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TECHNOLOGICAL PROPERTIES OF WILD BOARS MEAT

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ABSTRACT

Investigations were performed on meat originating from 22 carcasses of wild boars ripening in temperature 4 - 6°C during 12 days. During ripening process determinations of selected technological proprieties have been conducted. During long period of ripening low pH value which affected small changes of water holding ability and thermal drip was observed. Investigating tenderness of meat an essential improvement between 1st and 6th day of ripening was found. To summarize obtained results it can be concluded , that in spite of long ripening of wild boars carcasses only slight changes of technological properties of meat were observed.

Key words: wild boar meat, chemical composition, meat tenderness, thermal drip, water holding capacity

INTRODUCTION

Wild boars have adapted oneself very well to changing conditions in the natural environment, result of what is constant population increase of these animals. Poland is one of the countries with the most numerous population of wild boars, where about 80 000 specimens per year on the average are gained during the last years [7, 31]. Considerable quantities of very valuable meat of wild boars with high taste value are obtained. Large supply of wild boars meat caused that they are more and more often used not only to culinary purposes, but also to production of delicacy products. Gaining irregularly spread in time causes that wild boars carcasses before processing are often kept in cooling conditions for a long period of time. It creates a need of technological proprieties recognition, changing during the storage period, going beyond current opinion about shelf life of this raw material.

Investigations relating chemical composition of wild boars meat were the most often undertaken up to the present [7, 20, 35, 16, 26, 25, 23, 34, 29, 28, 17]. Tissue composition of wild boars carcasses [14, 3, 21, 23, 34, 17], and fatty acids composition were also taken under consideration. However, there are little publications in literature relating to technological proprieties of wild boars meat. A lack of complex investigations describing their change during ripening is observed [20, 25, 32, 34, 29]. Furthermore, a comparison of data presented by different authors relating wild boars meat between oneself, as well as with data given for other kinds of meat is often made difficult considering usage of not uniform analytical methods.

AIM OF THE STUDY

In consideration of gaining considerable quantities of wild boars meat, and more and more frequent using it to culinary and processing purposes, the investigations in range of estimation of technological proprieties of this raw material were undertaken. The aim of investigations was to qualify changes of selected technological proprieties of wild boars meat during the process of ripening.

MATERIALS AND METHODS

22 wild boars carcasses with mass of about 25–60 kg were raw material for this study. Carcasses (together with skin) underwent ripening in temperature of 4-6°C. This process was carried on to occurrence of first, organoleptically ascertained symptoms of deterioration on carcass surface, meaning minimum 12 days.

Investigations on meat originating from the *longissinus dorsi* muscle and from ham have been done. Tests from mentioned muscles were collected during the process of ripening, after 6, 24, 144, 288 h post mortem.

Determinations of pH values, water holding capacity [36] and thermal drip [18] were carried out. Evaluation of meat tenderness were made after 24, 144 and 288 h, while water, protein, fat and ash contents [5] were estimated 24h post mortem . Measurement of pH value was executed immediately in muscle using dagger electrode with help of pH-meter type PHM 80a (Radiometer A/S Co, Copenhagen). Meat tenderness measurement was carried out with INSTRON type 4301 device with knife of Warner-Bratzler on meat samples baked before tests in temperature of 180°C (until meat reached 70°C in the centre of sample). During the cutting of samples the following parameters were accepted: push of the cap -1kN, speed of register paper tape – 50 mm/min. Obtained results were elaborated statistically calculating standard error of the mean value (SEM). The influence of meat kind and of ripening time on

results obtained was evaluated using method of one- or two-factor variance analysis (Test F). To compare object mean values the q SNK (Student-Newman-Keuls) test was used.

RESULTS

Muscles used for investigation of technological properties of wild boars meat it means: *longissimus dorsi* muscle and ham muscle were analysed to determine the basic chemical composition (Table 1). On the basis of results it can be concluded that both kinds of muscles shown similar participation of basic components. Considerable protein content equal to 21.80% in the *longissimus dorsi* muscle and 21.39% in ham is also worth to notice. Examined meat also contained large quantities of water, 74.25% and 73.89%, respectively. Moreover, low content of fatty components characterized both groups of muscles: 1.95% in the *longissimus dorsi* muscle and 2.76% in the ham. Low variability of examined components is an essential information. Fat content shown the highest variability. However, its quantity in the *longissimus dorsi* muscle as well as in the ham can be considered as very low. Presented estimation of basic components content in wild boars meat is not far from numerous information concerning this subject met in the literature, describing meat of these animals as rich in proteins and poor in fat [7, 20, 35, 15, 26, 25, 22, 34, 28, 29, 17]. Analysed samples makes a very equalised material, devoid of adipose tissue, offering a good basis for investigations of other meat properties.

As first, the pH value of meat was determined as a factor which immediately influences technological properties of meat. This value measured 6 h post mortem in the *longissimus dorsi* muscle was 5.57, while in ham - 5.59 (Table 2).

Table 1. Chemical composition of wild boars meat

	Water x ± SEM [%]	Protein x ± SEM [%]	Fat x ± SEM [%]	Mineral compounds x ± SEM [%]
Longissimus dorsi muscle	74.25 ± 0.09	21.80 ± 0.09	1.95 ± 0.07	1.01 ± 0.01
Ham muscles	73.89 ± 0.15	21.39 ± 0.15	2.76 ± 0.15	1.02 ± 0.01

Table 2. Changes of pH values during the ripening process in wild boars meat

Time [h]	6 x ± SEM	24 x ± SEM	144 x ± SEM	288 x ± SEM	F Test
Longissimus dorsi muscle	5.57 ± 0.03^{A}	5.44 ± 0.01^{B}	5.60 ± 0.03^{A}	5.77 ± 0.04^{C}	103.68**
Ham muscles	5.59 ± 0.03^{A}	5.47 ± 0.02^{A}	5.60 ± 0.02^{A}	5.74 ± 0.03^{B}	104.19**
Test F	0.25	1.73	0.13	0.28	

Different large letters , ** - difference at P ≤0.01
Different small letters, * - difference at P ≤0.05

After 24 h the pH reached the minimum value (5.44 and 5.47, respectively), but observed reduction of examined values between 6 and 24 h was not large (0.13 and 0.12 of unit), considerably smaller than in analogical elements of pig's carcass [13]. It was observed that minimum pH values were similar or a little lower than that obtained for wild boars meat by other authors [7, 27, 4, 20, 25, 32, 34, 30]. During the ripening process increase of pH value was observed, causing statistically significant change of pH after 144 h in the *longissimus dorsi* muscle, while in the ham muscle not before 288 h. Reported by some authors slow

increase of pH during ripening of game, including wild boars meat, is confirmed [7, 30]. Obtained final pH values are very low and unusual after so long ripening in pig muscles [1].

Changes of thermal drip were next examined (Table 3). It was ascertained, that in fresh meat in 6 hours after gaining from wild boars, this value was approximately 33.2% in the *longissimus dorsi* muscle and 32.3% in ham. Values of this parameter considerably fluctuate depending of examined specimen during the whole process of ripening. Differences between each wild boar carcass were greater than differences resulting from time of ripening. Large variability of obtained results did not permit to ascertain any statistically proved relationships with time of ripening nor with kind of muscle.

Table 3. Thermal drip changes of wild boars meat during the ripening process

Time [h]	6 x ± SEM [%]	24 x ± SEM [%]	144 x ± SEM [%]	288 x ± SEM [%]	Test F
Longissimus dorsi muscle	33.2 ± 1.28^{a}	34.4 ± 1.09^{a}	35.0 ± 0.77^{a}	34.4 ± 0.95^{a}	0.56
Ham muscles	32.3 ± 1.37^{a}	33.5 ± 1.10^{a}	34.7 ± 0.82^{a}	33.7 ± 1.00^{a}	0.74
Test F	0.19	0.39	0.08	0.28	

Different large letters, ** - difference at P ≤0.01
Different small letters, * - difference at P ≤0.05

The mean value of water holding capacity of examined meat after 6 hours was equal to 19.7% in the *longissimus dorsi* muscle and 21.2% in ham, also showing none significant changes during the ripening process (Table 4). Observing data concerning changes of both parameters mentioned above during ripening (Figure 1, 2), it can be concluded that they are not large. Examined meat does not possess good water binding and holding ability and long period of ripening does not significantly improve these features in consequence of low pH and protein structure resulting from this fact. Low water holding capacity and large drip during thermal treatment are confirmed by not very numerous accessible literature data. The water holding capacity of ham measured 48 hours post mortem was about 8,7% higher than obtained in the presented investigations and equal to 28,92% [32]. Instead, the value of drip during baking of meat was similar and equal to 30-40% [25, 20]. Wild boars meat lost 35-45% of mass after cooking [29, 20]. Only Townsend [34] noticed decidedly lower value (17,6%).

Table 4. Changes of water holding capacity of wild boars meat during the ripening process

Time [h]	6 x ± SEM [%]	24 x ± SEM [%]	144 x ± SEM [%]	288 x ± SEM [%]	Test F
Longissimus dorsi muscle	19.7 ± 0.77^{a}	18.9 ± 0.69^{a}	18.4 ± 0.96^{a}	19.9 ± 0.85^{a}	0.73
Ham muscles	21.2 ± 1.25^{a}	20.2 ± 1.05^{a}	20.2 ± 1.43^{a}	21.4 ± 1.18^{a}	0.26
Test F	1.04	1.10	1.12	0.96	

Different large letters, ** - difference at P ≤0.01
Different small letters, * - difference at P ≤0.05

Figure 1. Changes of water holding capacity of meat during ripening of wild boars carcasses

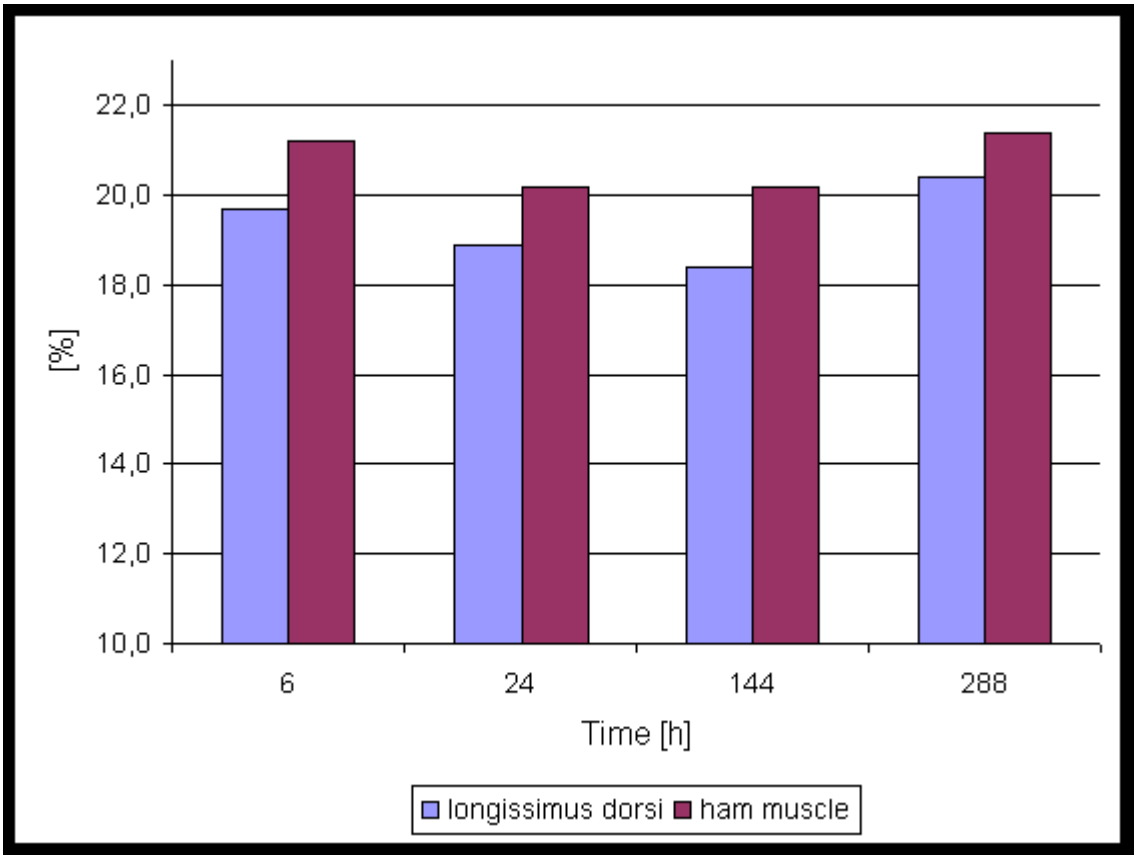
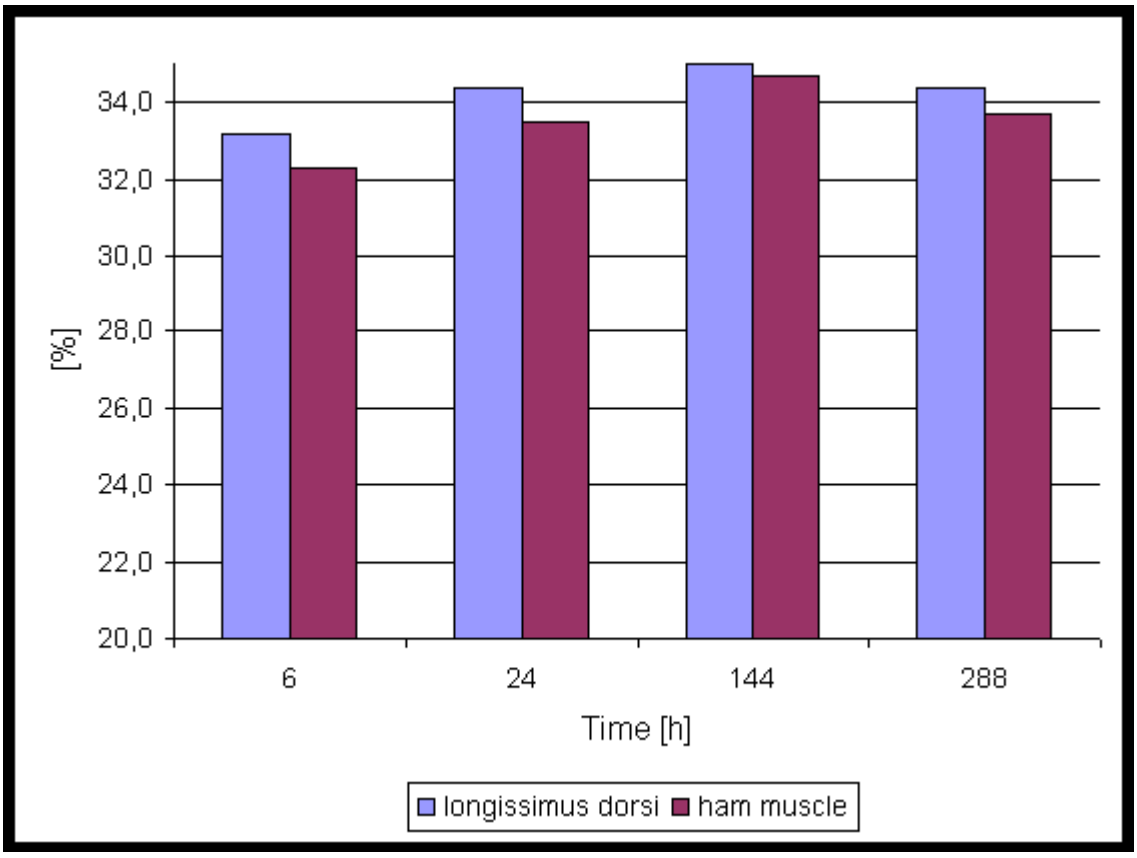


Figure 2. Changes of thermal drip of meat during ripening of wild boars carcasses



One of the most important parameters during technological evaluation of meat is its tenderness (Table 5). This feature has especially important meaning at estimation of meat value, intended for culinary purposes and this aim is also the main direction of game utilization. Investigations carried over estimation of wild boars meat tenderness shown, that shear force of baked meat after 24 h from gaining of animals carried out average 42.9N for the *longissimus dorsi* muscle and 48.7N for the ham. During next measurements, executed after 6 days of ripening, decrease in examined muscles about 7.3N and 6, 8N, respectively, was noticed what resulted in improvement of tenderness about 17% and 14%, respectively in relation to initial values. After next 6 days of ripening, the tenderness got better with next 8.6% and 8.3%, respectively. The shear force was 31.9N in the *longissimus dorsi* muscle and 37.8N in the ham. Comparing obtained values of shear forces one ascertained, that between 1st and 6th day of ripening, considerably greater improvement of tenderness was observed (highly significant differences) than between 6th and 12th day (lack of significant differences). It can result from total decay of *rigor mortis* between 1st and 6th day of meat ripening. Better tenderness of the *lomgissimus dorsi* muscle in comparison with the ham (after 1 day statistically significant differences were observed and after 6th and 12th days the differences were highly significant) was also noticed. Final difference between obtained values, equal to almost 6N, indicates better tenderness of the *longissimus dorsi* muscle about a dozen or so percent. Shear forces for samples of the same wild boar muscle examined by Rede et al. [25] was 11.4 lbs, while Townsend at al. [34] reported the value equal to 6.49kg/1.27cm. In case of semimembranous muscle, Mojto at al. [20] obtained values 5.39 and 5.88 examined after cooking and baking of meat samples, respectively. These results are only slightly higher than these obtained in the experiment presented above, what probably results from the fact, that meat examined by cited authors originated from older wild boars.

Table 5. Changes of shear force of wild boars meat during the ripening process

Time [h]	24 >x ± SEM [N]	144 x ± SEM [N]	288 x ± SEM [N]	Test F
Longissimus dorsi muscle	42.9 ± 1.19A	35.6 ± 1.21B	31.9 ± 1.28B	21.33**
Ham muscles	48.7 ± 1.82A	41.9 ± 1.52B	37.8 ± 1.63B	11.27**
Test F	7.13*	10.58**	8.10**	

Different large letters, ** - difference at P ≤0.01
Different small letters, * - difference at P ≤0.05

Improvement of meat tenderness shown after 12 days of ripening process, expressed as shear force value, equal to 22.4% in ham and 25.6% in the *longissimus dorsi* muscle, was not large taking under consideration so long period of ripening. Better tenderness of the latter is observed comparing obtained results with data relating pig's meat. It seems, that worse tenderness of wild boars meat in comparison to pig's meat can result, among other things, from its higher content of dark fibres as reported by Rede at al. [25]. Processes of protein proteolysis in such meat are slower [8, 9, 1, 2], what results from slower disintegration of cytoskeletal proteins, especially titin and nebulin [24]. Wild boar meat contains also more connective tissue proteins [15, 26, 23, 28] making tenderness worse. However, this fact did not have critical importance in the presented experiment, because meat of young animals containing weak collagen net has been here examined. Lower fat content occurring in wild boar meat may also have a negative influence on tenderness. Also a large thermal drip observed in the presented experiment during thermal treatment unfavourably influences on this feature.

To summarize results obtained in this study it can be concluded that applied 12 days long period of ripening caused slight increase of pH in examined raw material, what is one of the reasons of not large water holding capacity and thermal drip changes. Improvement of tenderness between 6th and 12th day of ripening was not shown. To take into consideration research done in last years concerning role of calpain in meat ripening [19, 11, 33, 10, 6, 12] it seems, that the quick decrease and remaining of low pH value does not favour to activity of these enzymes what can be one of the reasons of slow ripening of wild boars meat and its relatively small tenderness. Natural, not accelerated increase of mass of these animals and connected with this slow muscular tissue development also influences on long shelf life. It should be expected, that various diet delivering components contained in eaten herbs, such as microorganisms, natural antioxidants and other not finally recognized compounds, occurring in micro quantities, is also not without meaning.

CONCLUSIONS

1. Wild boars meat possesses profitable chemical composition as a raw material of high content of protein and low content of fat.
2. During 12 days ripening of wild boars carcasses in 4-6^{o}C none significant differences relating thermal drip and water holding capacity of meat were found what results from low pH value remaining in this period
3. Measurement of shear force of examined meat shown essential tenderness improvement between 24 and 144 h of ripening and lack of such improvement between 144 and 288 h. Moreover, better tenderness of the *longissimus dorsi* muscle in comparison to ham muscle was observed.
4. Long time keeping of wild boars carcasses in temperature equal to 4-6^{o}C does not significantly improve technological properties of meat, what should be taken into consideration during its storage and utilization.

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