DANUTA JAWORSKA, WIESŁAW PRZYBYLSKI

THE EFFECT OF SELECTED FACTORS ON SENSORY QUALITY OF PORK

S u m m a r y

This manuscript presents results of authors` research regarding selected factors influencing sensory pork quality. In the manuscript the role of breed, genes (RYR1[T], RN[-], CAST), slaughter weight as well as meatiness is comprised. Additionally, the role of intramuscular fat, ultimate pH and heat treatment on pork quality is discussed. It was stated that the optimization of the sensory aspects of the pork quality should not be limited to one aspect only but it should include the practical use of a number of dependent determinants. Obtaining high eating quality depends also on the quality of the raw material and the way of thermal processes (temperature, time, method of thermal process).

Key words: pork, sensory quality, determinants

Introduction

According to the data concerning meat consumption in Europe, pork is the dominant kind of meat and half of the amount is purchased by consumers as a culinary meat and then processed in households. Therefore it is essential to produce the high quality fresh meat which complies with the consumers` requirements. Intensification of meat production could cause the decrease of pork quality because of using breeds with high lean meat content in crossbreeding [14]. Pork quality is a complex property, which is influenced by multiple factors interacting with each other. The factors include breed, genotype, feeding, pre-slaughter handling, stunning, and slaughter method, chilling as well as meat aging [33].

The pork industry faces the dilemma of producing meat with a minimal amount of visible fat in order to take into consideration the consumers` health [29]. However, at

Dr inż. D. Jaworska, prof. dr hab. W. Przybylski, Katedra Technologii Gastronomicznej i Higieny Żywności, Wydz. Nauk o Żywieniu Człowieka i Konsumpcji, Szkoła Główna Gospodarstwa Wiejskiego w Warszawie, ul. Nowoursynowska 159 C, 02-766 Warszawa. Kontakt: danuta_jaworska@sggw.pl

the same time, sufficient intramuscular fat – IMF (fat located throughout skeletal muscle and responsible for the marbling) should be guaranteed so as to meet consumer expectation as for eating quality. Special attention should be paid to attributes such as tenderness and flavour [13, 49], which are connected with the amount of fat in meat [47]. In case of raw meat the share of different tissues is important and the most significant features of visual quality are colour (tone and its homogeneity), visible fat amount and drip loss [34] whereas in case of processed meat such features as water holding capacity, emulsifying capacity, ability to protein gellification, flavour and texture determine the quality [20, 43]. Meat features are strongly related to *post mortem* changes which depend indirectly on its glicolytic potential and level and degradation tempo in the glycolysis process. The ultimate pH has a great impact on numerous meat attributes such as juiciness, tenderness and water holding capacity (WHC) [15]. The aim of the review was to present and discuss results of authors` research regarding selected factors influencing sensory quality of pork.

Genetic factors

Breed

Proper breed selection is a very important part of pork production in relation to economics. Depending on the demanded proportions of the two major components of the carcass - meat and fat. Palka et al. [31] stated that the breed selection is connected with aspects such as ratio and diameter of muscle fibers, the content of intramuscular fat and the ability of water absorption, which is related to the quality traits such as palatability, juiciness and tenderness. The examples of a popular breeds in Poland are Large White and Polish Landrace. Pigs of both races provide good quality meat. Carcasses are well-muscled. Breed Złotnicka and Puławska are the examples of types with higher level of fat [37]. Another example is the Pietrain, which as a pure-breed, is rarely slaughtered due to inappropriate meat qualities - susceptibility to stress associated with the presence of the halotate gene (RYR_1^T), significant acidification and consequences in unfavorable colour and high drip loss. However, there are also some advantages – this breed has not the biggest daily gains but it achieves the highest meat percentage in the carcass and the largest dorsi muscle [33]. The comparison of sensory quality of meat from the Neckar and P76 lines indicates a higher quality of meat from Neckar line, which is characterized by significantly higher tenderness and juiciness and higher intensity of positive flavour attributes in the tested samples (Fig. 1). The result was probably associated with significantly higher levels of marbling in comparison with meat coming from P76 line. Numerous studies have confirmed a significant and positive impact of the increased marbling on sensory attributes such as tenderness, juiciness and flavour [11, 13, 19, 20].
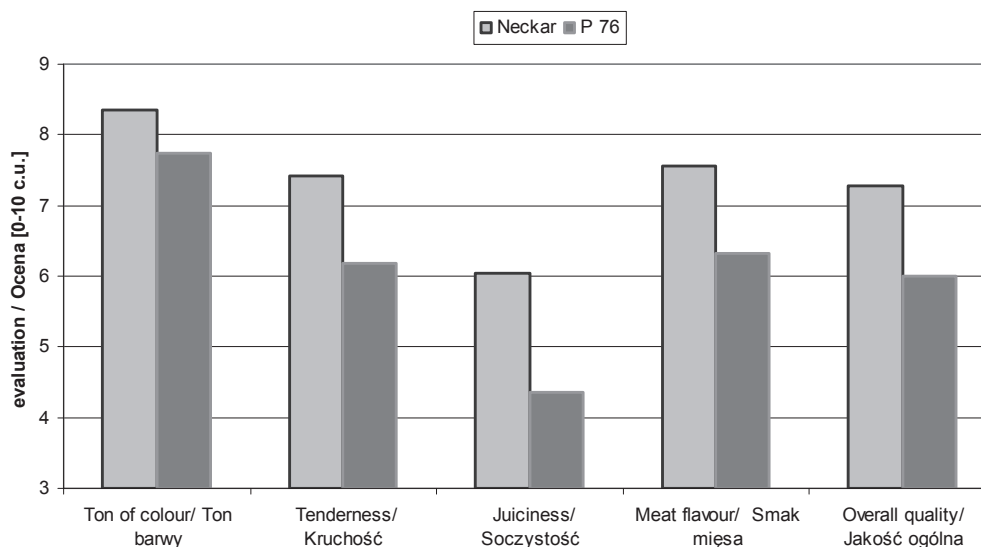
Fig. 1.   Sensory pork quality of two different genetic lines- prepared on the basis of [21].
Rys. 1.   Jakość sensoryczna mięsa tuczników dwóch linii genetycznych - opracowano na podstawie [21].

Many reports present the meat from Duroc pigs in a favorable light. In a study comparing 10 breeds, Duroc had high scores for texture, juiciness, and flavor and the highest scores for overall liking [46]. Other studies have found that compared to Landrace and Large White pork from Duroc pigs is also more palatable [48]. The occurrence of differences in meat quality among breeds could be explained by differences in pork characteristics, particularly in the high IMF content [48].

Genes

The genetic influence on pork quality comprises differences among breeds as well as differences among animals within the same breed. These differences can be caused by a large number of genes triggering small effects, known as polygenic effects, and in principle most traits of interest for pork quality have a multifactorial background [2]. However, pork quality attributes can also be associated with large monogenic effects. A gene can be considered a major one, when the difference between the mean value of the individuals homozygous for the gene and that of individuals not carrying this gene is equal to or greater than one phenotypic standard deviation of the trait of interest [39]. The proper selection of breeds is mainly determined by carcass structure, proportions and diameter of the fibers in the muscles, intramuscular fat, the degree of acidification of muscle tissue and losses in thermal processes. These features depend on the breed and influence of main genes which adversely affect meat quality, causing the occurrence of defective meat [39].

Most evidence points to the calpains as the main proteomes involved in *post-mortem* tenderization [9]. Although their precise actions remain uncertain it is thought that calpains act by degrading strategical and structural proteins of the cytoskeletal network such as titin, nebulin and desmin. The rate of calpastatin degradation and inactivation is related to the rate of proteolysis and tenderization observed in meat and affects meat quality in a direct way. However, the exact factors or sets of conditions that regulate the degradation of calpastatin by calpain are not known [16].

The results of presented study regarding the impact of gene calpastatyne (CAST/RsaI) on the pork quality show that the gene calpastatin (CAST/RsaI) affected the eating quality. Pork obtained from variants of polymorphic gene CAST: CC, CD and DD differed in tenderness (Fig. 2).
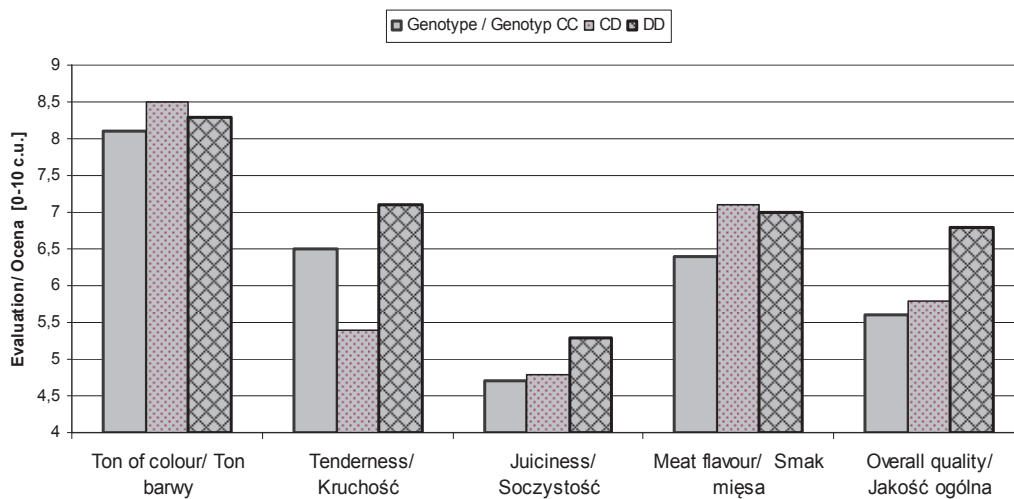

Fig. 2. Effect of polymorphic calpastatin gene CAST variants: CC, CD and DD on pork quality (unpublished data).

Rys. 2. Wpływ wariantów genetycznych CC, CD, DD genu kalpastatyny na jakość wieprzowiny (dane niepublikowane).

The main defect decreasing the sensory meat quality is PSE (pale, soft, exudative). This defect is related to gene RYR_1^T responsible for higher susceptibility to stress. It occurs most commonly in meat breeds and their meat is affected by low pH in the initial period of *post-mortem* changes and 24 hours after slaughter.

The biggest problem for the sensory quality of PSE meat is significant liquid loss during heat treatment and unfavorable light color [35]. It should be noted that the problem of excessive drip loss also applies to the type of ASE meat (acid, soft, exudative) as well as RSE (reddish, soft, exudative). Glycolytic metabolism in ASE meat is slower

than in the PSE type, however, it also leads to the bright colour composition and soft consistency with the excessive drip loss [25].

Acid meat after cooking is characterized by the lowest level of juiciness, marbling and palatability. RSE meat is also watery, but its colour is not changed as much as in case of ASE or PSE meat. Faulty ASE meat connected with gene RN⁻ has a low level of juiciness and palatability. DFD meat (dark, firm, dry) rarely occurs as far as pork is concerned, but its appearance always disqualifies the meat as the culinary one [25].

DFD meat also has a very high susceptibility to changes determined microbiologically; a significant relationship between pH_{48} after 12 days of storage and the total number of bacteria (r = 0.74) in the study of [22] was demonstrated.

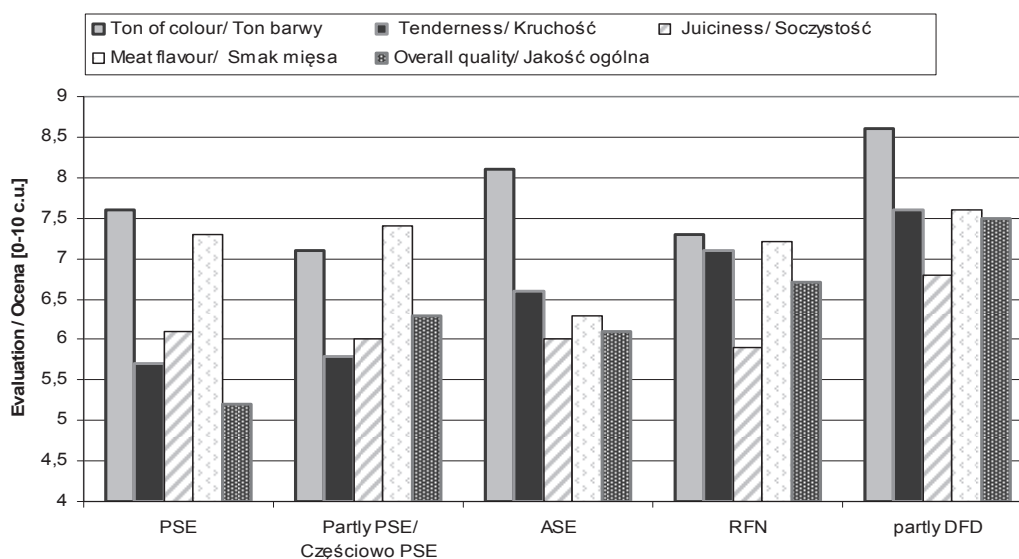Different characteristics of faulty meat quality is presented in Fig. 3.

Fig. 3.   Characteristic of pork characterized by different quality - prepared on the basis of [34].
Rys. 3.   Charakterystyka mięsa wieprzowego różnej jakości - opracowano na podstawie [34].

The DFD raw meat was the least acceptable before heating but after heat treatment it was evaluated as tender and juicy. PSE meat was characterized by the lowest quality due to the lowest tenderness and juiciness. However, heat-treated meat of the RFN and partially DFD type was characterized by favorable values of sensory quality. ASE meat was characterized by high intensity of colour, low intensity of meat flavour, low juiciness and tenderness (Fig. 4). Another study [50] also confirms a lower technological quality of PSE and acid meat. The muscle protein profile showed significantly higher quantity of μ-calpain in PSE and acid meat compared to normal meat. Additionally, lower quantity of polypeptides with molecular sizes 31 and 29 kDa, which were

products of CK (creatinine kinaze) degradation, was observed in faulty meat. The lower quantity of myofibrillar proteins (myosin LC1, TnT, and TnC) in meat with higher glycogen levels and lower pH showed higher rates of proteolysis.

Meatiness

In accordance with the requirements of the market, in recent years (2005 - 2011), the average meatiness of carcass has increased (from 52.5 to 55.0 %) [38]. Nowadays breeding is focused on meatiness increase and fat tissue decrease, which resulted in many cases in IMF reduction [26, 45]. Greater efficiency in meat has increased the efficiency of the most valuable elements of lean meat, which are most preferred by consumers. The rate of weight gain has a direct impact on reducing the period of fattening pigs. Muscle growth is dependent on the rate of deposition of protein and fat, which is determined by genotype and environmental factors. Increasing slaughter weight of pigs results in a more intense color of meat, higher intramuscular fat content, lower drip loss. However, production of heavier carcasses is required for numerous meat products, such as raw sausages, fermented hams or the products intended for the Japanese market, where marbled meat is more preferable.

In the study of [40] it was stated that meat obtained from the carcasses classified into class S (according to EUROP) characterized by lower IMF in comparison to class U. However, in the content of dry matter, total protein and ash in meat coming from the carcasses classified into S, E and U. Meat from the carcasses classified into class S was characterized by a significantly higher drip loss than the one from the carcasses classified into class E but no significant differences were observed between mean values of pH_{24} and pH_{48}, WHC, thermal drip, water-soluble protein content and meat colour parameters. There was a significantly higher frequency in occurrence of PSE and partly PSE meat in carcasses qualified for the class S [40]. Other authors [12] indicated that meat obtained from carcasses of class S and E did not differ in colour and technological value, also sensory attributes were not different. They claimed that meat obtained from carcasses with meatiness above 60 % characterized higher frequency of PSE occurrence. The value of culinary meat depends to a great extent on the decrease of intramuscular fat, which is responsible for sensory quality formation especially tenderness, juiciness sensation as well as meat palatability. Meat from class U was characterized by lower visual quality of raw meat in comparison to the class S (although the difference was not statistically significant). However, the quality of the meat after heat treatment of the U class was characterized by a significantly higher overall quality associated with a significantly higher tenderness and higher juiciness (Fig. 4).
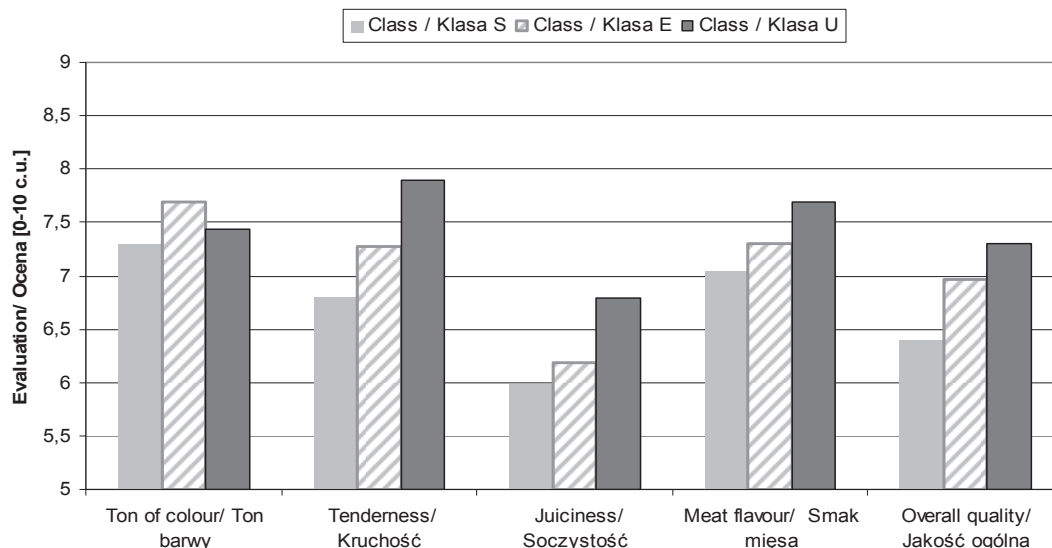
Fig. 4.   Sensory pork ork quality obtained from different meatiness classes - prepared on the basis of [18].

Rys. 4.   Jakość sensoryczna wieprzowiny z różnych klas mięsności - opracowano na podstawie [18].

Intramuscular fat

The amount of visible fat is the strongest visual discriminative stimulus determining the consumer' decision and therefore loin chops with a low or medium amount of marbling received higher acceptability [13]. The level of IMF is dependent on breed, MI^+ gene, meatiness, slaughter weight and also feeding of animals in the growing period [39]. The relationship between IMF and pork tenderness is controversial – some researchers report a positive relationship [11, 13], whereas others did not find it [14]. IMF in pork has been reported to positively influence juiciness, tenderness and flavour [4]. Presently improvement of pork quality by increasing IMF level in muscles is one of main breeders` purposes in European countries [39] as improvement of meatiness has caused decreasing its sensory quality. The results presented in this paper indicated that the level of IMF has a significant effect on sensory acceptance in visual quality and eating quality (Fig. 5).

The acceptability of pork at the purchase stage was significantly higher if the level of IMF was below 2.0 %, whereas tenderness, juiciness, meat flavour and overall quality in cooked meat were higher if IMF was above 2.0 %. According to [44] recommended IMF contents for acceptable palatability in pork range from 2 % to 4 %, other researchers [4, 8] suggest that acceptable pork eating quality requires a minimum IMF of 2.5 % to 3.0 %. Higher values are associated with a risk of pork rejection by

consumers. The minimum level of 1.5 % IMF was found as necessary to ensure a pleasing eating experience [13].
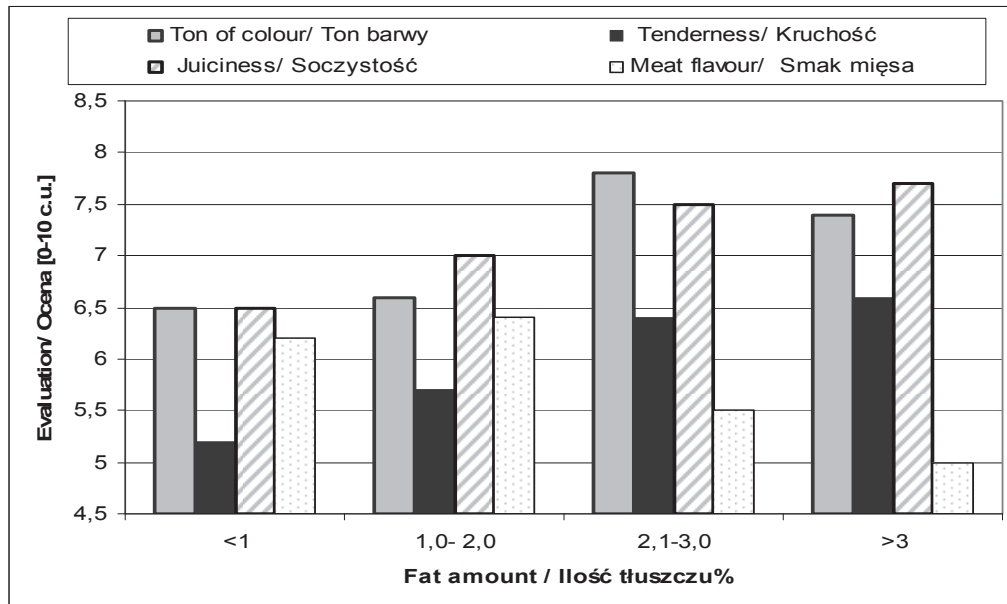

Fig. 5.   Sensory pork characteristic in relation to different IMF level - prepared on the basis of [5].
Rys. 5.   Jakość sensoryczna wieprzowiny o różnym poziomie tłuszczu śródmięśniowego – opracowano na podstawie [5].

pH value

     To monitor changes in muscle tissue after slaughter, a good indicator is the measurement of pH. The pH of the meat measured after slaughter enables to follow all changes in the muscle tissue after slaughter and diagnose any defects. Additionally, pH is one of the main determinants of the sensory meat quality. Achieving an appropriate pH value of slaughtered meat ensures proper water absorption, the formation of favorable colour, tenderness and flavour [17, 20]. According to [26], pH is the most important parameter which determines the sensory quality and technological value of meat. As it was mentioned by many authors [5, 11, 36] the technological traits are characterized by adequate technological value (described by pH, WHC, technological yield, drip loss), as well as appropriate sensory quality- light red colour, with a little fat cover, without visible marbling and a low level of drip loss [4, 21]. These authors indicated that a high intramuscular fat content, a high level of pH after slaughter and minimum losses during heat treatment result in appropriate tenderness, juiciness and flavour.

In order to guarantee a high sensory quality culinary meat should have pH_{24} and pH_{48} in the range >5.50 to 5.80 [36].

The relationship between pH value and sensory quality is presented on Fig. 6.
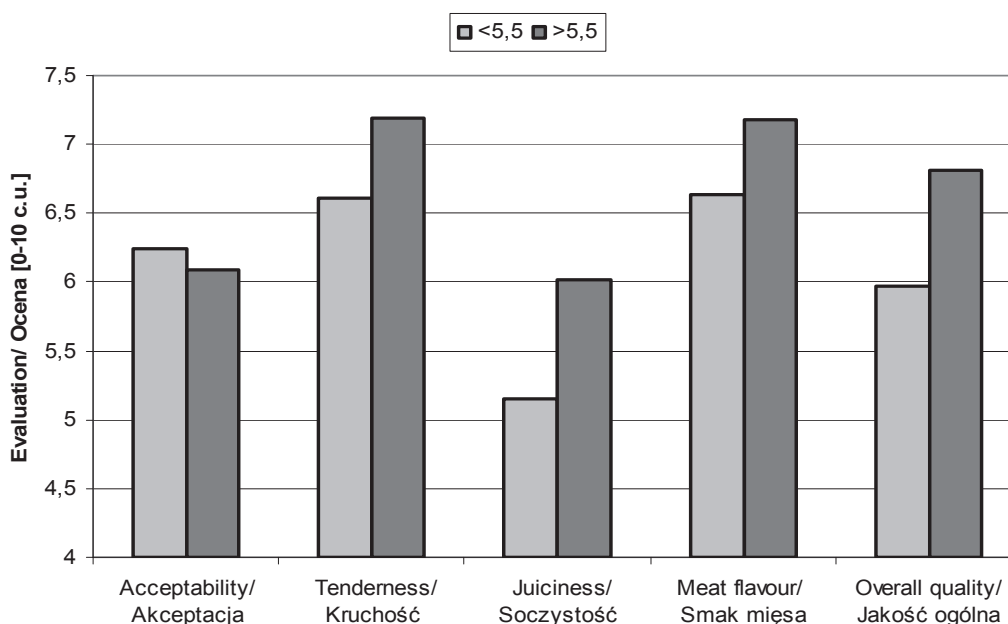

Fig. 6.   Sensory pork characteristic characterized by different ultimate pH level (unpublished data).
Rys. 6.   Jakość sensoryczna wieprzowiny o różnym poziomie pH końcowego (dane niepublikowane).

In Fig. 6 the meat quality with pH value below 5.5 was characterized by lower tenderness, juiciness and flavor in comparison to meat where the ultimate pH was higher than in case of pH above 5.5.

The other authors [30] claimed that the ultimate pH is a meat characteristic difficult to control with precision. However, contradictory findings in juiciness and tenderness results, also need to be clarified.

Processed meat – eating quality

It is well known that different cooking methods, core temperatures and types of muscle result in different eating qualities of pork. Physicochemical processes that occur in the meat tissue during heating cause significant changes and influence texture, colour, flavour and the final properties of the heated meat. The method of heating has an important effect on the eating quality of meat. Meat is heated using different media for heat transfer, such as dry heat methods (roasting, broiling or pan frying), moist

heating methods (boiling or braising) or microwave cooking. The heating method should be chosen to be appropriate for the type of meat (the amount of connective tissue, size). The temperature gradient influences the rate and extent of the changes of protein structure in the meat, whereas the method of heat transfer influences the odour, flavour and colour. **Colour** is influenced by heat treatment and endpoint temperature. Increase of endpoint temperature will increase the brown colour on the surface. Dry heat methods, especially pan-frying, influence the surface colour: a brownish colour is achieved. **Flavour** is a combination of taste and aroma. Flavour comprises a combination of nonvolatile and volatile compounds. Flavour is generated from reactions of various flavour precursors, including reducing monosaccharides and inosine monophosphate (IMP), during heating. Several odours and flavours are produced through the heat-induced changes in amino acids, carbohydrates and fat. Dry heat methods, especially pan-frying, increase the amount of Maillard reaction, and moist heat methods prevent the reactions from taking place [27]. In addition to the Maillard reaction, lipid degradation products are responsible for developing meat flavour during heating. In study of [49] it is showed that pork flavour increased as the core temperature increased from 65 to 80 °C while both juiciness and tenderness decreased. Texture consists of many features out of which the most important ones are tenderness and juiciness. The effect of core temperature on **tenderness** depends on the pork cut (content of meat and connective tissue). In selecting the optimal core temperature, special attention must be paid to the muscle and the cooking method. Generally the tenderness decreases when the core temperature increases from 65 to 75 °C. Heating at low temperatures in an oven increases the overall tenderness of the meat compared with the use of medium and high oven temperatures [3].

The effect of core temperature on **juiciness** depends more on the cooking method than on the amount of connective tissue in the meat. The cooking loss is generally larger when roasting compared to pan-frying because of the longer cooking time. Increasing the oven temperature results in less juicy meat at the same core temperature. At 65 °C core temperature there is no difference between roasting and frying. With increasing core temperature, the decrease in juiciness is faster when the meat is prepared in an oven compared with frying, irrespectively of the portion size [1, 3].

In general, optimal tenderness and juiciness and minimum cooking loss in meat are achieved when it is heated from low to moderate temperatures.

The characteristic of two roasted pork samples up to different end temperatures is presented on Fig. 7. The roasted meat up to 80 °C is characterized by higher intensity of odour and flavour meat notes in comparison to sample roasted to lower temperature. With increasing core temperature, the decrease in juiciness was observed. The differences in tenderness were not significant.
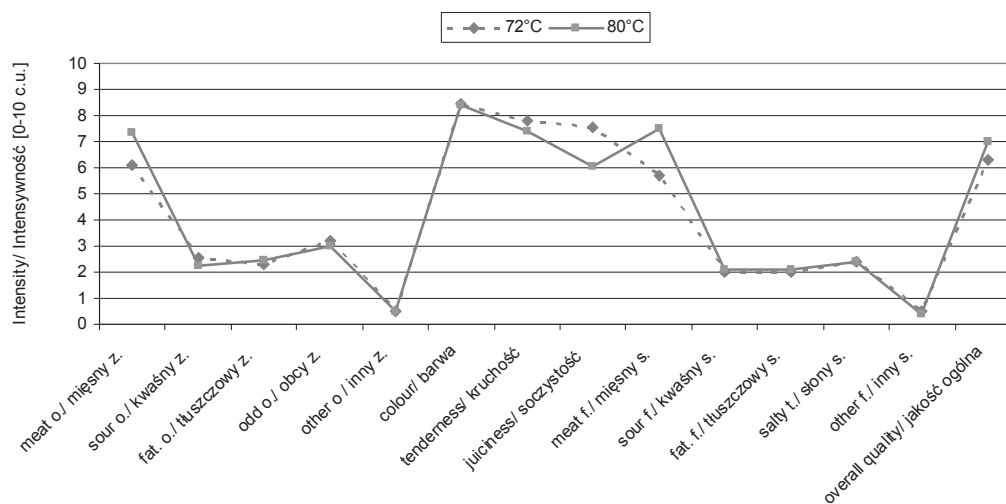
Fig. 7.   Sensory pork quality of roasted samples; o. – odour, f. – flavour, t. – taste (unpublished data).
Rys. 7.   Jakość sensoryczna pieczonej wieprzowiny; z. – zapach, s. – smak (dane niepublikowane).

On the one hand thermal changes affect loss ps in solubility due to aggregation of the myofibrillar proteins, and on the other hand lead to an increase in solubility as a result of the degradation of tertiary protein structures of intramuscular collagen. Further effects of heating are gel formation in most meat products, hydrolytic changes, alteration in the rate of proteolysis, and modification of the nutritive value. As the endpoint temperature increases, there is a significant reduction in fibre diameter. As the heating temperature is raised, the sarcomere length decreases. There is a high negative correlation between changes in cooking losses and sarcomere length during heating of meat [32]. Oxidative processes are known to be the major cause of meat quality deterioration, affecting nutritional composition [7]. The Maillard reaction is important to obtain a browning surface of meat during frying and roasting. Yet it also induces the formation of several carcinogenic heterocyclic amines. High heated proteins could also cause aggregation which has an influence on protein digestion and their nutritional value [41, 42].

However, for experimental purposes, the method must be standardized, strictly controlled and must not overshadow the treatment effects [32].

Final remarks

Different genes can affect the appearance of defective meat. It occurs most commonly in animals of special breeds or genotype and its meat affected by low pH in the initial period of *post-mortem* changes and 24 hours after slaughter. It is claimed that

pH_{24} and pH_{48} ranging from 5.50 to 5.80 and the carcass meatiness in the range of 55 - 58 % is related to higher eating quality. The IMF level of 2 - 3 % guarantees higher juiciness and tenderness. Numerous studies indicate that several aspects of the thermal processes of raw material (temperature, time, method of thermal process) have a critical influence on the eating quality of pork. However, the optimization of sensory pork quality should be considered as a complex issue as is determined by a set of connected factors depending on unstable consumers` expectation. Factors to be considered depend on the end use of the meat and the way meat is heat treated.

References

[1] Aaslyng M.D., Bejerholm C., Ertbjerg P., Bertram H.C., Andersen. H.J.: Cooking los and juiciness of pork in relation to raw meat quality and cooking procedure. Food Qual. Prefer.*,* 2003. **14**, 277-288.

[2] Andersson L.: Genetic dissection of phenotypic diversity in farm animals. Nat. Rev. Genet. 2001, **2**, 130-138.

[3] Bejerholm C., Aaslyng M.D.: Cooking of meat. In: Jensen W.K., Devine C., Dikeman M.: Encyclopedia of Meat Sciences, Elsevier LTD, Oxford, UK, 2004.

[4] Channon H.A., Kerr M.G., Walker P.J.: Effect of Duroc content, sex and ageing period on meat and eating quality attributes of pork loin. Meat Sci., 04, **66**, 1- 88.

[5] Czarniecka-Skubina E., Przybylski W., Jaworska D., Wachowicz I., Urbańska I., Niemyjski S.: Charakterystyka jakości mięsa wieprzowego o zróżnicowanej zawartości tłuszczu śródmięśniowego. Żywność. Nauka. Technologia, Jakość, 2007, **6 (55),** 285-294.

[6] D'Souza D.N., Mullan B.P.: The effect of genotype, sex and management strategy on the eating quality of pork. Meat Sci., 2002, **60**, 95-101.

[7] Dikeman M., Devine C.: Sensory and Meat Quality. Optimization of Sensory Assessment of Men. In: Jensen W.K., Devine C., Dikeman M.: Encyclopedia of Meat Sciences, Elsevier LTD, Oxford, UK, 2004.

[8] De Vries A.G., Faucitano L., Sosnicki A., Plastow G.S.: The use of gene technology for optimal development of pork meat quality. Food Chem., 2000, **69**, 397-405.

[9] Dransfield E.: Modelling post-mortem tenderization. Role of calpains and calpastation in conditioning. Meat Sci., 1993, **34**, 217-234.

[10] Ellis M., Lympany C., Haley C.S., Brown I., Warkup C.C.: The eating quality of pork from Meishan and Large White pigs and their reciprocal crosses. Animal Sci., 1995, **60**, 125-131.

[11] Fernandez X., Monin G., Talmant A., Mourot J., Lebret B.: Influence of intramuscular fat content on the quality of pig meat-2 – Consumer acceptability of m. *longissimus lumborum*. Meat Sci., 1999, **53, 1**, 67-72.

[12] Florowski T., Pisula A., Kamyczek M.: Ocena wpływu wysokiej mięsności na jakość mięsa świń wolnych od genu RYR1T, Med. Weter., 2007, **63, 3**, 326- 329.

[13] Fortin A., Robertson W.M., Tong A.K.W.: The eating quality of Canadian pork and its relationship with intramuscular fat. Meat Sci., 2005, **69**, 297-305.

[14] Goransson A., von Seth G., Tornberg E.: Influence of intramuscular fat on the eating quality of pork. In: Proceeding*s* 38th International Congress of Meat Science and Technology, 23-28 VIII, Clermont Ferrand, France, 1992, pp. 245-248.

[15] Hocquette J.F., Ortigues-Martya I., Pethickb D, Herpinc P., Fernandezd X.: Nutritional and hormonal regulation of energy metabolism in skeletal muscles of meat-producing animals, Livestock Prod. Sci., 1998, **56**, 115-143.

[16] Huff Lonergan E., Zhang W., Lonergan S.M.: Biochemistry of postmortem muscle – Lessons on mechanisms of meat tenderization. Meat Sci., 2010, **86**, 184-195.

[17] Huff-Lonergan E, Baas T.J., Malek M., Dekkers J.C.M., Prusa K., Rothschild M.F.: Correlations among selected pork quality traits. J. Anim. Sci., 2002, **80**, 617-62

[18] Jaworska D., Przybylski W., Czarniecka-Skubina E., Wachowicz I.: Jakość sensoryczna mięsa wieprzowego pochodzącego od tuczników o zróżnicowanej mięsności. Rocz. Inst. Przem. Mięs. Tłuszcz., 2007, **XLV**, 53-62.

[19] Jaworska D., Przybylski W., Kajak-Siemaszko K., Czarniecka-Skubina E.: Sensory quality of culinary pork meat in relation to slaughter and technological value. Food Sci. Technol. Res., 2009, **15 (1)**, 65-74.

[20] Jaworska D., Przybylski W., Kołożyn-Krajewska D., Czarniecka-Skubina E., Wachowicz I., Trząskowska M., Kajak K., Lech A., Niemyski S.: The assessment of relationships between characteristics determining technological and sensory quality of pork. Anim. Sci. Pap. Rep., 2006, **24 (2)**, 121- 135.

[21] Jaworska D., Przybylski W., Kajak-Siemaszko K., Olczak E., Skierka E., Niemyski S.: Evaluation of technological value and sensory quality of pork meat, originated from two paternal PenArLan lines. Roczn. Nauk. Pol. Tow. Zootech., 2009, **5, 3**, 105-113.

[22] Kajak-Siemaszko K., Przybylski W., Jaworska D., Rosiak E.: Charakterystyka jakości technologicznej, sensorycznej i trwałości mięsa wieprzowego o zróżnicowanej końcowej wartości pH. Żywność. Nauka. Technologia. Jakość, 2007, 1 **(50)**, 26-34.

[23] Kajak-Siemaszko K., Aubry L, Peyrin F., Bax M.L, Gatellier P., Astruc T., Przybylski W., Jaworska D., Gaillard-Martinie B., Santé-Lhoutellier V.: Characterization of protein aggregates following a heating and freezing process. Food Res. Int., 2011, **44**, 3160-3166.

[24] Karamucki T., Rybarczyk A., Jakubowska M., Gardzielewska J.: The slaughter value and meat quality traits of pork carcasses within a weight range of 70.1-80.0 and 80.1-90.0 kg depending on pork sex. Anim. Sci. Pap. Rep., 2006, **24 (2),** 137-150.

[25] Koćwin-Podsiadła M., Krzecio E., Przybylski W.: Pork quality and methods of its evaluation- a review. Pol. J. Food Nutr. Sci., 2006, **15/56**, 3, 241-248.

[26] Lonergan S.M., Stalder K.J., Huff-Lonergan E., Knight T.J., Goodwin R.N., Prusa K.J., Beitz D.C.: Influence of lipid content on pork sensory quality within pH classification. J. Anim. Sci., 2007, **85**, 1074-1079.

[27] Meinert L., Tikk K., Tikk M., Brockhoff P.B., Bejerholm C., Aaslyng M.D.: Flavour formation in pork semimembranosus: Combination of pan-temperature and raw meat quality Meat Sci., 2008, **80**, 249-258.

[28] Migdał W.: Wykastrować zapach? Magazyn Przem. Mięs., 2009, **11-12,** 44-46.

[29] Ngapo T.M., Martin J.F., Dransfield E.: International preferences for pork appearance: II. Factors influencing consumer choice. Food Qual. Pref., 2007, **18**, 139-158.

[30] Ngapo T.M., Gariépy C.: Factors affecting the eating quality of pork. Critic. Rev. Food Sci. Nutr., 2008, (**48) 7**, 599-633.

[31] Palka K., Migdał W., Wojtysiak D., Natonek-Wiśniewska M., Dudkiewicz A., Muzyczka K., Wantuch M., Bauerek E.: Wpływ rasy i wieku świń na właściwości modelowych farszów mięsnych i kiełbas. Żywność. Nauka. Technologia. Jakość, 2010, **1 (68)**, 80-92.

[32] Palka K.: Heat effects on meat. In: Jensen W.K., Devine C., Dikeman M.: Encyclopedia of Meat Sciences, Elsevier LTD, Oxford, UK, 2004.

[33] Pisula A., Pospiech E. (Red.): Mięso - podstawy nauki i technologii. Wyd. SGGW, Warszawa 2011.

[34] Połom A., Baryłko-Pikielna N.: Analiza czynników decydujących o preferencjach polskich konsumentów mięsa wieprzowego. Żywność. Nauka. Technologia. Jakość, 2004, **3 (40)**, 5-23.

[35] Przybylski W., Jaworska D., Boruszewska K., Borejko M., Podsiadły W.: Jakość technologiczna i sensoryczna wadliwego mięsa wieprzowego. Żywność. Nauka. Technologia. Jakość, 2012, 1 (**80)**, 116-127.

[36] Przybylski W., Jaworska D., Czarniecka-Skubina E., Kajak-Siemaszko K.: Ocena możliwości wyodrębniania mięsa kulinarnego o wysokiej jakości z uwzględnieniem mięsności tuczników, pomiaru barwy i pH z zastosowaniem analizy skupień. Żywność. Nauka. Technologia. Jakość, 2008, **4 (59),** 43-51.

[37] Przybylski W., Niemyjski S., Pospiech E., Rzosińska E., Czyżak-Runowska G.: Ocena przydatności wybranych grup genetycznych świń do produkcji ciężkich tuczników mięsnych. Rocz. Inst. Przem. Mięs. Tłuszcz., 2005, **42/43**, 7-16.

[38] Przybylski W.: Trzoda chlewna. W: Pisula A., Pospiech E. (Red.): Mięso-podstawy nauki i technologii. Wyd. SGGW, Warszawa 2011.

[39] Rosenvold K., Andersen H.J.: Factors of significance for pork quality – a review. Meat Sci., 2003, **64**, 219-237.

[40] Rybarczyk A., Kmieć M., Gardzielewska J., Karamucki T., Jakubowska M., Terman A., Polasik D.: Effect of carcass meatiness level on meat quality of pigs monomorphic at genes RYR1 AND LEP. Pol. J. Food Nutr. Sci., 2009, **59 (4)**. 325-328.

[41] Santé-Lhoutellier V., Aubry L., Gatellier P.: Effect of oxidation on in vitro digestibility of skeletal muscle myofibrillar proteins. J. Agric. Food Chem., 2007, **55 (13)**, 5343-5348.

[42] Traore S. Aubry L., Gatellier P., Przybylski W., Jaworska D., Kajak-Siemaszko K., Sante-Lhoutellier V.: Effect of heat treatment on protein oxidation in pig meat. Meat Sci., 2012, **91**, 14-21

[43] Troy D.J., Kerry J.P.: Consumer perception and the role of science in the meat industry. Meat Sci., 2010, **86**, 214-226.

[44] Verbeke W., van Oeckel M.J., Warnants N., Viaene J., Boucqué Ch.V.: Consumer perception, facts and possibilities to improve acceptability of health and sensory characteristics of pork. Meat Sci., 1999, **53**, 77-99.

[45] Wajda S., Daszkiewicz T., Borzuta K., Winarski R.: Jakość mięsa z tusz świń tuczników zakwalifikowanych do różnych klas w systemie EUROP. Rocz. Inst. Przem. Mięs. i Tłuszcz., 2005, **XLII (III)**, 73-77.

[46] Warriss P.D., Kestin S.C., Brown S N., Nute G.R.P: The quality of pork from traditional pig breeds. Meat Focus Int., May/June, 1996, pp. 179-182.

[47] Webb E.C., O'Neill H.A.: The animal fat paradox and meat quality. Meat Sci., 2008, **80**, 28-36.

[48] Wood J.D., Brown S.N., Nute G.R., Whittington F.M., Perry A.M., Johnson S.P., Enser M.: Effect of breed, feed level and conditioning time on the tenderness of pork. Meat Sci., 1996, **44**, 105-112.

[49] Wood J.D., Enser M., Fisher A.V., Nute G.R., Richardson R.I., Sheard P.R.: Manipulating meat quality and composition. Proc. Nutr. Soc., 1999, **58**, 363-370.

[50] Żelechowska E.**,** Przybylski W., Jaworska D., Santé-Lhoutellier V.: Technological and sensory pork quality in relation to muscle and drip loss protein profile. Eur. Food Res. Technol., 2012, **234 (5)**, 883-894.

WPŁYW WYBRANYCH CZYNNIKÓW WARUNKUJĄCYCH JAKOŚĆ SENSORYCZNĄ WIEPRZOWINY

S t r e s z c z e n i e

W pracy przedstawiono wybrane wyniki badań autorów pracy w zakresie wybranych czynników determinujących sensoryczną jakość wieprzowiny. Zamieszczono charakterystykę wpływu rasy, genów (RYR1T, RN- i CAST), masy tuszy, mięsności w odniesieniu do jakości sensorycznej mięsa. Omówiono wpływ zawartości tłuszczu śródmięśniowego, wartości pH, warunków obróbki cieplnej na jakość mięsa. Stwierdzono, że optymalizacja sensorycznych cech jakości mięsa nie powinna być traktowana jednokierunkowo, powinna obejmować praktyczne wykorzystanie szeregu wzajemnie powiązanych determinantów. Otrzymanie mięsa kulinarnego wysokiej jakości jest uzależnione także od jakości surowca oraz od sposobu prowadzenia procesów cieplnych (temperatura, czas, metoda).

Słowa kluczowe: wieprzowina, jakość sensoryczna, determinanty �