



Compositional Quality of Bazna Pork Meat: Comparative Studies with Genetically Improved Breeds

Vladuta Marioara LUPAU, Alexandra TABARAN*, Sorin Daniel DAN, Oana Lucia REGET, Ana Andreea CIOCA, Marian MIHAIU

Faculty of Veterinary Medicine, University of Agricultural Sciences and Veterinary Medicine Cluj-Napoca, Mănăştur Street No. 3/5, Cluj-Napoca, Romania

* Corresponding author: A. Tabaran e-mail: alexandra.lapusan@usamvcluj.ro

RESEARCH ARTICLE

Abstract

Pork meat is considered one of the most consumed food products around the world. Pork meat industry is in continuous development because of the high demand on the market. The quality of pork meat is known to be related not only to the breeding conditions but also to the breed. Our study aimed to investigate the differences in compositional parameters of Bazna pork meat and the genetically improved breeds, which are now the main source of meat on the market. Results show that the meat provided by Bazna breed is superior from the compositional aspect from that found on the market. It is therefore important to stimulate and develop the breeding systems of Bazna pigs.

Keywords: meat, pork, composition, fatty acids.


Received: 02 March 2022

Accepted: 26 September 2022

Published: 15 November 2022

DOI:

10.15835/buasvmcn-vm:2022.0004

 © 2022 Authors. The papers published in this journal are licensed under the Creative Commons Attribution-NonCommercial-NoDerivatives 4.0 International License

INTRODUCTION

Pork meat is considered among the favorite culinary choices of consumers worldwide. In Romania, pigs' breeding is not only a meat industry but also a very ancient tradition. Romanians are known to prefer the pork meat to that of poultry or beef (Popescu, 2020). Given the high demand for this type of meat, the industry has focused more on breeding the highly productive breeds, such as Duroc, Landrace, Pietrain (Glinoubon et al., 2015). The other breeds which are considered more primitive, like Managalitza or Bazna, have seen a rapid decrease in numbers (Ciobanu et al., 2001). Currently, pork is produced mostly from three-way hybrids (Landrace × Yorkshire × Duroc, or LYD) or more highly crossbred pigs owing to their good growth performance and meat quality (Kim et al. 2018). Recent studies, have drawn again the attention to the positive aspects of consuming the meat provided by pigs with a slower rate of development, like Bazna breed (Şonea et al., 2020). Although some information exists, there is still a lack of supported scientific results that would clearly underline the compositional particularities of this breed to that of other breeds. Pork quality is a large concept which relies on multiple properties (Shi et al., 2021). Among the most desired attributes of pork meat are water-holding capacity, color, fat content and composition, oxidative stability and uniformity (Ribeiro et al., 2021). These attributes are mainly influenced by the genotype, of course related to the breed, and the feeding strategy, which in traditional systems holds particular aspects (Sundrum et al., 2011). Our current study aims to reveal these compositional aspects of

Bazna pork meat, raised in traditional systems, and to compare the results found with those obtained from other breeds, raised in industrial systems.

MATERIALS AND METHODS

Sample collection

Our study focused on 15 male adult Bazna pigs, bought from the SCDA Turda (Agricultural Research and Development Institution Turda) at the age of 4 months, and a live weight of approximately 30 kg. The animals were brought in a farm from Sălaj County, and bred in an extensive care system, having access to the outside environment and being fed with cereals, grass and no concentrates. The slaughtering was performed in one year from their acquisition, when the body mass weight arrived at approximately 100 kg. After slaughtering the samples were collected. All the compositional parameters investigated were determined from various carcass regions which are known to have a greater nutritional value. The carcass regions selected were the loin, steak, shoulder and flank areas. For comparison, 15 samples of raw pork meat were randomly collected from various markets, obtained by industrial processing. The sampling was performed from the same areas as in the Bazna pork meat carcasses following the same procedures and protocols of examination.

The sensory quality evaluation

The sensory evaluation was made by three field specialists, which have assessed the exterior aspects, color, smell, consistency, tenderness and flavor of all the gathered samples. Afterwards, the color aspects of the samples were determined also with the Hunterlab MiniScan EZCM-600 spectrophotometer, using the protocol provided by the producer. Briefly, the instrument registers the values of luminosity (L^*), red color (a^*) and yellow color (b^*).

The determination of compositional parameters

The biochemical parameters (fat%, protein%, water %, collagen %) were determined with the FoodScan Lab (Foss, Denmark) apparatus according to the standard protocol. The fatty acids profiles were assessed by classical GC method using a protocol previously described by Mihaiu et al., 2011. Briefly, 1 μ L of the prepared sample was injected into the Shimadzu GC-17A series gas-chromatograph, equipped with a 30m polyethylene glycol coated column (Alltech AT-WAX, 0.25mm I.D., 0.25 μ m film thickness). Helium was used as the carrier gas at a pressure of 147 kPa. The injector and detector temperatures were set at 260 $^{\circ}$ C. For the oven temperature the temperature used were: 70 $^{\circ}$ C for 2 min. then raised to 150 $^{\circ}$ C at 10 $^{\circ}$ C/ min. rate and held at 150 $^{\circ}$ C for 3min., then further raised up to 235 $^{\circ}$ C at a 4 $^{\circ}$ C/min.

Statistical analysis

In order to evaluate the possible differences in meat composition among the studied pig breeds, we have performed the ANOVA test (Origin 8.5 software, USA). The statistic differences were obtained by finding the probability index "p", which represents the probability that the observed differences to occur at hazard. The statistical interpretation of the results according to the index was made as follows: $p > 0,05$ results / differences not significant statistically; $p \leq 0,05$ results / differences statistically significant, (level of trust 95%).

RESULTS AND DISCUSSIONS

Sensorial examination

The three field experts have evaluated the organoleptic aspect of the Bazna meat which was brought to them non-identified. The samples were brought along with meat from other species so as to reveal possible differences. All three evaluators have revealed that the Bazna meat samples show differences in color, structure (intermuscular fat) and flavor. The color shown by Bazna meat was more reddish, showing a high level of intermuscular fat which relates also to a particular flavor. The smell was pleasant without any strange odors. The tenderness of Bazna pork meat was superior to that of the meat collected from various markets. The more intense color was also confirmed by the spectrometer analysis (Figure 1).

As shown in Figure 1, the luminosity values of Bazna pork meat were lower than that of industrially obtained pork meat, which shows a more reddish and intense color. Also, the other values were statistically different ($p < 0.05$) from those obtained in other samples, which underline the variation in color compared to industrially obtained meat.

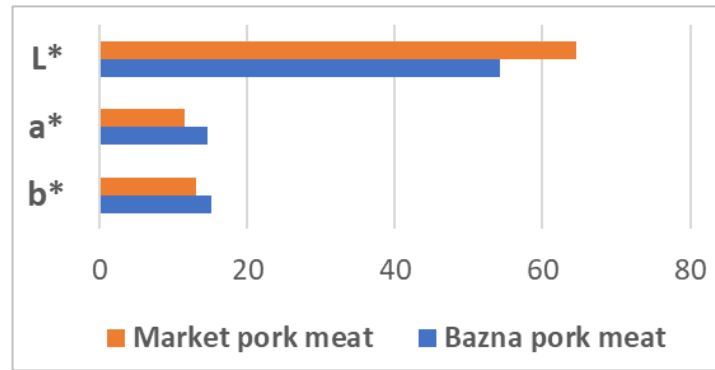


Figure 1. The variation of color parameters at Hunterlab MiniScan spectrometer analysis

The results obtained after the evaluation of the compositional parameters in various carcass regions are shown in Table 1.

Table 1. The compositional parameters of Bazna meat according to various carcass regions (mean ± standard deviation)

	Water (%)	Fat (%)	Protein (%)	Collagen (%)	Collagen/protein
Loin	64±0,13	12,70±0,04	24,2±0,03	1,7±0,02	4,79±0,5
Flank	62,7±0,4	15,32±0,03	16,19±0,04	1,40±0,05	11,07±0,06
Shoulder	69,4±0,7	12,12±0,02	22,08±0,4	1,75±0,05	12,16±0,4
Steak	66,33±0,1	24,92±0,01	16,63±0,02	1,19±0,03	9,71±0,03

From a compositional aspect, the quality of Bazna meat varies considerably according to the region of the carcass. The highest variation as shown in table 1, was found in the level of water and fat percent. The lowest fat percentage was found in the shoulder area (12.12%), followed by loin and flank. The highest protein percent (24.2%) was found in the loin muscles and the lowest in the flank area (16.19%). The collagen showed little variation among the various regions analyzed, being the lowest in the steak area (1.19%) and the highest (1.75%) in the shoulder area.

Compared to other types of meat the most obvious difference was in the fat and protein percent, as shown in Figure 2. Also, at the statistical analysis, the results were significantly different ($p < 0.001$) in the steak, flank and loin areas.

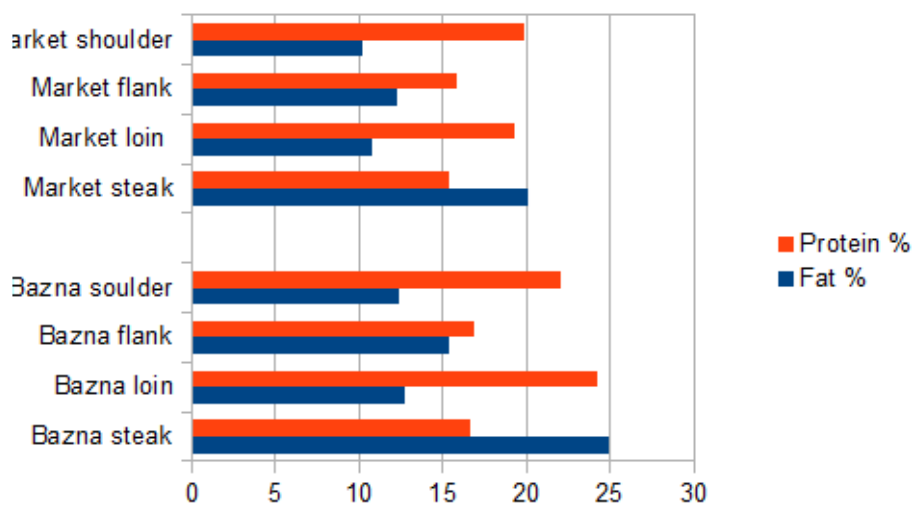


Figure 2. The variation of fat and protein according to carcass region and breed

Regarding the fatty acids profile, we revealed that Bazna pork meat has a high value, having a slightly higher levels of polyunsaturated fatty acids than that shown by a previous study on Mangalitsa pork meat (Cordiș et al., 2015). The results obtained are shown in Table 2.

Table 2. The fatty acids profiles in the samples examined

Fatty acid	Abbreviation	Region			ANOVA test
		Steak	Flank	Loin	
Palmitic	16:0	17.19	23.47	24.26	*
Palmitoleic	16:1	2.28	3.21	4.12	*
Heptadecanoic	17:0	ND	0.25	ND	ND
Cis-10-heptadecanoic	17:1	ND	0.13	ND	ND
Stearic	18:0	3.57	5.92	5.40	NS
Oleic	18:1	42.98	41.40	45.85	*
Vaccenic	18:1 Isomer	4.53	3.42	5.33	*
Linoleic	18:2	25.25	11.94	10.75	*
Alfalinolenic	18:3	0.59	0.56	0.30	NS
Arahidic	20:0	0.67	0.48	0.12	NS
Cis-11- Eicosenoic	20:1	0.59	0.10	0.17	*

Note: ND – not detected; * significant differences ($p \leq 0,05$); NS - differences not significant statistically

As shown in table 2, there were statistically different values obtained in the level of fatty acids according to the carcass area studied. It is an important fact, given that, some areas, like loin and steak, revealed to have higher levels of unsaturated fatty acids. These acids are essential in human diet and maybe the higher levels of these acids can be due to the fact that these regions are more tender and higher in inter-muscular fat. Our results are similar to that of other breeds, raised in traditional systems and with a lower rate of development such as Mangalitsa (Petroman et al., 2021; Szabó, 2006). But other studies on meat provided by other breeds have shown differences. For example, Holló et al. (2003) has shown a higher level of saturated fatty acids and lower level of unsaturated fatty acids compared to our study. We also compared our values to that of Seenger (2007) and revealed a lower level of saturated fatty acids (42.85% vs. 37.12 %). Also, in Great White breed, a breed that is industrially grown and produces a higher level of meat in a shorter period of time, the percentage of unsaturated fatty acid was reported to be 36.86% compared to our which was of 38.17% (Seenger, 2007). The highest levels of saturated fatty acids revealed by previous studies were found in Duroc breed (Nistor et al., 2012; Kim et al. 2020).

CONCLUSIONS

From a quality and processing standpoint, Bazna pork meat has advantages over other industrially grown breeds used in production, rendered as a more intense coloration and better tenderness characteristics. It has also high nutritional values, showing a superior percentage of proteins and essential fatty acids than the pork meat found on the industrial market. We therefore recommend the development and consumption of Bazna pork meat, given the obvious higher benefits than the meat provided by the genetically improved breeds.

Author Contributions: V.M.P, A.T., M.M. Conceived and designed the analysis; V.M.P., S.D.D., O.L.R, A.A.C. Collected the data; O.L.R., A.T., A.A.C. Contributed data or analysis tools; V.M.P, A.T., S.D.D., O.L.R., A.A.C. Performed the analysis; V.M.P, A.T., M.M. Wrote the paper.

Funding Source: This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

Conflicts of Interest

The authors declare that they do not have any conflict of interest.

REFERENCES

1. Ciobanu DC, Day AE, Nagy A. Genetic variation in two conserved local Romanian pig breeds using type 1 DNA markers. *Genet Sel Evol.* 2001; 33:417-432.
2. Cordiș I, Mihaiu M, Tăbăran A, Mihaiu R, Dan SD, Reget O, et al. Compositional Studies on Mangalitsa Meat Products for Public Consumption, *Bulletin UASVM serie Veterinary Medicine.* 2015; 72(1):57-61.
3. Glinoubon J, Sanchai J, Prapas M, Michael W, Kreuzer M. Effects of Crossbreeding Thai Native or Duroc Pigs with Pietrain Pigs on Carcass and Meat Quality. *Agriculture and Agricultural Science Procedia.* 2015; 5:133-138.
4. Holló G, Seregi J, Ender K, Nürnberg K, Wegner J, Seenger J, et al. Examination of meat quality and fatty acid composition of Mangalitsa. *Acta Agraria Kaposvariensis* 2003; 7 (2):19-32.
5. Kim GW, Kim HY. Physicochemical properties of *M. longissimus dorsi* of Korean native pigs. *J Anim Sci Technol.* 2018; 60:2-5.
6. Kim JA, Cho ES, Jeong YD, Choi YH, Kim YS, Choi JW, et al. The effects of breed and gender on meat quality of Duroc, Pietrain, and their crossbred. *J of Anim Sci. and Tech.* 2020; 62(3):409-419.
7. Mihaiu M, Lapusan A, Bele C, Mihaiu R, Dan SD, Taulescu C, et al. The assessment of the quality and traceability biomarkers in the buffalo milk primary production, *Roum. Biotech Let.* 2011; 16 (5): 5548-5555.
8. Nistor E, Bampidis V, Pentea M, Prundeanu H, Ciolac V. Nutritional quality of pork produced by Mangalitsa breed. *Scientific Papers: Animal Science and Biotechnologies* 2012; 45 (2): 386-389.
9. Shi Y, Wang X, Borhan MS. A Review on Meat Quality Evaluation Methods Based on Non-Destructive Computer Vision and Artificial Intelligence Technologies. *Food Sci Anim Resour.* 2021; 41(4):563-588.
10. Seenger JK. The effect of slaughter weight and genotype on the fatty acid composition of intramuscular and subcutaneous fat in pigs, Theses of Ph.D. Dissertation 2007, Szent István University, Gödöllő, Faculty of Agricultural and Environmental Sciences, 1-22.
11. Sundrum A, Aragon C, Schulze-Langenhorst L, Bütfering M, Henning M, Stalljohann G. Effects of feeding strategies, genotypes, sex, and birth weight on carcass and meat quality traits under organic pig production conditions. *NJAS - Wageningen Journal of Life Sciences.* 2011; 58 (3/4):163-172.
12. Szabó P. Fatty acid composition of the tissues of Mangalica and other pig genotypes. *Hungarian J. Anim. Prod.* 2006; 55:293-311.
13. Șonea CG, Socol CT, Criste FL. Current perspectives for Mangalica and bazna pigs breeding for efficient biodiversity management, genetic conservation and animal improvement in Romania. *Rev Rom Med Vet* 2020; 30(1): 29-33.
14. Petroman C, Popescu G, Szakal RN. Fatty Acid Profile of Lipid Fractions of Mangalitzza (*Sus scrofa domesticus*) from Northern Romania: A GC-MS-PCA Approach. *Foods.* 2021;10(2):242.
15. Popescu A. Pork market crisis in Romania: pig livestock, pork production, consumption, import, export, trade balance and price. *Scientific Papers Series Management, Economic Engineering in Agriculture and Rural Development.* 2020; 20(1): 461-574.
16. Ribeiro DM, Martins CF, Costa M, Coelho D, Pestana J, Alfaia C, et al. Quality Traits and Nutritional Value of Pork and Poultry Meat from Animals Fed with Seaweeds. *Foods* 2021; 10: 2961-2970.