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EFFECT OF pH_{24} AND INTRAMUSCULAR FAT CONTENT ON TECHNOLOGICAL AND SENSORY QUALITY OF PORK

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The aim of this work was to estimate the influence of pH_{24} and intramuscular fat content on culinary quality of meat. The research was executed on 60 hogs. The percent of meat in carcass after slaughter was estimated and the samples of *Longissimus lumborum* muscle for the next studies were taken. The fat and protein content, pH after 1, 3 and 24 h *post mortem*, natural drip loss, parameters of meat colour in the CIE L*a*b* system and cooking yield index characterising the meat efficiency after cooking process in LD muscle were determined. Moreover, sensory analysis of raw meat and meat after heat treatment was conducted. Statistical analysis of results was conducted by means of Statistica 6.0 PL software package by using the two-factor analysis of variance.

The hogs studied were characterised by high meatiness (56.57–58.12%), a high content of protein (average 23%) and low natural drip loss (average 4.67%). In meat samples characterised by higher pH_{24} a better sensory quality in relation to higher IMF was observed, however in meat samples characterised by lower pH_{24} this relationship was not observed. Simultaneously, the influence of pH_{24} and IMF content on the sensory quality of meat after heat treatment was determined using canonical analysis. The determination coefficient obtained indicated that the level of IMF and pH_{24} *post mortem* determined in 59% the overall sensory quality of meat. Taking into consideration cooking yield and natural drip loss in explained variable set it was stated that the sensory quality of cooked meat was determined in 67% by these indicators. The results obtained indicated that based on the above-mentioned traits of meat it could be possible to select meat of proper quality as culinary meat, intended for sale.

INTRODUCTION

Many authors [Hay & Preston, 1994; Morrisey *et al*., 1998; Sellier, 1998; Koćwin-Podsiadła *et al.,* 2006; Migdał *et al*., 2007; Grześkowiak *et al.*, 2007] related the chemical composition and quality of pork to genetic factors (main genes, breed, sex, age), and environmental factors (nutrition, conditions of maintenance and trade before slaughter). These factors significantly influence the rate and extent of processes occurring in the muscle tissue after slaughter.

To monitor changes in muscle tissue after slaughter, a good indicator is the measurement of pH. Many researchers [Monin & Sellier, 1985; Bendall & Swatland, 1988; Fernandez *et al*., 1994, Eikelenboom & Hoving-Bolink, 1994; Eikelenboom *et al*., 1995; Monin & Quali, 1991; Czarniecka-Skubina *et al.,* 2006; Jaworska *et al.,* 2006] have stated that pH of meat significantly affects many technological and sensory quality traits of meat.

According to Migdał *et al*. [2007], the most important parameters which determine the quality and technological values of meat are chemical composition and texture (tenderness) of meat. An increase of meatiness, which is a consequence of intensive breeding of pigs, results in a significant reduction of fat and change in the chemical composition of meat tissue [Hay & Preston, 1994; Morrisey *et al*., 1998; Wajda *et al*., 2004].

Some authors [Wood *et al*., 1999; Fortin *et al*., 2005; Eikelenboom & Hoving-Bolink, 1994; Fernandez *et al*., 1999; Przybylski *et al*., 2007a] suggest that intramuscular fat content (IMF) significantly determines sensory quality and usability of meat for culinary treatment. As it was mentioned by many authors [Fernandez *et al*., 1999; Resurrection, 2004; Ngapo *et al*., 2007a, b; Przybylski *et al*., 2007a] the technological traits are characterised by adequate technological value (described by pH, water holding capacity, technological yield (curing and cooking, drip loss), as well as appropriate sensory quality, *i.e.* light red colour, with a little fat cover, without visible marbling and a low level of drip loss.

Previous works show that the culinary quality of pork meat after heat processing was related to the rate of pH changes after slaughter, intramuscular fat content and drip loss [Wood *et al*., 1999; Channon *et al*., 2004; Jaworska *et al*., 2007]. These authors indicated that a high intramuscular fat content, a high level of pH after slaughter and small losses during heat treatment result in good levels of tenderness, juiciness and flavour.

The aim of this work was to estimate the influence of pH_{24} and intramuscular fat content on the quality of pork meat. Our previous studies indicated that pH_{24} and intramuscular fat content separately affected the sensory quality of pork and its technological usability. In this study, we would like to verify

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the simultaneous affect of both traits: pH_{24} and intramuscular fat content on the sensory quality of pork. These factors are applied to evaluate technological quality *post mortem* in meat plants. Measurements of these technological traits enable determining the quality of meat classified into two categories: processing and culinary treatment, at the level of a meat plant.

MATERIAL AND METHODS

The study was carried out in the laboratory of Catering Technology and Food Hygiene, Department of the Faculty of Human Nutrition and Consumer Sciences of the University of Life Sciences – SGGW, and after slaughter directly in ZM Mróz slaughter-plant in Borzęciczki. Experimental material was obtained from 60 carcasses of pigs derived from crossing Naima sows with hybrids P-76 PenArLan boars. In each subgroup the number of barrows and gilts was equal.

Pigs were produced and reared under the same conditions and were fed the same standard diet. The animals have unlimited access to water and the growth period was the same for all pigs. The animals were slaughtered in a commercial slaughter-plant at 105 kg live weight according to standard technologies (the distance from the farm to the slaughter-house was 200 km, the animals took a rest for about 2 hours after transport). They were stunned using an automatic electric device and exsanguination was carried out in a horizontal position. Parameters of high-voltage stunning process were as follows: 700 V, 50 Hz, and 1.3 A. Then, hanging carcasses were scalded with water evaporation and singed in a Danish oven.

After slaughter, on the technological line, carcass meat percentage was measured using the CGM apparatus (Sydel corporation, France), on the basis of the measurement of backfat thickness and *Longissimus* muscle thickness taken at the height of the last rib, 7 cm from carcass mid-line [Borzuta, 1998]. The average meatiness was 57.45±2.35%, hot carcass weight value – 86.98±8.96 kg, loin muscle thickness LD – 59.26±5.57 mm, and back fat thickness – 14.24±3.07 mm. Immediately after slaughter, samples of *Longissimus* muscle (taken behind the last rib, about 1 kg) were taken and stored in the slaughter plant at 4°C and 78% humidity for 24 h and then transported in cooling conditions to the laboratory for analyses.

The samples of *Longissimus* muscle were determined for: fat content according to the Polish Standard PN–73/A-82111, protein content according to the Polish Standard PN–75/A-04018, value of pH using a pH-meter 330 model (WTW corporation, Germany) after 1, 3 and 24 h *post mortem,* and drip loss after 48 h *post mortem* according to Prange *et al*. [1977]. Parameters of meat colour in the CIE L*a*b* system (L – lightness, a – reference to the red, and b – saturation towards the yellow colour) were determined using a CR310 Minolta equipment. Moreover, the cooking yield (CY) was determined by cooking a meat portion in water with the addition of sodium chloride (0.8%) to achieve a temperature of 72°C in the sample's epicenter.

The sensory quality of meat was determined firstly in raw material and then in the heat-treated material. The sensory visual quality of raw meat (ton of colour, marbling, acceptability) and cooked meat (odour, hue of colour, homogenity of colour, tenderness, juiciness, fat perceptibility, meat flavour and overall quality) was determined at 96 h *post mortem* by sensory scaling methods using an unstructured scale (0-10 c.u.-convenient unit) with precisely defined anchors [Meilgaard *et al.,* 1999; PN-ISO 4121:1998].

Raw meat was presented to the evaluators in slices, placed on disposable foam polystyrene trays used as a standard in the retail sale network. The trays with meat were wrapped in transparent PE film, simulating meat sale conditions applied in trade. The samples were cooked in a salt water solution (0.8%) according to Baryłko-Pikielna *et al*. [1964] up to 72°C temperature in the sample's epicenter, and next were kept covered until reaching 75°C. Then the samples were cooled (temperature 21°C for 1-2 h) and cut into portions of approximately equal size (about 25 g) and placed into plastic (PP) disposable covered boxes. All the samples were separately coded for assessment (three digit codes) and were put in random order to avoid the carry-over effect (*i.e.* the influence of the previous sample on the next one). The analysis was conducted in rooms with daily light, at a room temperature (20°C). To neutralize the taste, each person received hot tea, without sugar between the assessments of samples. Sensory analysis was carried out by a panel of 10 assessors trained in the range of the executed analysis. All panelists had 4 years experience in evaluation of pork meat. The analysis was conducted at the Catering Technology and Food Hygiene Chair, Warsaw University of Life Sciences (SGGW).

In order to determine meat quality, the pigs were divided into 3 groups differing in intramuscular fat content (IMF) in *Longissimus* muscle: I group ≤1% of IMF content, II group 1.1–2% of IMF content, and III group 2.1–3% of IMF content. Among these groups of hogs, two subgroups of different pH_{24} value were distinguished: I group with pH ≤5.50, and II group with pH >5.50. The population of the pigs studied was free from HAL and RN^- gene.

The statistical analysis of the results was elaborated using Statistica 6.0. PL package (StatSoft Inc. 2001). The simple correlation and canonical coefficients were calculated. Two-way analysis of variance was applied. The use of canonical analysis allows to precisely explain a relationship between groups and attempts to explicate the overall variability of the analysed aggregation of variables. This analysis allows to estimate the correlation degree of two variable sets, explicating variables collection X (fat contents, pH_{24}, cooking losses and drip loss after 48 h *post mortem*) with a set of variables to explain (sensory quality characters of raw meat and meat after cooking). The degree of correlation of these variable sets explained canonical correlation coefficient C_R and compound determination coefficient C_R^2. It made it possible to estimate what part of total variance of Y collection is explained by the items of the X collection. According to Przybylski *et al.* [2007b], the application of aggregation statistical methods allows a better study of the relationships between meat quality traits.

RESULTS AND DISCUSSION

Mean values of the results obtained showed that the hogs studied were characterised by appropriate slaughter value (meatiness) and technological value (described by water holding capacity, cooking yield, drip loss after 48 h) and sensory quality of meat. The experimental population was characterised by relatively high meatiness and protein content, 57.45% and 23% on average, respectively (Table 1).

The meat samples were characterised by a low natural drip loss (average 4.76%), lower than that obtained in the study carried out on analogous material by Jaworska *et al.* [2007]. Also in the study of Krzęcio *et al*. [2004], a wide range of drip loss (1 to 15%) was observed. The slaughter value of pigs was similar to values observed by other authors for equivalent genetic material [Krzęcio *et al.*, 2003; Przybylski *et al.*, 2005; Jaworska *et al.*, 2006, 2007]. The cooking yield obtained in this study (average 73%) was satisfactory. It should be pointed out that meat samples with intramuscular fat content above 2% and with higher pH_{24} showed a higher cooking yield than the meat samples with IMF below 2% and low pH_{24} value. This relationship was also indicated by Jaworska *et al.* [2007], although cooking yield obtained by these authors was slightly higher (74.2–76.6% in relation to the meatiness class) than the values observed in this study.

It should be noticed that the meat samples with a higher pH_{24} value and a higher IMF content were also characterised by a lower drip loss. These observations are in agreement with findings of Czarniecka-Skubina *et al.* [2006] and Przybylski *et al.* [2007a]. As indicated by Monin & Sellier [1985] and Krzęcio *et al*. [2003], meat with low ultimate pH was characterised by a higher drip loss. A significant effect of ultimate pH on drip loss and other meat quality traits was defined as the "Hampshire effect". The results obtained indicate a significant effect of IMF level in muscle tissue, as well as a degree of acidity of muscle tissue expressed by pH_{24} value, on the technological quality of pork meat. Fernandez *et al* [2002] confirmed that halothane gene influenced the kinetics changes of muscle *post mortem* and related meat quality traits. Many authors [Jossel *et al*, 2003; Lindahl *et al*., 2004] stated that RN^- genotype was related with the eating and technological value. It should be emphasized that in the reported study pigs was free from HAL and RN^- genes.

The sensory analysis of raw meat (Tables 2 and 3) indicates that an increase in IMF level was significantly correlated with an increase of meat marbling (r=0.48) which caused a significant decrease of meat acceptability (r=-0.37). The meat with high pH_{24} and a high IMF content was characterised by the highest overall sensory quality (Table 2).

It should be pointed out that in meat with low pH_{24} the significant influence of IMF on the sensory quality of meat after heat treatment was not observed. IMF affected significantly some sensory traits in the group showing pH_{24} values above

TABLE 1. Characteristics of slaughter value and technological quality of the meat samples from pigs with different levels of intramuscular fat content and pH_{24} values in *Longissimus* muscle.

Traits	pH subgroup	Group of fatteners: 1	2	3
		Average intramuscular fat level (%): 0 – 1	1.1 – 2	2.1 – 3
Number of animals	≤5.5	10	10	10
	>5.5	10	10	10
Protein content (%)	≤5.5	23.30±0.54	23.22±1.15	22.36±0.91
	>5.5	23.19±1.26	23.18±0.94	22.61±0.98
Fat content (%)	≤5.5	0.73±0.22[a]	1.31±0.25[b]	2.38±0.36[c]
	>5.5	0.52±0.19[a]	1.58±0.31[b]	2.45±0.28[c]
pH_1	≤5.5	6.38±0.18	6.31±0.31	6.28±0.27
	>5.5	6.36±0.27	6.40±0.19	6.49±0.20
pH_3	≤5.5	6.26±0.17[a]	6.06±0.22[b]	5.93±0.39[b]
	>5.5	6.31±0.31[a]	6.21±0.20[a]	6.23±0.16[a]
pH_{24}	≤5.5	5.44±0.04[a]	5.45±0.08[a]	5.44±0.08[a]
	>5.5	5.56±0.04[b]	5.67±0.07[b]	5.69±0.12[b]
Colour parameters in CIE Lab system L*	≤5.5	55.56±1.76	56.69±2.93	54.63±4.26
	>5.5	55.27±1.42	54.81±1.51	54.60±2.08
Colour parameters in CIE Lab system a*	≤5.5	15.30±1.20[a]	14.79±1.35[a]	11.18±5.34[b]
	>5.5	15.63±0.56[a]	14.49±1.05[a]	13.41±3.41[ab]
Colour parameters in CIE Lab system b*	≤5.5	6.15±0.88[a]	6.96±1.06[a]	8.81±2.84[c]
	>5.5	7.19±2.05[a]	5.47±1.88[b]	6.22±1.95[a]
Cooking yield (%)	≤5.5	71.12±1.29[a]	73.25±4.81[b]	73.80±2.91[b]
	>5.5	70.90±1.77[a]	74.15±3.76[b]	74.74±3.44[b]
Natural drip loss: 48 h (%)	≤5.5	5.88±1.68[a]	6.26±2.41[a]	4.44±2.22[a]
	>5.5	4.41±0.98[b]	4.04±1.63[b]	2.96±1.48[b]

a, b, c – significant differences $p<0.05$ (within row and within columns). Values without letters are not statistically significant.

5.5, whereas this was not the case in the group with pH_{24} >5.5 (Table 2). This observation suggests that both IMF content and pH_{24} should be taken into account in the selection of meat with satisfactory sensory quality. Another interesting result is that the meat sensory quality did not differ between groups 2 and 3. This fact could suggest that it is possible to select meat with IMF level between 1-2% which is more acceptable by consumers (Table 2).

The correlation coefficients obtained (Table 3) show that an increase of IMF content caused a significant increase of meat marbling (r=0.48) and simultaneously a significant decrease of its acceptability in consumers assessment (r=-0.37). Other authors [Fernandez *et al.*, 1999; Połom & Baryłko-Pikielna, 2004; Ressureccion, 2004; Fortin *et al.*, 2005; Czarniecka-Skubina *et al.*, 2007; Jaworska *et al.*, 2007] indicated higher consumer preferences for raw meat with light red colour, without visible marbling and without drip loss. Based on the correlation coefficients, a significant positive influence of IMF contents on tenderness (r=0.42), juiciness (r=0.33), meat flavour (r=0.48) and also overall quality (r=0.42) of cooked meat was observed in the study (Table 3).

Protective effects of fat content during heat treatment on juiciness and tenderness of meat are due to prevention of water evaporation, its penetration in the muscle tissue and are simultaneously related to a higher cooking yield. Statistically significant relationships were found between cooking yield and tenderness (r=0.44), juiciness (r=0.60), meat flavour (r=0.28) and overall quality (r=0.41) of cooked meat. Higher pH_{24} caused a significantly increase of juiciness (r=0.48), meat flavour (r=0.52) and overall quality (r=0.48), (Table 3).

According to Daszkiewicz *et al*. [2005], intramuscular fat content, which is responsible for marbling of meat and loosening the structure of connective tissue, is necessary to reach the desired sensory quality of meat. A level of 1.5% IMF was

TABLE 2. Sensory quality of the meat samples with different intramuscular fat content and pH_{24} value in *Longissimus* muscle.

Traits	pH subgroup	Group of fatteners		
		1	2	3
		Average intramuscular fat level (%)		
		0 – 1	1.1 – 2	2.1 – 3
Number of animals	≤5.5	10	10	10
	>5.5	10	10	10
Sensory evaluation of raw meat at the 96th hour after slaughter (0–10 c.u.)				
Hue of colour	≤5.5	6.06±1.16	6.04±1.28	6.25±0.52
	>5.5	6.53±1.81	5.88±1.00	5.61±1.91
Homogeneity of colour	≤5.5	6.21±1.66	6.47±1.21	6.76±0.47
	>5.5	6.65±1.51	6.74±0.95	5.21±1.09
Marbling	≤5.5	3.43±0.91	3.58±1.62	4.02±1.48
	>5.5	3.65±1.94	3.95±1.51	4.77±1.70
Acceptability	≤5.5	6.39±1.00	6.16±1.15	6.18±0.48
	>5.5	6.20±1.20	6.51±0.93	5.76±1.28
Sensory evaluation of cooked meat at the 96th hour after slaughter (0-10 c.u.)				
Odour	≤5.5	7.06±1.80	5.92±2.04	7.73±0.78
	>5.5	7.71±0.78	6.79±1.71	7.82±0.71
Hue of colour	≤5.5	8.00±0.62	7.32±1.13	7.59±0.93
	>5.5	8.00±0.97	7.86±0.96	8.29±0.76
Homogeneity of colour	≤5.5	7.72±0.63	6.89±1.42	7.95±0.73
	>5.5	8.00±0.64	7.55±0.85	8.32±0.60
Tenderness	≤5.5	6.47±1.22	6.58±0.78	6.77±1.48
	>5.5	6.63±1.74	7.33±0.82	7.61±1.34
Juiciness	≤5.5	4.97±1.37	4.91±1.14	5.58±1.74
	>5.5	5.36±1.28	6.54±0.85	6.17±1.76
Fat perceptibility	≤5.5	2.41±0.54	2.75±0.48	2.46±0.37
	>5.5	2.66±0.50	2.57±0.58	2.47±0.40
Meat flavour	≤5.5	6.62±0.70^{a}	6.39±0.85^{a}	6.99±0.91^{a}
	>5.5	6.77±0.52^{a}	7.27±0.54^{ab}	7.51±0.89^{b}
Overall quality	≤5.5	6.22±0.83^{a}	6.05±0.46^{a}	5.66±0.71^{a}
	>5.5	6.40±1.00^{a}	6.98±0.66^{b}	7.07±1.10^{b}

a, b, c – significant differences p<0.05, within row and within columns). Values without letters are not statistically significant.

TABLE 3. Simple correlation coefficients between traits of technological quality and sensory quality attributes of pork meat.

Variable	Correlation coefficients (n=60)										
	Raw meat			Cooked meat							
	Hue of colour	Marbling	Acceptability	Odour intensity	Hue of colour	Homogeneity of colour	Tenderness	Juiciness	Fat perceptibility	Flavour	Overall quality
Protein	0.04	-0.11	0.15	-0.34*	-0.32*	-0.23	-0.02	-0.03	0.32*	-0.10	-0.06
IMF	-0.08	0.48*	-0.37*	0.15	0.07	-0.01	0.42*	0.33*	-0.14	0.48*	0.42*
pH_1	-0.01	0.09	0.05	0.25	0.21	0.13	0.12	0.09	-0.08	0.29*	0.24
pH_3	0.08	0.05	0.07	0.19	0.21	0.19	0.23	0.19	-0.06	0.30*	0.24
pH_{24}	-0.36*	0.42*	-0.33*	0.28*	0.20	0.03	0.22	0.48*	-0.15	0.52*	0.48*
Colour L*	0.53*	-0.16	0.30*	-0.25	-0.05	0.03	0.01	-0.18	0.08	-0.26*	-0.19
Colour a*	-0.23	0.01	-0.18	0.03	-0.18	-0.04	-0.37*	-0.30*	-0.00	-0.34*	-0.41*
Colour b*	0.15	-0.07	-0.00	-0.50*	-0.27*	-0.18	0.00	-0.16	0.32*	-0.42*	-0.23
Cooking yield	-0.20	0.29*	-0.26*	-0.28*	-0.16	-0.17	0.44*	0.60*	0.28*	0.28*	0.41*
Drip loss	0.28*	-0.13	0.14	-0.42*	-0.42*	-0.24	-0.04	-0.24	0.27*	-0.37*	-0.33*

* – significant correlation p<0.05

TABLE 4. Results of canonical analysis determining a relationship between parameters of slaughter value and technological quality with sensory quality attributes of pork.

Traits		Canonical variable					
Explanatory variable		u 1	u 2	u 1	u 2	u 3	u 4
IMF	x 1	- 0.67	- 0.75	- 0.49	- 0.32	- 0.81	0.08
pH_{24}	x 2	- 0.99	0.11	- 0.85	- 0.42	- 0.07	- 0.31
Cooking yield	x 3	-------	------	- 0.14	- 0.91	0.01	0.39
Drip loss: 48 h	x 4	--------	-----	0.87	- 0.14	- 0.21	- 0.44
Explanation variable		v 1	v 2	v 1	v 2	v 3	v 4
Hue of colour of raw meat	y 1	0.39	- 0.36	0.36	0.23	- 0.32	0.05
Marbling of raw meat	y 2	- 0.61	- 0.51	- 0.38	- 0.41	- 0.59	- 0.20
Acceptability of raw meat	y 3	0.46	0.30	0.30	0.37	0.34	0.05
Odour of cooked meat	y 4	- 0.36	0.01	- 0.59	0.49	- 0.13	- 0.06
Hue of colour of cooked meat	y 5	- 0.28	0.08	- 0.53	0.37	0.05	0.41
Homogeneity of colour of cooked meat	y 6	- 0.09	- 0.03	- 0.32	0.39	- 0.03	0.47
Tenderness of cooked meat	y 7	- 0.30	- 0.39	- 0.01	- 0.63	- 0.34	0.12
Juiciness of cooked meat	y 8	- 0.59	- 0.03	- 0.31	- 0.82	0.01	0.16
Fat perceptibility in cooked meat	y 9	0.20	0.18	0.45	- 0.57	0.28	- 0.13
Meat flavour of cooked meat	y 10	- 0.63	- 0.35	- 0.61	- 0.17	- 0.38	0.35
Overall quality of cooked meat	y 11	- 0.57	- 0.17	- 0.37	- 0.56	- 0.18	0.07
Canonical correlation coefficient C_R		0.77**		0.82**			
Determination coefficient C_R^2		0.59		0.68			

** – coefficient significant at p≤0.01. Table presents canonical factoring loads which explain a relationship between canonical variable and individual traits; u 1, u 2, u 3, u 4, v 1, v 2, v 3, v 4 – canonical variable.

found to be the minimum level necessary to ensure a pleasure of eating [Fortin *et al*., 2005]. In the research of Przybylski *et al.* [2007a], the level of 2-3% of IMF content was associated with the highest sensory quality after heat treatment. According to Ngapo *et al*. [2007a], consumers in Europe showed a strong preference for non-marbled pork, they preferred light red meat with lean fat cover, no marbling and no drip. Consumers expressed a higher degree of purchase intent for leaner pork but found more highly marbled pork to be more tender, juicy and flavorful, which appears to indicate a disparity between purchase intent based on visual evaluation and that based on sensory evaluation of the cooked product [Brewer *et* *al*., 2001]. The level of 1-2% of IMF in pork meat is not visible during purchase (lean meat without marbling) but simultaneously the sensory quality of such meat after heat treatment is satisfactory and could meet the consumers' demands.

According to Fortin *et al*. [2005] and Połom & Baryłko-Pikielna [2005], an increase of the overall quality of cooked meat is mostly dependent on the tenderness and juiciness of meat, while intensity of negative notes of odour, sour flavour and off-flavour, as well as hardness and fibrousness decrease the sensory quality. In the study of Jaworska *et al*. [2007], a positive influence was reported for high intramuscular fat content and high pH value of meat on tenderness, juiciness and meat flavour. Also Czarniecka-Skubina *et al*. [2007] confirmed better technological value and culinary usability of meat with a higher level of intramuscular fat in comparison to lean meat. Moreover, the results obtained indicate that cooked meat with a lower drip loss after 48 h *post mortem* was characterised by better meat flavour and overall quality (r=-0.37 and r=-0.33, respectively), (Table 3).

The influence of pH_{24} value and intramuscular fat content on the sensory quality of cooked meat was studied using canonical analysis. On the basis of the results obtained (Table 4), the determination coefficient was calculated. It was shown that the sensory quality of meat was determined, for 59% of its variability, by intramuscular fat content and pH_{24} *post mortem* (Table 4).

The analysis of canonical loads describing the degree of relationship between the starting variable (characterising technological and sensory quality of meat) and the canonical variable indicated that pH_{24} had the strongest effect on juiciness, meat flavour and overall quality of cooked meat. Intramuscular fat level was related to tenderness and meat flavour of cooked meat samples. Cooking yield was strongly related to tenderness and juiciness, whereas drip loss was strongly related to juiciness and meat flavour (Table 4). Additionally, cooking yield and drip loss were added to the set of explanatory variables and it was found that 67% of the sensory quality of cooked meat was determined by these four indicators. According to Przybylski *et al*. [2007b], the sensory quality of meat is in the highest degree determined by slaughter value (meatiness) and parameters of technological value (pH, colour parameters, water holding capacity, cooking yield, drip loss). As indicated by Czarniecka-Skubina *et al*. [2006], changes in pH of pork meat after slaughter in 52% influenced the drip loss.

The results obtained indicate that, based on the above-mentioned traits of meat, it could be possible to select meat of proper quality at the meat processing plant stage. The proper sensory quality means satisfactory acceptability at shops and markets and proper eating quality (juiciness, tenderness and meat flavour after heat treatment). These results can be useful for the selection of culinary meat, but the value of pH and intramuscular fat content should be taken into consideration as well.

CONCLUSIONS

1. Significant simultaneous effects of pH_{24} and intramuscular fat content on technological (cooking yield, drip loss) and sensory quality of meat (meat flavour, overall quality) were confirmed.

2. In meat with low pH_{24} (acid), IMF did not influence meat flavour nor overall sensory quality.

3. In meat with higher pH_{24} (above 5.50), an increase of intramuscular fat content resulted in the improvement of the sensory quality (tenderness, juiciness, meat flavour and overall quality) after cooking. The samples with a higher intramuscular fat content were also characterised by a lower drip loss and a higher cooking yield.

4. Canonical analysis showed that 59% of the sensory quality was determined by intramuscular fat level and pH_{24} *post mortem*. Taking into consideration cooking yield and drip loss in the explanatory variable set, the determination coefficient increased to 90%.

5. The results obtained indicate that, based on pH_{24} and intramuscular fat content, it could be possible to select meat of proper culinary quality at the meat processing factory stage, which should be characterised by a low drip loss, a higher cooking yield and good overall sensory quality.

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