

## Research on meat quality of some wild animal species for human consumption

A. Crăciunescu, S. Stanciu\*, Mihaela Moatăr

Banat's University of Agricultural Sciences and Veterinary Medicine "King Michael I of Romania" from Timișoara,,  
Calea Aradului, No.119, 300645, Romania

Received: 01 March 2014; Accepted: 26 March 2014

---

### Abstract

Through research in this paper was intended to assess meat quality of hunting mammals (*Sus scrofa ferus*, *Cervus elaphus* L.), with the purpose of establishing a solid scientific basis at national level to streamline correct information and achieve as accurate a overview of the nutritional quality, dietary, sensory and technological meat this. The purpose of the research was motivated by the following: lack of information on objective and detailed description of game meat quality, wildlife hunting Romanian specific, broadening knowledge with analytical data on the nutritional quality of game meat, especially the information on the quality intrinsic intramuscular lipids of mammalian meat hunting useful for managing a healthy food diet, obtaining information on the content of some trace elements of game meat, important in terms of completing the concept of meat quality (nutrient-biological) lack of information on the assessment of the degree heavy metal contamination of game meat, taking into account the limited control of the food game exploited its natural and environmental factors pollutants; need to obtain information on the technological quality of game meat processor is relevant and absolutely necessary the further processing of an adequate economic efficiency, correlation of physical, chemical and sensory attributes of technology for processing game meat culinary effective.

**Keywords:** meat quality, dietary, food, trace elements

---

### 1. Introduction

Nutrition has a vital role in determining the health of the population of a country; a healthy diet requires adequate involvement and continuous scientific side with a view to boosting and adaptive control systems of the body.

The main criterion for the choice of topic for thesis was that now, the research cited in the literature and consultation with the latest scientific information from online databases reveals little information on meat quality hunting fauna specific to Romania, research at international food being focused on the value of game meat less tamed and exploited under semi-intensive, focusing on the

influence of diet and slaughter handling techniques before slaughter on meat quality.[1-6]

### 2. Method and methods

Organizing own research has been conducted in a well structured organization that aimed to supplement the information incomplete experiments above, the characterization of the quality of game meat from ruminant mammal carcasses - deer (*Cervus elaphus* L) and omnivores - boar (*Sus scrofa ferus*) operated under a specific wildlife management area N-V Romania, track quality parameters in order to achieve the physical, chemical, and sensory processing.[7-20]

However, qualitative analysis of game meat has been linked with a brief description of the physiological status of the animals used as biological material by

means of hematological and metabolic parameters in meat processing are known to influence certain physiological conditions on carcass conformation, so the quality of the meat. Biochemical profile tests are an effective method of updating the ability of the body's adaptability to the natural habitat of animals and the Blood is important in light of the health of their animals at harvest (current research), the need to assess nutritional metabolic herds animals established itself by the fact that many nutritional deficiencies can cause pathogenic conditions or nutritional disorders, with negative effects on the animal.[21-27]

To achieve the goal, investigations were conducted on a total of 37 adult individuals boars (17 males and 20 females) and 21 red deers (10 males and 11 females) harvested within organized hunting area N-V Romania (Caraş-Severin Hunting Forestry Department) hunting seasons in 2008-2009, 2009-2010 and 2010-2011, according to Law no. 407/2006 as amended by O.U.G. No. 102/2010. They were supposed to establish specific parameters, namely:

- physical parameters (dynamic acidity during maturation meat color (L\*, a\*, b\*, C, ho), tenderness - Warner Bratzler forces);
- chemical parameters: gross chemical composition (dry substance, the water, total fat, total protein, organic matter, non-nitrogenous substances, mining, minerals total), the energy profile of intramuscular fat in fatty acids, trace elements (Mn, Cu, Zn, Fe, Mg ) xenophobic heavy metals (Cd, Pb );
- technological parameters: water retention capacity (losses refrigeration-drip cooking losses);
- sensory parameters: appearance, color, aroma, flavor, juiciness, tenderness;
- blood parameters: Hematology-red blood cell parameters (total RBC - RBC, hemoglobin - HGB, mean corpuscular volume - MCV, mean erythrocyte hemoglobin - MCH, mean hemoglobin concentration - MCHC ), leukocyte (total WBC - WBC ) and platelet (total number of platelets - PLT) and biochemistry (glucose, total protein, cholesterol, triglycerides, Ca<sub>2</sub><sup>+</sup> and P<sub>3</sub><sup>+</sup>).

Since the current research provides experimental protocol qualitative characterization perspective game meat physicochemical, toxicological, sensory, technological and physiological status, evidence collection and sampling required the use of two types of tissue: muscle tissue and blood.

The analytical methods used in their research included a legislative framework provided in Romanian standards, harmonized with European Community law and international standards or in accordance with methods used in reference works.[1-27]

### 3. Results and discussions

Quality rating boar meat (*Sus scrofa ferus*) and physiological status of the animal before slaughter revealed the following:

Hematologic and metabolic profile indicators determined on blood collected from wild boars studies showed insignificant differences between males and females for each index, females showing superior value compared to males. Correlations between metabolic indices analysis suggests the operation line type anabolic metabolism, is directly related to nutritional status of animals and the nutritional composition of the last sacraments, before slaughter.

During chilling/maturation of boar meat, dynamic pH showed a downward trend during the first 48 h postmortem, the mean values recorded at this time are limited to the range 5.38 (triceps) -5.54 (*m Trapezius cervicalis*) characterizing both extremes muscles harvested from female carcasses. Further development of the parameter bottom, the end of the materialized 10 days aging the average acidity of the meat in the range of 5.79-6.02; in all samples muscle growth pH after slaughter recorded in all muscle groups in the study, was within the safe range to avoid unwanted events such as PSE or DFD. From the statistical point of view, animal sex influenced acidity meat spontaneously; a possible cause of spontaneous broken influence may have been due to possible microbial load different regions butchers.

Color boar meat (cured and vacuum packed) was described by brightness (L\*) whose average values fluctuated between 45.76-49.44 units muscles *Longissimus dorsi*, *Semitendinosus* and *Triceps* from carcasses of males showing high brightness

homologous muscles harvested from female boar carcasses.

Current research results describe an attractive color boar meat from the point of view, with a dark red pigmentation (specific game), more intense than that of pigs, which correlated with reduced speed rate downward for meat acidity combined with rapidly lowering the temperature of storage, as well as a higher content of myoglobin in meat game, as a result of intense muscular effort).

Wild boar meat tenderness forces described by Warner Bratzler (expressing hardness portion of meat, heat treated at break) was characterized by environments that varied between 35.00-51.44 N/cm<sup>2</sup>, muscle tenderness males expressing lower than that determined from samples taken from carcasses females, *Longissimus dorsi* muscles were defined with the lowest hardness. Through statistical analysis, *M. triceps* showed significant differences between males and females for Warner Bratzler force values, 75% of all tests performed for the entire musculature is insignificant.

The analytical data on the composition of boar meat revealed the following:

- in all muscle groups examined, the value determined for the dry muscle males exceeds that determined from samples taken from carcasses females average content ranging from  $26.23 \pm 0.46$  % (*m. Semitendinosus females*) and  $27.84 \pm 0.60$ % (*m. Trapezius cervicalis males*) .
- according to the data obtained , the average content of protein reveals a uniformity of composition in the four muscle groups examined, ranging between 20.9%-22.77% with minimal protein made mainly in the corresponding samples of females;
- the amount determined for the total lipids of wild boar meat were the highest amplitude component of variance between the muscles studied , averages falling between 2.65% (*M. Longissimus dorsi* of males) and 5.22 % (*m. Trapezius cervicalis dams*), total lipid content of muscle meat females is higher than males assigned *Longissimus dorsi* muscles, *Trapezius Triceps* and *cervicalis*.

- description of the qualitative and quantitative profiling of lipid fatty meat of wild boar reveals a wide range of variation values are averages of the main lipid fractions showed the following ranges: 33.60÷37.03% AGS, 43.70÷47.15% AGMN (monounsaturated lipid fraction of boar meat is dominated by  $\omega$ -9 fatty acids (C18 : 1 $\omega$ -9 C16 : 1 $\omega$ -9)) and 17.53÷21.01% PUFA (polyunsaturated lipid fractions are major represented by C18 : 2 $\omega$ -6, C20: 6 and C18 - 4 $\omega$ : 3 $\omega$ -3).

The total amount of fatty acids determined. PUFA content correlated with PUFA ratio values ( $\omega$ -6/ $\omega$ -3) is the scientific substrate quality assessment of boar meat lipids; analytical data indicates nutritional superiority of muscle lipids analyzed in the following order: *Longissimus dorsi*, *triceps*, *Trapezius cervicalis* and *Semitendinosus*.

- energy value calculated specific heat showed boar meat, boar meat calorificity ranging between 154.41 (*m. Semitendinosus*) ÷ 171.03 Kcal/100 g meat (*M. Trapezius cervicalis*), both muscle groups belonging female carcasses .
- analytical data obtained through the analysis of minerals in meat of wild boar, confirming the presence of significant amounts of Cu, Zn, Mn, Fe and Mg metals essential for a balanced daily food ration, quantitative variation of each trace element is specific muscle group and sex boar, as follows:
  - the average content of meat from carcasses harvested females was higher muscle samples from carcasses male counterparts for the analyzed muscles in the dorsal, ham and shoulder, overall mean values were in the range 1.80 ÷ 1.93 mg / kg DM.
  - compared between sexes, female muscles and dorsal shoulder area harvested has a medium containing higher Zn and Mn homologous muscles from carcasses males of the cervical muscles the opposite situation , the ranges of the mean values of 34.35 to 40.09 mg / kg DM for Zn and 0.28 ÷ 0.37 mg / kg DM for Mn.

- the average Fe content of the dorsal and cervical muscles from carcasses of males recorded higher values calculated for the corresponding muscles from carcasses of females in the entire area of samples analyzed average values falling within  $57.72 \div 65.00$  mg/kg SU;
- average content of Mg boar meat samples indicate superiority of carcasses unanimous intermuscular females average values being assigned to the range  $218.16 \div 280.02$  mg/kg DM, these values have led to the significant differences between males and females when *Longissimus dorsi* and *Semitendinosus* m .
- research results confirm the presence of heavy metals in meat of wild boar xenobiotic (Cd and Pb), which is quantitatively lower maximum permissible limit (MRL) of 0.05 ppm to 0.1 ppm Cd and Pb (EC, 2006), averages ranging between  $0.0088 \div 0.0154$  mg/kg DM for Cd and  $0.0023 \div 0.0082$  mg/kg DM for Pb. The accumulation of these two heavy metals in muscle tissues of wild boars are the result of environmental contamination sources of livable (water, air, soil).

From the technological point of view, drip loss during chilling boar meat were more pronounced in samples from males to females , the range of the average values ranged from 4.27% ( *M. triceps* in females)  $\div$  5,40% ( *m.Trapezius cervicalis* males). Also, by boiling samples this superiority is mostly repeated muscle, with significant differences between males and females for corresponding values m. *Longissimus dorsi*, *Semitendinosus* and *Triceps*.

In terms of sensory boar meat was characterized by dark earliest and juicy the meat females with a specific flavor of game (slight characteristic flavor of nuts) and its pronounced intensity (especially for samples collected from males), coupled with a pleasant taste and a mean score on the overall assessment shows a positive image (4.04 respectively 4.33 points).

Evaluation of meat quality deer (*Cervus elaphus* L.) and physiological status of the animal before slaughter revealed the following:

- Large variations between the sexes of hematological and metabolic parameter values can be justified by the existence of differences between individuals analyzed (sex, age, body weight) correlated with stressors before slaughter, average values for each index was determined blood similar to those mentioned in the literature , describing the physiological status of deer contention by physical methods.
- Evolutionary deer meat pH showed a downward curve in the first 48 hours postmortem , except muscles harvested from the dorsal and cervical carcasses males and females carcasses thigh muscles in this time of measurements , the mean acidity deer meat is in the range  $5.48 \div 5.57$ . At 120 hours of aging, the acidity of deer meat was standardized in the range of 5.64 to 5.66, so that at the end of the maturation process (240 hours) acidity of the meat characterized in amounts in the range of  $5.70 \div 5.76$ , there are no statistically significant differences between males and females for the parameter values, intramuscular, throughout the period of maturation.
- In terms of colorimetric , deer meat has been characterized by a lightness ( $L^*$ ) in the range 27.56 (m. *Trapezius cervicalis* females)  $\div$  29.88 units (m *Triceps Brachi* males) compared between sex, *Longissimus dorsi* and *Semitendinosus* muscles harvested from carcasses of females are brighter than those collected from males for the two muscle groups analyzed presenting the situation around. Values colorimetric parameters of deer meat in current research confirms Color To shut the game- specific species, the data obtained are close to deer meat characteristics colorimetric indices aged 5 to 6 years operated farms, youth literature values indicating meat brightness between  $32 \div 34$  units.
- Muscle tenderness deer described objective is achieved through the expression of a physically firmer at break was defined by the range of  $19.65$  (M. *Longissimus dorsi* females) $\div$  $45.26$  N/cm<sup>2</sup> (M. *triceps* to the male), muscle samples from carcasses of females being more tender than those from carcasses of males.

Compositional characteristics of deer meat have outlined the following:

- a. dry matter content of the muscles analyzed results show the superiority of values from samples taken from carcasses females bounding sphere value is bounded by 24.53% (*M. triceps* in males) and 25.63 (*m.Trapezius cervicalis* of females);
- b. on the total protein content of the muscles analyzed to reveal the expansiveness higher values of muscle samples collected from carcasses of females (from 21.71% in muscles from the shoulder down to 22.72% in *M. Longissimus dorsi*) while males average values between 21.35% ÷ 22.58%;
- c. the average total lipids is consistent and dependent on the proportion of total protein and moisture content of the samples analyzed , the superiority parameter samples from carcasses of females compared to the males collected from carcasses, a maximum of 1.77% at the muscles cervical female carcasses was offset within the same sex, the minimum of 1.13% m *Longissimus dorsal* feature, repeating situation for media samples from carcasses of males, but different amplitude (maximum 1.32% and the minimum 0, 83% );
- d. a description of the quantitative and qualitative lipid fatty acid profile of meat from deer showed average values for the major lipid fractions, between 30.34÷45.84 % for AGS, 24.68÷45.15% for AGMN (fraction monounsaturated lipid deer meat is dominated by  $\omega$ -9 fatty acids (C18 : 1 $\omega$ -9 C16 : 1 $\omega$ -9) ) and 21.69 ÷ 41.91 % for PUFA (polyunsaturated lipid fractions are the major C18: 2 $\omega$ -6, C20: 4 $\omega$ -6 , C18:3 $\omega$ -6 , C20:3 and C22 - 5 $\omega$ :5 $\omega$ -3 ), the percentage being carried out of the total fatty acids determined. AGS content, AGMN and PUFA ratio values correlated with PUFA/AGS and PUFA ( $\omega$ -6/ $\omega$ -3) of deer meat quantitatively and qualitatively assess intramuscular lipids, analytical data indicating deer meat as a protein source potential high to ensure a favorable lipid balance for all muscle groups examined;
- e. energy value calculated for deer meat revealed by both dietary properties employment in an area bounded variation lower 153.37 Kcal/100 g meat (*M. Longissimus dorsi* from males ) and higher Kcal/100 166.66 g meat (*M. Trapezius cervicalis females*) and in terms of low fat content and the ratio of water : protein;
- f. nutritional aspect, analytical data obtained from the analysis of minerals in deer meat indicates the presence of significant quantities of Cu, Zn, Mn, Fe and Mg, the mean and the limits of variation of metal content being displayed by muscle group and sex deer:
  - the average content of meat from carcasses harvested females was higher muscle samples from carcasses male counterparts for the analyzed muscles of the thigh , shoulder and neck , overall mean values are bounded between 7.75 ÷ 10,174 mg / kg DM.
  - compared between sexes , muscular males (bulls) harvested from the dorsal thigh and shoulder has a higher average content in Zn homologous muscles from carcasses of females in the cervical muscles situation is opposite bounding interval of the mean values of 82, 88÷116.06 mg/ kg DM;
  - average content of Mn deer meat quantitatively describe the superiority of the values resulting from the analysis of samples taken from carcasses *Longissimus dorsi* muscles males, *Trapezius Triceps* brachii and cervicalis, average values being defined area 2.04÷3.48 mg/kg SU;
  - the average Fe content of the dorsal muscle, thigh and neck from carcasses of males (bulls) resulted in values higher than those calculated for the corresponding muscles from carcasses of females in the entire area of samples analyzed average values falling within 79.80 ÷ 92.23 mg / kg DM between males and females with significant differences from corresponding values *M. Semitendinosus*.
  - average content of Mg deer meat ranged between 214.00÷285.03 mg/kg DM harvested from the dorsal muscles and shoulder carcasses of males showing a higher

content in this macroelement to its counterpart in female carcasses. Gender Relevant statistical analysis revealed differences for the values obtained from *M. Longissimus dorsi* and *Triceps brachii* respectively significantly distinct from *M. Semitendinosus*.

- aspect toxicological analyzes confirm the presence of heavy metals in the flesh of deer xenobiotic (Cd and Pb) concentrations were evaluated in AML environments, ranging between  $0.021 \div 0.039$  mg/kg DM for Cd and  $0.026 \div 0.06$  mg/kg DM Pb, although the data obtained are a direct consequence of bioaccumulation of heavy metals, their low level does not endanger.

#### 4. Conclusions

Losses by applying heat treatment deer meat have values between 31.62% (*M. Longissimus dorsi*) and 39.48% (*m. Trapezius cervicalis*), while losses chilling of the samples had values between 2.93% (*M. Longissimus dorsi females*) and 3.86% (*m Trapezius cervicalis from males*).

Sensory analysis of muscle samples deer carcasses showed a very pleasant aroma and strong grass, this feature is complemented by strong intensity and particular flavor, the meat was characterized as sufficiently juicy, with a tenderness and having a good appearance very nice assessed by respectively 4.58, 4.71 points.

Research results are compared to data on quality parameters of game meat (wild boar and deer), typical of areas with those mentioned in the literature.

Considering the data presented, the consumption of game meat is a viable alternative gourmet meat from other domestic species exploited in the industrial system.

**Compliance with Ethics Requirements:** Authors declare that they respect the journal's ethics requirements. Authors declare that they have no conflict of interest and all procedures involving human and/or animal subjects (if exists) respect the specific regulations and standards.

#### References

1. Banu, C.; Oprea, Al., Dănicel, Ghe.; *Îndrumător în tehnologia produselor din carne*, Ed. Tehnică, București, 1985
2. Banu, C.; *Manualul inginerului de industrie alimentară*, Ed. Tehnică București, 2002
3. Banu, C.; *Manualul inginerului de industrie alimentară*, Vol. II, Ed. Tehnică București, 2002;
4. Banu, C.; Crăciunescu, A.; Chisăliță, I.; Ștefan, Carolina; Moatăr, Mihaela; Area improvements with forest vegetation and sustainable development environment, *Journal of Horticulture, Forestry and Biotechnology*, **2011**, XV(4), 124-127
5. Banu, C.; Crăciunescu, A.; Chisăliță, I.; Ștefan, Carolina; Moatăr, Mihaela; Elements for the determination best age (age exploitability) which table can be harvest in stands wood household under regular forest treatment, *Journal of Horticulture, Forestry and Biotechnology*, **2011**, XV(4), 124-127
6. Bazgan, O; *Diagnostic de laborator și igiena alimentelor de origine animală*, Ed. Moldogrup, Iași, 1999
7. Bănățeanu, I.A.; *Compendiu de igienă alimentară*, Ed. Ceres-București, 1985
8. Crăiță M., Eladi A.; *Îndrumător pentru controlul alimentelor de origine animală în rețeaua comercială*, Buletin informativ nr. 9-10-M.A.I.A.D.S.V.-București, 1990
9. Chisăliță, I.; *Probleme actuale și de perspectivă privind conservarea, protejarea și dezvoltarea fondului forestier din județul Caraș-Severin, Pădurea românească la cumpăna mileniilor*, Facultatea de Silvicultură și Exploatarea forestiere, Universitatea Transilvania, **2000**, 33-36
10. Chisăliță, I.; Măsuri de combatere a poluării mediului prin instalarea vegetației forestiere pe haldele de flotare ale întreprinderii miniere Moldova Nouă, *Cercetări științifice*, **2005**, IX(2), 175-178
11. Chisăliță, I.; Crăciunescu, Adam; Țenche – Constantinescu, Alina; Research concerning the macro and micro fauna of the sterile dumps in Moldova Nouă after 10 years of forestation, *Cercetări științifice seria a XII a, Horticultură-Inginerie genetică*, **2008**, XII, 279-287
12. Chisăliță, I.; Crăciunescu, Adam; Țenche – Constantinescu, Alina; Research concerning the coverage of sterile dumps in Moldova Noua with forestry vegetation, *Cercetări științifice seria a XII a, Horticultură-Inginerie genetică*, **2008**, XII, 415-420
13. Crăciunescu, Adam; Dezvoltarea și vitalitatea zonelor rurale din România, în contextul integrării în Uniunea Europeană, "Perspectivele economice ale francofoniei asupra dezvoltării durabile", *Forumul Francofon al Afacerilor*, Paris, **2004**, 22-24

14. Crăciunescu, Adam; Pădurile și implicația fenomenului de deșertificare, *Workshopul tehnic privind preîntâmpinarea secetei în Balcani*, Poiana Brașov, **2004**, 56-59
15. Crăciunescu, Adam; Diversitatea și polifuncționarea pădurilor românești, producția de lemn, conservarea biodiversității, gestiunea vieții sălbatică, *Manifestări menite să promoveze imaginea valorilor tradiționale românești la cultura europeană*, Universitatea Agronomică din Gambroux, Belgia, **2004**, 67-69
16. Crăciunescu, Adam; Research on seedling biomass on two soil types in the Crișului Alb Plain, *Cercetări științifice seria a-XII-a*, Horticultură-Ingenierie genetică, **2008**, 340-344
17. Ciolac, Ramona; Csoz, I.; Pet, Elena; Martin, Simona; Dincu, Ana Maria; Research on the features witch customize areas with developed agritourism from Central Region of Romania, *Lucrări științifice Management Agricol*, **2011**, XIII(4), 103-108
18. Drugă M.; *Ghid practic de control al calității produselor de origine animală*, Ed.Mirton, Timișoara, 1998
19. Iosim, Iasmina; Iancu, Tiberiu; Popescu, Gabriela; Martin, Simona Cristina; Marin, Diana; Radac, Bianca; The implementation of negotiating styles in agrotourism, *Lucrări Științifice, Facultatea de Management Agricol*, **2013**, Seria I, XV(1), 123-1228
20. Lile, Ramona, *Calitatea și managementul calității*, Ed. Mirton, Timișoara, 2010, 89-92
21. Negrea A.; *Tehnologia, calitatea și controlul sanitar veterinar al produselor de origine animală*, Ed.Moldogrup Iași, 2001
22. Orboi, Manuela-Dora; Development of rural communities by diversification of rural economy in the context of sustainable development, *Lucrări științifice*, Facultatea de Zootehnie și Biotehнологii, **2012**, 45(1), 450-453
23. Otaru O.; Mihaiu M.; *Igiena veterinară a produselor alimentare, Vol. 1 Inspekția cărnurilor*, Ed. Risoprint, Cluj-Napoca, 2001
24. Sălăgean, C.D.; *Tehnologia produselor din carne*, Ed. Risoprint - Cluj-Napoca, 2009
25. Sălăgean, C.D.; *Tehnologia cărnii și a produselor din carne – Îndrumător de lucrări practice*, Ed. Risoprint, Cluj-Napoca, 2010;
26. Solomonesc, A.; Chisăliță, I.; Moatăr, Maria Mihaela; Ștefan, Carolina; Foră, G.C.; Issues of forest management in Reșița County”, *Journal of Horticulture, Forestry and Biotechnology*, **2012**, 16(2), 243-246
27. Stanciu, S.; Tabără Amănar, C.; Comparative analysis of the offenses covered by forest legislation in Romania, *Journal of Horticulture, Forestry and Biotechnology*, **2011**, 15(1), 203-208
28. Vintilă, Cornelia; *Tehnologia prelucrării cărnii de calitate*, Editura Waldpress, Timișoara, 2008