Animal Science Papers and Reports vol. 22 (2004) no. 4, 569-576
Institute of Genetics and Animal Breeding, Jastrzębiec, Poland

Quality of pig carcasses belonging to different classes in the EUROP grading system

Stanisław Wajda[1], Tomasz Daszkiewicz[1], Magdalena Wajda[2]

[1] Department of Science of Commodities of Animal Raw Materials, Faculty of Animal Bioengineering, University of Warmia and Mazury in Olsztyn, Oczapowskiego 5, 10-719 Olsztyn, Poland

[2] Chair of Meat Technology and Chemistry, Faculty of Food Science, University of Warmia and Mazury in Olsztyn, Pl. Cieszyński 1, 10-726 Olsztyn, Poland

(Received August 7, 2004; accepted October 11, 2004)

The meat (*m. longissimus dorsi*) was obtained from 282 fattener carcasses, selected at three large meat plants and considered representative of the fatteners population in Poland. The selection was preceded by carcass fatness analysis, performed on over 12 thousand fatteners slaughtered at different meat plants. The randomly selected carcasses were allocated to four quality classes, according to their meat content, *i.e.* E, U, R and O (97, 90, 81 and 14 carcasses, respectively).
It was found that carcasses belonging to higher quality classes were characterized by lower weight, and that their meat contained more crude protein and non-protein N, and less fat. The fat content of carcasses showed high variability. About 80% of meat samples in class E contained 0.51-2.00% fat, in class U – 0.51-2.5%, in class R – 1.01-3.0%, and in class O – 0.1 to above 3.0%. Carcasses with PSE meat constituted 12.7%, and their proportion was increasing with an increase in meat content of carcass – it was the highest in class E (18.2%) and the lowest in classes O and R (9 and 7.4%, respectively). The results of taste-panel evaluation indicate that meat from carcasses containing more fat was characterized by better juiciness and tenderness.

KEY WORDS: carcass grading / EUROP system / fatteners / meat quality / pigs

Producers delivering fatteners characterized by high meat content of carcass are preferred by meat processing plants in the European Union. This is possible due to the EUROP grading system and purchase price lists [Engel *et al.* 2003]. Increased meatiness of pig carcasses is connected with higher efficiency of pig fattening, as well as

higher market and technological valueof the carcasses [Korzeniowski *et al.* 1997, Strzelecki *et al.* 1997, Strzelecki *et al.* 1998].

However, apart from the above advantages, high carcass meatiness is connected also with some negative effects, such as quality deterioration. Intensive selection towards maximum meatiness resulted in a decrease in meat quality, due to higher frequency of watery meat occurrence [Pospiech *et al.* 1998, Denaburski *et al.* 2003, Koćwin-Podsiadła *et al.* 2003]. The correlation between meat per cent of carcass and quality of pig carcasses is considered important by meat plants.

The objective of the present study was to determine the quality of pig carcasses qualified to different classes in the EUROP grading system.

Material and methods

The material consisted of 282 carcasses of fatteners considered representative of the pig population in Poland and selected at the Meat Plants in Łuków, Morliny near Ostróda and Prime Food in Przechlewo. The selection was preceded by long-term studies on carcass fatness, comprising over 12,000 fatteners slaughtered at different meat plants in Poland [Grześkowiak *et al.* 2002, Borzuta *et al.* 2003].

After about 45 min from stunning, pH_{45} of the *longissimus dorsi* (LD) muscle was measured on 165 (44 class E, 56 class U, 54 class R, and 11 class O) carcass-sides

Chilled (2-4°C) left carcass-sides from the Meat Plant in Łuków (63) and Przechlewo (132), were transported to the Meat Plant in Morliny and cut into elements according to the method of Walstra and Merkus [1996], considered obligatory in the EU member states as for the attestation of apparatuses used for meat content estimation in pig carcasses. Samples of the LD muscle for meat quality evaluation were taken from the region of the last three thoracic vertebrae. The samples were subjected to qualitative analysis after about 48 hours from slaughter. The following parametres were determined: contents of dry matter, fat, crude protein, non-protein nitrogen and ash, water-holding capacity (WHC, by the Grau and Hamm method), color lightness (using Spekol spectrocolorimeter with R 45/0 remission attachment, at a wavelength of 560 nm), and meat pH_{48} (pH-meter Radiometer with GK 23311C electrode) [Znaniecki 1983]. The sensory evaluation of cooked meat [Znaniecki 1983] was performed according to a five-point scale (1 point – the worst, 5 points – the best) given by Polish Standard [PN-ISO 4121, 1998].

Calculations were done using the computer programme STATISTICA ver. 6.0, on the basis of one-factor analysis of variance. Significance of differences between means of carcass classes (EURO grades) was determined with the Duncan test.

Results and discussion

Mean carcass weight was 79.33 kg. The lightest were carcasses of class E (75.65 kg), while those belonging to lower quality classes were heavier (Tab. 1). An increase in carcass fatness, accompanying an increase in weights, was also reported by Kortz *et al.* [2002] and Wajda *et al.* [1998].

Table 1. Means and their standard deviations (SD) for cold carcass weight, meat content of carcass and basic chemical composition of meat

Item		Class of carcass in the EUROP system			
		E	U	R	O
Cold carcass weight (kg)	mean	75.65^{a}	78.21	79.37	80.81^{b}
	SD	6.95	8.78	9.18	9.76
Meat content of carcass (%)	mean	58.47^{A}	52.72^{B}	48.15^{C}	43.03^{D}
	SD	2.66	1.49	1.33	1.14
Dry matter (%)	mean	24.70	24.73	24.78	24.81
	SD	0.75	0.99	0.96	1.41
Crude protein (%)	mean	21.89^{Aa}	21.41^{A}	21.16^{b}	20.38^{Bc}
	SD	1.39	1.52	1.59	1.94
Non-protein N (%)	mean	$0,510^{Aa}$	0.509^{Aa}	0.488^{b}	0.480^{B}
	SD	0.029	0.052	0.053	0.049
Fat (%)	mean	1.32^{A}	1.66^{AB}	1.88^{B}	2.50^{C}
	SD	0.63	0.67	0.86	1.52
Ash (%)	mean	1.15^{a}	1.15^{a}	1.13	1.12^{b}
	SD	0.05	0.05	0.05	0.06

$^{aA...}$ Within rows means bearing different superscripts differ significantly at: small letters – $P \leq 0.05$; capitals – $P \leq 0.01$.

The analysis of LD chemical composition (Tab. 1) shows that meat from carcasses of class O was characterized by the highest mean dry matter content (24.81%), and meat from carcasses of class E – by the lowest (24.70%). The differences between means for classes were slight and not significant, but the results obtained indicate upward tendency in dry matter per cent while moving from quality grade E to O.

High nutritive value of meat results, first of all, from the fact that it is a source of valuable protein of animal origin. In the present study, the highest crude protein content of LD was noted in meat from E and U (21.89% and 21.41%, respectively), whereas the lowest (20.38%) in meat from O carcasses. The protein content of meat from carcasses belonging to class O was lower compared with meat from E and U ($P \leq 0.01$) and R ($P \leq 0.05$) carcasses. Concentration of non-protein N varied from 0.48% of LD from O to approximately 0.50% of LD from E and U carcasses ($P \leq 0.01$).

Nowadays, much attention is paid to intramuscular fat content of pork. In LD from E carcasses, mean fat content amounted to 1.32% and was almost twofold lower than in LD from carcasses O (2.50%) – Table 1. High variation in fat content of meat is showed in Table 2. No significant differences in fat concentration were found between upper and lower EURO classes .

Table 2. Intramuscular fat content across EUROP carcass quality classes

Fat content of meat	Class of carcass in the EUROP system							
	E		U		R		O	
	n	%	n	%	n	%	n	%
<0.50%	1	0.98	0	0.00	0	0.00	0	0.00
0.51-1.00%	36	35.29	12	13.63	7	8.86	0	0.00
1.01-1.50%	32	31.37	29	32.95	23	29.11	4	26.66
1.51-2.00%	20	19.60	24	26.58	21	26.58	3	20.00
2.01-2.50%	9	8.82	16	18.18	17	21.51	2	13.33
2.51-3.00%	2	1.96	3	3.40	5	7.18	4	26.66
>3.00%	2	1.96	4	4.54	6	7.59	2	13.33

n = number of animals.

Nutritive value of pork depends, among others, on the concentration of mineral substances (Tab. 1). In the present study, it was highest in LD from carcasses graded into classes E and U (1.15%), and the lowest (P≤0.05) in LD from those of class O (1.12%). The relations appearing between chemical composition of LD and meat content of carcass are consistent with results reported by Kortz *et al.* [2002], Pospiech *et al.* [1998] and Wajda *et al.* [1998].

Table 3. Means and their standard deviations (SD) for physico-chemical properties of meat

Item		Class of carcass in the EUROP system			
		E	U	R	O
pH_{45}	mean	6.13	6.19	6.24	6.16
	SD	0.38	0.40	0.31	0.39
pH_{48}	mean	5.34	5.38	5.38	5.44
	SD	0.13	0.14	0.12	0.16
Colour brightness (%)	mean	26.08	26.96	25.83	27.43
	SD	2.68	3.44	2.43	2.98
Water-holding capacity (cm^2)	mean	8.61^{A}	8.97^{a}	8.76^{A}	9.43^{Bb}
	SD	1.28	1.32	1.10	1.40

$^{aA..}$ Within rows means bearing different superscripts differ significantly at: small letters – P≤0.05; capitals – P≤0.01.

Table 3 shows that LD muscle was characterized by similar mean levels of pH_{45} and pH_{48}, ranging from 6.13 to 6.24, and from 5.34 to 5.44, respectively. Slightly lower values of pH_{45} and pH_{48} were recorded in class E, while higher – in classes R and O. Generally, pH_{48} was low in all four carcass quality classes.

Measurements of pH of LD allowed to calculate shares of carcasses with PSE meat in each class (Tab. 4). In class E such carcasses constituted 18.2%, in class U – 14.3%, in class R – 7.4%, and in class O – 9.1%. The mean per cent of carcasses with PSE meat appeared quite high – 12.7%. Increase in per cent of carcasses with PSE meat, accompanied by increase in their meat content, was also observed by Sieczkowska *et al.* [2001].

Table 4. Share of carcasses with PSE meat (pH≤5.8)

Class of carcass	Number of carcasses	PSE meat number of carcasses	%
E	44	8	18.2
U	56	8	14.3
R	54	4	7.4
O	11	1	9.1
Total	165	21	12.7

Table 5. Score for sensory evaluation of meat

Item		Class of carcass in the EUROP system			
		E	U	R	O
Aroma – intensity	mean	5.00	5.00	5.00	5.00
	SD	0.00	0.00	0.00	0.00
Aroma – desirability	mean	5.00	5.00	5.00	5.00
	SD	0.00	0.00	0.00	0.00
Taste – intensity	mean	4.44	4.57	4.48	4.57
	SD	0.61	0.60	0.60	0.58
Taste – desirability	mean	4.44	4.57	4.48	4.57
	SD	0.61	0.60	0.60	0.58
Juiciness	mean	4.00^{A}	4.27	4.19	4.43^{B}
	SD	0.65	0.63	0.67	0.58
Tenderness	mean	4.12	4.23	4.26	4.63
	SD	0.68	0.67	0.64	0.60

^{AB}Within row means bearing different superscripts differ significantly at P≤0.01.

The lowest WHC – 9.43 cm^2 – was found in LD from carcasses of class O (Tab. 3), which resulted from its reduced protein content. In remaining classes, mean WHC varied from 8.61 to 8.97 cm^2, differing ($P \leq 0.01$ and $P \leq 0.05$) from that obtained for class O..

Differences in meat colour brigtness between carcass classes appeared relatively small and not significant (Tab. 3). Only LD from class O was characterized by slightly lighter colour, which could result from its highest fat content.

Taste-panel evaluation of cooked pork indicated its good quality (Tab. 5). However, meat from carcasses belonging to E class was less juicy ($P \leq 0.01$) and tender than that belonging to class O. Pork with the highest intramuscular fat content (class O) was characterized by the best juiciness and tenderness.

The results of taste-panel evaluation confirm the opinion that high intramuscular fat content positively affects the culinary value of meat [Eikelenboom *et al.* 1996, Park *et al.* 2001]. However, this effect becomes visible only when a certain level of fat content is exceeded.

Summarizing, carcasses belonging to higher quality classes were characterized by higher concentrations of crude protein and non-protein N, and lower fat content. Fat content of carcasses showed high variability. Carcasses with PSE meat constituted 12.7% of the total number of animals studied, and the proportion was increasing with an increase in meat content of carcass.. The results of juiciness and tenderness evaluation indicate lower quality of meat from carcasses of class E, and the best quality of meat from carcasses of class O.

REFERENCES

1. BORZUTA K., BORYS A., GRZEŚKOWIAK E., WAJDA S., STRZELECKI J., LISIAK D., 2003 – Zmienność wartości rzeźnej i jakość mięsa tuczników ze skupu letniego 2002 r. (Variability of slaughter value and meat quality of fatteners slaughtered in summer of 2002). ***Roczniki Instytutu Przemysłu Mięsnego*** XL, 5-11.
2. DENABURSKI J., BĄK T., DASZKIEWICZ T., 2003 – Ocena jakości mięsa tuczników pochodzących od różnych producentów (The meat quality evaluation of fattening pigs from different producers). ***Żywność (Nauka, Technologia, Jakość)*** 4 (37), 122-134.
3. EIKELENBOOM G., HOVING-BOLINK A.H., VAN DER WAL P.G., 1996 – The eating quality of pork. 2. The influence of intramuscular fat. ***Fleischwirtschaft*** 76, 517-518.
4. ENGEL B., BIUST W.G., WALSTRA P., OLSEN E., DAUMAS G., 2003 – Accuracy of prediction of percentage lean meat and authorization of carcass measurement instruments: adverse effects of incorrect sampling of carcasses in pig classification. ***Animal Science*** 76, 199-209.
5. GRZEŚKOWIAK E., BORZUTA K., STRZELECKI J., WAJDA S., 2002 – Badanie zmienności stopnia umięśnienia i otłuszczenia surowca wieprzowego w wybranych zakładach mięsnych kraju (Variability of meatiness and fattness of fatteners in some chosen Polish slaughterhouses). ***Roczniki Instytutu Przemysłu Mięsnego i Tłuszczowego*** 39, 67-75.
6. KOĆWIN-PODSIADŁA M., KRZĘCIO E., ANTOSIK K., 2003 – Rynek mięsa wieprzowego. Postęp w doskonaleniu mięsności i jakości mięsa w Polsce w świetle danych i standardów krajów Unii Europejskiej (The Polish pork meat market, the meatiness and meat quality improvemant in comparison to data and standards of leading UC countries). ***Żywność (Nauka, Technologia, Jakość) Suplement*** 4 (37), 214-220.

7. KORTZ J., RYBARCZYK A., KARAMUCKI T., GARDZIELEWSKA J., JAKUBOWSKA M., NATALCZYK-SZYMKOWSKA W., 2002 – Charakterystyka jakości tuszy oraz podstawowego składu chemicznego mięsa tuczników klasyfikowanych w systemie EUROP na podstawie mięsności określanej aparatem ULTRA-FOM oraz metodą SKURTCh (Carcass quality and basic chemical composition of meat in porkers classified into EUROP system according to the Ultra Fom apparatus *vs* dissection metod). In Polish with English summary. ***Prace i Materiały Zootechniczne,*** Zeszyt specjalny 13, 85-91.
8. KORZENIOWSKI W., KWIATKOWSKA A., JANKOWSKA B., 1997 – Uzysk surowców do produkcji wędzonek z tusz wieprzowych o różnej mięsności (Output of raw materials from pig carcasses of different meatiness to production of smoked bacon). Polish-Slovak-Czech Scientific Meeting "Current problems on pig production", Olsztyn, 7 May, 110.
9. PARK B., CHO S., KIM J., YOO Y., LEE J., AHN CH., KIM Y., YUN S., 2001 – Carcass composition and meat quality by intramuscular fat contents in *Longissimus dorsi* of Hanwoo. Proceedings of the 47th International Congress of Meat Science and Technology, August 26-31, Cracov, Poland, Vol. I, 116-118.
10. PN-ISO 4121, 1998 – Polska Norma. Analiza sensoryczna. Metodologia. Ocena produktów żywnościowych przy użyciu metod skalowania. (Polish Standard: Sensory analysis. Methodology. Evaluation of food products by methods using scales).
11. POSPIECH E., BORZUTA K., ŁYCZYŃSKI A., PŁÓKARZ W., 1998a – Meat defects and their economic importance. ***Polish Journal of Food and Nutrition Sciences*** 7/48, No 4 (S), 7-20.
12. POSPIECH E., ŁYCZYŃSKI A., MIKOŁAJCZAK B., GRZEŚ B., IWAŃSKA E., PIETRZAK M., FIRLEJ Z., WANDERSTEEN H., SOŚNICKI A.A., 1998b – Evaluation of meat quality and musculature of selected cuts and carcasses of pigs with differentiated meatiness. ***Polish Journal of Food and Nutrition Sciences*** 7/48, No 4 (S), 222-229.
13. SIECZKOWSKA H., KRZĘCIO E., ZYBERT A., KOĆWIN-PODSIADŁA M., 2001 – Influence of hot carcass weight and lean meat content of fatteners on selected meat and carcass quality traits. ***Polish Journal of Food and Nutrition Sciences*** 10/53, No 3 (S), 229-232.
14. STRZELECKI J., BORZUTA K., LISIAK D., 1998 – Koszty własne produkcji tusz wieprzowych w zależności od klas mięsności (Cost of pig carcasses production depending on meatiness class). In Polish. ***Gospodarka Mięsna*** 8, 26-31.
15. STRZELECKI J., BORZUTA K., WAJDA S., 1997 – Wpływ składu tkankowego na ekonomikę rozbioru i wykrawania tusz wieprzowych (Influence of tissue composition on economical aspects of cutting and deboning of pig carcasses). ***Roczniki Instytutu Przemysłu Mięsnego i Tłuszczowego*** 34, 15-18.
16. WAJDA S., MELLER Z., DASZKIEWICZ T., 1998 – Quality of meat from pig carcasses belonging to different classes of the EUROP system. ***Polish Journal of Food and Nutrition Sciences*** 7/48, No 4 (S), 273-278.
17. WALSTRA P., MERKUS G.S.M., 1996 – Procedure of assessment of lean meat percentage as a consequence of the new EU reference dissection method in pig carcasses classification. Report ID-DLO 96.014, 1-22.
18. ZNANIECKI P., 1983 – Zarys obrotu, oceny i przetwórstwa surowców pochodzenia zwierzęcego (Outline of turnover, evaluation and processing of animal raw materials), PWRiL, Warszawa, 221-237.

Stanisław Wajda, Tomasz Daszkiewicz, Magdalena Wajda

Jakość mięsa wieprzowego pochodzącego z tusz zakwalifikowanych do różnych klas w systemie EUROP

Stre szczenie

Materiał badawczy stanowił mięsień *longissimus dorsi* (LD) z 282 tusz tuczników specjalnie wyselekcjonowanych w trzech dużych zakładach mięsnych tak, aby możliwie najdokładniej odzwierciedlały krajową populację tuczników. Ich wybór poprzedziły szerokie badania otłuszczenia tusz, które objęły ponad 12 tysięcy tuczników ubijanych w różnych zakładach mięsnych na terenie całej Polski. Wybrane losowo tusze zakwalifikowano, na podstawie ich mięsności, do jednej z czterech klas: E, U, R i O (odpowiednio 97, 90, 81 i 14 tusz.

Ze wzrostem klasy tusz obniżała się ich masa, a w mięsie rosła zawartość białka ogólnego i związków azotowych niebiałkowych, a zmniejszała się ilość tłuszczu. Stwierdzono dużą zmienność zawartości tłuszczu w mięsie. Około 80% próbek LD z tusz w klasie E miało zawartość tłuszczu od 0,51 do 2,00%, w klasie U – od 0,51 do 2,5%, w klasie R - od 1,01 do 3,0%, a w klasie O – od 1,01 do powyżej 3,0%. Stwierdzono, że udział tusz z mięsem PSE był stosunkowo wysoki i wynosił 12,7%, przy czym udział tej wady zwiększał się w miarę wzrostu mięsności tusz. Największy procent mięsa PSE zaobserwowano w obrębie tusz w klasie E (18,2%), a najmniejszy w klasie O (9%) i R (7,4%). W ocenie organoleptycznej stwierdzono, że mięso z tusz o większym otłuszczeniu odznaczało się większą soczystością i kruchością.