Weniger, H. J., D. Steinhauf, G. Pahl (1963): Muscular Topography of carcasses. BLV Verlagsgesellschaft, München.
12. Živković, J., B. Buković, B. Njari (1992.): Utjecaj pasminskog sastava na prinos i kakvoću svinjskog mesa. Stočarstvo, 46(1-2): 25.

SAŽETAK

Mesnatost svinjskih polovica i kakvoća mesa neprekidno zaokupljaju pažnju znanstvenika. Udjeli pojedinih tkiva, a osobito visok udio mišićnog tkiva, može imati za posljedicu slabiju kakvoću mesa. Fewson (1987) i Kralik i sur. (1990., 1991.) navode negativnu korelaciju između udjela mišićnog tkiva u trupu i pH1 m. longissimus dorsi (MLD). Kralik i sur.

(2001), Senčić i sur. (1997), kao i Petričević i sur. (2001), ističu da je, osim vrednovanja svinjskih polovica prema prinosu mišićnog tkiva, potrebno istraživati i prinos pojedinih dijelova u trupu radi njegove uporabne vrijednosti, uz istovremeno istraživanje svojstava mesa, kao što su pH1, pH2, sp.v.v. i boja. Autori su ustanovili da kvalitativna svojstva mesa značajno ovise o trgovačkoj klasi. Svrha našeg rada bila je da se na osnovi razvrstavanja trupova u klase, utvrde udjeli buta, leđa, trbušno-rebarnog dijela, plećke i vrata u njima, kao i kvalitativna svojstva dugog leđnog mišića.

U istraživanju je korišteno 150 svinjskih trupova podrijetlom od tropasminskih križanaca (VJ x ŠL) x NJL, koji su prema prinosu mišićnog tkiva bili podijeljeni u trgovačke klase prema European Grading System; S (60% i više miš. tkiva), E (55-60%), U (50-55%), R (45-50%) i O (40-45%). Prinos mišićnog tkiva, a također i masnog tkiva i kostiju utvrđeni su disekcijom uz prethodno rasijecanje trupova na osnovne dijelove prema Wenigeru i sur. (1963). Vrijednosti pH1 izmjerene su unutar 45 minuta post mortem, a pH2 24 sata p.m. Sposobnost vezanja vode (sp.v.v.) određena je metodom kompresije po Grau-Hammu (1952) nakon hlađenja (24 sata p.m.). Boja mesa utvrđena je na presjeku MLD-a fotometrijski pomoću Gōfo-uređaja. Obrada podataka obavljena je u statističkom programu SAS ver. 6.12.

Razvrstavanje polovica u klase prema mesnatosti pokazalo je da je najveći udio mišićnog tkiva u polovicama bio u S klasi (61,98%), zatim slijede klase: E (58,71%), U (54,28%), R (48,80%) i O (42,83%). Razlike u relativnom prinosu mišićnog tkiva između klasa S i E, U, R i O, zatim između E i UO, kao i U i R,O te između R i O klase bile su statistički visoko značajne ($P < 0,01$). Ta tvrdnja vrijedi i za razlike između udjela masnog tkiva u pojedinim klasama. Udjel masnog tkiva bio je najniži kod S klase (20,45%), zatim slijede E (23,03%), U (27,29%), R (34,05%) i O klasa (40,37%).

Rasijecanjem svinjskih trupova na pojedine dijelove (but, leđa, TRD, plećka i vrat) utvrđeno je da su razlike u udjelu osnovnih dijelova između pojedinih klasa bile u većini slučajeva statistički visoko značajne ($P < 0,01$) i išle su u prilog viših klasa (S, E, U). Udjeli buta u trupu prema klasama bili su: 30.34%, 29.48%, 28.63%, 27.91% i 26.15%.

Mišićno tkivo analiziranih uzoraka svinja ima normalnu kakvoću. Vrijednosti pH1 mišićnog tkiva kretale su se od 5,97 do 6,15, a pH2 od 5,65 do 5,85. Vrijednosti za sp.v.v. bile su u skladu s kretanjem pH1 vrijednosti i bile su povoljnije kod klasa trupova s nižom mesnatošću. Najjači intenzitet boje ustanovljen je kod S klase, a najslabiji kod U klase (65,97 odnosno 58,20). Kvalitativna svojstva mišićnog tkiva bila su povoljnija kod trupova s nižom nego kod onih s višom mesnatošću.