RESEARCH ON THE TECHNOLOGICAL PROPERTIES OF PORK MEAT FROM THE MANGALITSA BREED, ORIGINATING FROM PIGS OF DIFFERENT AGES RAISED IN THE NE AREA OF THE COUNTRY

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Abstract

The Mangalitsa pig breed is considered one of the oldest pig breeds in Europe. By the end of the 19th century, Mangalitsa pigs were the main breed of pigs raised in Europe, being fattened to a weight of 250 - 300 kg, primarily for fat. Although it was not created in our country, Mangalitsa is considered a local breed because it has been raised on our territory since ancient times, during which it has perfectly adapted to our natural and breeding conditions. This paper presents results obtained from the analysis of the technological properties of pork meat from the Mangalitsa breed, originating from pigs of different ages, of both sexes. The study analyzed the rate of losses due to refrigeration, freezing and thawing, as well as the rate of losses due to frying and boiling the pork meat from the Mangalitsa breed. In most cases, the results showed a higher percentage of losses in younger specimens, which had a lower degree of fattening.

Key words: *technological properties, Mangalitsa breed, losses, refrigeration, freezing*

INTRODUCTION

Mangaliţa is a typical breed of pigs specialized for fat production, with a percentage of meat in the carcass of 30-35% and 65-70% fat [4, 8, 9, 12, 13].

This breed of pigs is one of the old-type breeds, and has been formed several centuries ago by the cross between primitive European and Asian pigs. The Mangaliţa pig breed was introduced to Romania from Serbia in the 19th century [2].

The rusticity of the Mangaliţa breed allowed to obtain a population of pigs with a high resistance to diseases, severe macroclimate and microclimate conditions and to grazing especially on wet lands. It is also noted that under the conditions of semi-intensive exploitation, feeding does not involve the administration of protein of animal origin, making very good use of forest fruits, such as beech trees fruits and acorns [3].

At the end of the 19th century, Mangaliţa pigs represented the main breed of pigs raised in Europe. In those times, Mangaliţa pigs were fattened up to a weight of 250 - 300 kg, being raised especially for fat, mainly in oak forests [6].

The morphological and production characteristics demonstrate the particularly valuable qualities of this breed, being, along with the rusticity, a plea for their maintenance and promotion in the 21st century animal husbandry [7].

At the age of one year, the youth achieves 65-75% of full development, and the adult state is reached at the age of 4 years. The meat has superior taste qualities,

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it is juicy, tender, and lends itself very well to the preparation of winter salamis [5, 6].

From a genetic point of view, the Mangaliţa is a well-established breed. Within the breed, several varieties are distinguished, which differ from each other more by color, after which they differ, the basic characteristics being very similar [10].

Pork is made up of muscle tissue from slaughtered pigs, together with all surrounding tissue, bones, fat, fascia, aponeurosis, blood vessels, nerves and lymph nodes [11].

MATERIAL AND METHOD

The biological material used in this research consisted of Mangalitsa pigs raised on a livestock farm in the northeastern part of Romania, specialized in breeding, reproduction, and valorization of Mangalitsa pigs.

To achieve the purpose of the study, the biological material used consisted of red variety Mangaliţa pigs of both sexes and different ages. Two experimental groups were formed from the studied biological material, each consisting of 10 individuals, castrated males, and females of the red variety.

In the livestock farm where the research was conducted, a semi-free range system is applied, with pigs being fed concentrated feed and having permanent access to pasture. The individuals in the two experimental groups were slaughtered in a specialized pig slaughterhouse at the age of approximately one year and a body weight exceeding 100 kg, respectively at the age of one and a half years and a body weight of 140 kg.

The determination of the average body weight at slaughter of the biological material was done within the slaughterhouse, immediately after the slaughter process.

The evaluation of the technological properties of the meat from the Mangalitsa pigs, which make up the two experimental groups, was done in accordance with current standards. The number of samples analyzed was 10 for each technological property.

To determine the technological properties of Mangaliţa pork, samples were taken from three distinct body regions (neck, thigh, and loin) and subjected to analysis.

Pork preservation is most often done through refrigeration and freezing. Refrigeration should be done immediately after cutting. The refrigeration process involves rapid cooling of the pork to final temperatures above the freezing point, between 0 and +4°C.

Refrigeration is a heat transfer process without changing the state of aggregation, accompanied by moisture transfer from the meat to the cooling environment.

Freezing is a technological operation during which most of the water in the cellular juice and free water in the tissues is turned into ice by cooling the product to a temperature below its freezing point.

Preserving meat by freezing involves cooling it to a final temperature between -15 and -20°C.

Pork freezing was done quickly to maintain its quality, as slow freezing leads to the formation of large crystals that perforate the cell wall, and the loss of liquids results in poor quality meat [1].

Losses recorded after refrigeration and freezing were determined by direct weighing of meat samples using an analytical balance. For refrigeration, determinations were made at 1 day and 3 days, and for freezing after 1 day, both in frozen state and after thawing.

Pork shrinks when boiled, reducing its volume, and the loss of cellular juice increases. Mangaliţa pork samples were boiled over medium heat in a slightly acidulated liquid, and losses recorded after boiling were determined by weighing them

with an analytical balance after prior cooling.

The samples were placed in a slightly acidulated liquid that completely covered the meat, then boiled slowly for 30-45 minutes, depending on size. The slightly acidulated boiling liquid helps to quickly coagulate surface proteins, thus preventing the loss of nutrients from the meat.

To achieve the purpose of the study, losses recorded by meat samples subjected to frying were also calculated. This operation was carried out by frying the meat in hot oil. After frying, the meat samples were left to rest for 5 minutes to drain the excess oil.

The meat samples from the two groups were placed in oil heated to 140-160°C in a deep pan, where they were well fried on both sides until browned, then removed from the hot oil, drained, and weighed.

Losses resulting from the frying operation were determined by weighing the Mangalitsa pork samples fried in oil. These losses can vary depending on the water and fat content of the meat, with anatomical portions that have a higher fat content recording greater losses.

RESULTS AND DISCUSSIONS

In the present research, the Mangalitsa pigs, red variety, from the two experimental groups were slaughtered at approximately one year of age and a body weight exceeding 100 kg, respectively at one and a half years of age and a body weight of approximately 140 kg, thus obtaining a higher percentage of fat in the carcass. The average slaughter weight was 102.34±1.05 kg for the pigs aged one year, and 143.78±1.81 kg for the Mangalitsa pigs aged one and a half years, as presented in Table 1.

Table 1. Average slaughter weight

Group	Age	n	Sex	Live weight X ± sx (kg)
Group L_1 Mangalitsa red variety	12 months	10	♀+♂	102,34±1,05
Group L_2 Mangalitsa red variety	18 months	10	♀+♂	143,78±1,81

To determine the losses due to refrigeration, samples of neck, loin, and pork leg were kept at temperatures between 0 and +4 ºC throughout storage. Plastic containers were used to store the meat samples, which were weighed after 24 and 72 hours.

The average values recorded for the losses due to refrigeration of pork meat after a period of 24 hours ranged between 0.83%, as recorded for neck samples from 18-month-old specimens, and 1.51%, as obtained for loin samples from 12-month-old specimens.

After 72 hours from the start of refrigeration, the loss rate ranged between 1.96% and 2.31% for pork leg, between 1.17% and 1.33% for pork neck samples, and between 2.09% and 2.39% for pork loin (Table 2).

Table 2. Refrigeration loss rate

Specification	n	Leg		Neck		Loin	
		Initial sample weight (g)	Losses (%)	Initial sample weight (g)	Losses (%)	Initial sample weight (g)	Losses (%)
After 24 hours							
L_1 - Mangalitsa red variety, 12 months	10	252,04±1,51	1,45	250,33±1,32	0,96	262,64±1,80	1,51
L_2 - Mangalitsa red variety, 18 months	10	259,22±1,27	1,23	253,46±1,58	0,83	257,71±2,21	1,42
After 72 hourse							
L_1 - Mangalitsa red variety, 12 months	10	252,04±1,51	2,31	250,33±1,32	1,33	262,64±1,80	2,39
L_2 - - Mangalitsa red variety, 18 months	10	259,22±1,27	1,96	253,46±1,58	1,17	257,71±2,21	2,09

The smallest losses were recorded for all three anatomical regions in the case of Mangalitsa pigs aged 18 months, attributed to their fattening state.

During the research, losses due to freezing of meat samples were determined 24 hours after freezing, as well as after thawing, to highlight the losses of cellular juice.

Following the determination of losses due to freezing of Mangalitsa pork after a period of 24 hours, average values ranged between 0.87% and 0.98% for pork neck, average values between 3.43% and 3.58% for pork leg, and average values between 4.21% and 4.36% for loin (Table 3).

Table 3. Freezing loss rate

Specification	n	Leg		Neck		Loin	
		Initial sample weight (g)	Losses (%)	Initial sample weight (g)	Losses (%)	Initial sample weight (g)	Losses (%)
Lotul L_1 Mangalitsa red variety, 12 months	10	250,04±1,51	3,58	258,21±1,46	0,98	263,48±1,83	4,36
Lotul L_2 Mangalitsa red variety, 18 months	10	247,70±1,35	3,43	256,15±1,27	0,87	257,71±2,13	4,21

According to the data in Table 3, the freezing loss rate varied depending on the anatomical region from which the samples were taken, as well as the age of the slaughtered pigs. Thus, the smallest losses were recorded in the case of group L2, consisting of Mangalitsa red variety specimens aged 18 months.

As a result of determining the thawing loss rate, the average values obtained ranged between 3.09% and 3.19% for the Mangalitsa neck, between 7.79% and 7.91% for the pork leg samples, and between 8.48% and 8.57% for the pork loin samples (Table 4).

Table 4. Thawing loss rate

Specification	n	Leg		Neck		Loin	
		Initial sample weight (g)	Losses (%)	Initial sample weight (g)	Losses (%)	Initial sample weight (g)	Losses (%)
Lotul L_1 Mangalitsa red variety, 12 months	10	246,20±1,71	7,91	261,12±1,72	3,19	257,65±2,35	8,57
Lotul L_2 Mangalitsa red variety, 18 months	10	258,74±1,31	7,79	252,23±1,56	3,09	259,75±2,11	8,48

The highest thawing losses were recorded in group L1, consisting of Mangalitsa red variety specimens aged 12 months.

To achieve the purpose of this study, the losses due to frying the Mangalitsa pork were also determined. The values obtained from frying the leg, neck, and loin of Mangalitsa pork are presented in Table 5.

Table 5. Frying loss rate

Specification	n	Leg		Neck		Loin	
		Initial sample weight (g)	Losses (%)	Initial sample weight (g)	Losses (%)	Initial sample weight (g)	Losses (%)
Lotul L_1 Mangalitsa red variety, 12 months	10	273,95±1,43	22,48	264,64±1,59	20,18	288,03±1,93	30,39
Lotul L_2 Mangalitsa red variety, 18 months	10	261,21±1,73	25,81	282,31±1,93	19,95	286,23±1,81	31,25

The frying losses ranged between 19.95% - 20.18% for the Mangalitsa neck, between 22.48% and 25.81% for the pork leg, and between 30.39% and 31.25% for the pork loin.

Regarding the boiling loss rate, it was highest for the pork loin, with average values ranging between 39.71% - 39.88%, and lowest for the pork neck, with average values between 28.35% for the 18-month-old pigs in group L2 and 30.35% for the 12-month-old pigs in group L1 (Table 6).

Table 6. Boiling loss rate

Specification	n	Leg		Neck		Loin	
		Initial sample weight (g)	Losses (%)	Initial sample weight (g)	Losses (%)	Initial sample weight (g)	Losses (%)
Lotul L_1 Mangaliță varietatea roșie, vârsta 12 luni	10	262,30±1,76	38,92	265,25±1,51	28,47	269,02±2,33	39,88
Lotul L_2 Mangaliță varietatea roșie vârsta 18 luni	10	271,21±1,53	38,12	264,34±1,78	28,35	8272,62±2,11	39,71

The boiling loss rate for Mangalitsa pork varied significantly, mainly due to the chemical composition of each type of meat.

CONCLUSIONS

Following the determination of refrigeration losses for pork after a period of 24 hours, the lowest value was 0.83%, recorded for neck samples from 18-month-old Mangalitsa red variety specimens.

After 72 hours from the start of refrigeration, the loss rate ranged between 1.96% for pork leg and 2.39% for pork loin.

The freezing loss rate varied depending on the anatomical region from which the samples were taken, as well as the age of the slaughtered pigs. Thus, the smallest losses were recorded in group L2, consisting of 18-month-old Mangalitsa red variety specimens.

The highest thawing losses were recorded in group L1, consisting of 12-month-old Mangalitsa red variety specimens.

The losses resulting from boiling the Mangalitsa pork varied significantly, mainly due to the chemical composition of each type of meat, particularly the water and fat content.

REFERENCES

1. Banu, C. şi colab., Calitatea şi analiza senzorială a produselor alimentare, **2007**. Editura Agir, Bucureşti.
2. Ciobanu D.C., Day A.E., Nagy A., Wales R., Rothschild M.F., Plastow G.S., Genetic variation in two conserved local Romanian pig breeds using type 1 DNA markers. *Genet. Sel. Evol*., **2001**, 33, 417-432.
3. Ciornei Ş.G., Posibilităţi de conservare a rasei Mangaliţa prin aplicarea unor biotehnologii de reproducţie. **2015.** Editura Ion Ionescu de la Brad Iaşi.
4. Egerszegi I., Rátky J., Solti L., Brüssow K.P. Mangalica - an indigenous swine breed from Hungary (Review). *Arch. Tierz.* **2003**., *Dummerstorf 46*,245-256.
5. Gavrilaş Angela, Stan V., Zootehnie. **2000.** Universitatea de Ştiinţe Agricole şi Medicină Veterinară Iaşi.
6. Habeanu M., Hebean V., Grosu H., Lefter N., Ropota M., Sonea G., Lipidele, între controverse și certitudini în nutriția porcilor. Editura Ars Academica, **2011**. ISBN:978-606-8017-63-1.
7. Hoha G.V., Precup L., Elefteriu E., Nistor C.E., Ivancia M., Păsărin B. Cercetări privind performanţele de creştere a rasei Mangaliţa crescută în ferme din judeţul Iaşi, Romania. Chişinău, Republica Moldova: *Universitatea Agrară de Stat din Moldova,* **2018**, Vol. 52(2), pp. 407-411. ISBN 978-9975-64-302-3.
8. Hollo G., Seregi J., Euder K., Nuernberg K., Wegner J., Segner J., Hollo I., Repa I.. Examination of meat quality and fatty acid composition of Mangalitsa, *Acta Agraria Koposvariensis,* **2003**, 7(2): 19-32.
9. Lugasi A., Gergely A., Horvari J., Barna E., Lebovics V.K., Kontraszati M., Herman I., Gandel J., Meat quality and human nutritional importance of Mangalica, *Hungarian Journal Animal Production*, **2006**, 55, 263-277.
10. Nagy A., Cercetări privind menținerea efectivelor de suine din rasele Bazna şi Mangaliţa „in situ" la minim de risc genetic pentru evitarea consangvinizării. Faza 3 - Determinarea indicilor de creştere a tineretului din rasele de suine Bazna şi Mangaliţa. Alegere reproducătorilor masculi şi femele; *Raport de activitate al fazei 3, al proiectului ADER 1.1.5.* **2013.** Academia de Ştiinţe Agricole şi Silvice "Gheorghe Ionescu-Şişeşti" Institutul de Cercetare şi Dezvoltare Agricolă Fundulea, Staţiunea de Cercetare-Dezvoltare Agricolă Turda.
11. Necula, V., Analiza senzorială a alimentelor, *Note de curs.* **2010**. Facultatea de Alimentaţie şi Turism, Universitatea Transilvania din Braşov.
12. Petrovic M., Mijatovic M., Radovic C., Radojkovic D., Josipovic S., Genetic resources in pig breeding - carcass quality traits of breeds Morovka and Mangalitsa, *Biotehnology in Animal Husbandry*, **2007**, 23 (5-6), 421-428.
13. Petrović M., Radović Č., Parunović N., Mijatović M., Radojković D., Aleksić S., Stanišić N., Popovac M., Quality traits of carcass sides and meat of Moravka and Mangalitsa pig breeds, *Biotechnology in Animal Husbandry*, **2010**, 26 (1-2), p 21-27, ISSN 1450-9156 Publisher: Institute for Animal Husbandry, Belgrade-Zemun, UDC 636.4 DOI: 10.2298/BAH1002021P.