RESEARCHES ON NUTRITIVE VALUES ON ROE DEER *(CAPREOLUS CAPREOLUS)* MEAT

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Abstract: *One of the species of cynegetic interest well represented numerically in the north of Moldavia, the roe deer (Capreolus capreolus) (Linnaeus, 1758) is a hunt species with high demand. Researches were developed on four roe deer: two males and two females, harvested in the north area of Moldavia (counties Suceava and Iaşi). The assessment of meat quality represents a process which includes the analyses of physico-chemical and organoleptic parameters, the establishment of nutritional, biological, food and culinary values. Samples were processed in order to determine proteins collagen, fat, water, and the pH, known as that the nutritional value of meat is given by these parameters and expression of the sensorial characteristics based on relationships in which they are found. The obtained results reflect the high nutritional value of meat from deer, and from an alimentary point of view the meat came from females situates in consumers top preferences.*

Keywords*: deer, meat, nutritive values*

INTRODUCTION

The quantitative and qualitative level of human nutrition is an essential indicator in assessing the welfare degree of a population.

In the food quality is feeling increasingly the tendency to return to nature and to monitor the achievement of products with physicochemical parameters as close to those of naturally derived products.

The continuing concern represented by the early appearance of the obesity and diabetes in young population as well as rapidly ascending dynamics of their frequency compels finding an alternative healthier food, by ingestion of foods low in fat but with high protein content. This correlated with the food diversity in continuing expansiveness represent important elements on the decision to purchase and consumption, the ultimate goal to achieve a balance between the producer - the quality principles - consumer concomitant with the correct information (Postolache et col., 2013).

In the reference literature, there are many debates on the nutritional properties of game meat, by age, sex and degree of development of animals. All these researches highlight the interest increasingly higher of consumers for game meat because of the low amount of fat and cholesterol of meat, but with high protein content, essential amino acids and vitamins (Daszkiewicz et col., 2012; Hutchison et col., 2010; Pollard et col., 2002, Wiklund et col., 2003).

Game meat represents an alternative food in continuing expansiveness, due to its high nutritional properties, of particular taste and continued interest in the livestock industry, as well as for the consumer, by diversification (exploitation) of cynegetic resources at an industrial level.

MATERIAL AND METHOD

The investigations were conducted in the Pathological anatomy and Forensic Laboratory, Faculty of Veterinary Medicine Iaşi, and in Meat quality control and Experimental and Applied Physiology, Faculty of Animal Sciences Iaşi, on deer corpses harvested from hunting fund Frasin, Suceava county and hunting fund Turia Perieni, Iaşi.

As a biological material was used 4 deer (*Capreolus capreolus*) individuals (2 males and 2 females).

The protein, fat, water and beffe quantity from meat were determined with the use of Food Check automatic analyzer.

Automatic meat analyzer (Fig. 1) is a near-infrared spectrometer which is used to analyze the composition, using the infrared absorbance characteristics of the sample spectra.

Fig.1. Food–Check Automatic meat analyzer

The operating principle of the method is as follows: the light of a tungsten halogen lamp illuminates the entrance slit of the monochromator. Inside the monochromator, the light is diffracted by an optical grating. For each grating angle, a different NIR wavelength is obtained at the exit slit. The monochromator NIR light leaving the monochromator strikes the meat placed into the sample compartment. After interaction with the grain meat sample, the remaining light leaves the sample. A large portion of this light is collected under a wide angle on a silicon detector underneath the sample plate to generate a corresponding photometric signal.

From the ratio values read by the analyzer and those of reference, are established calibration constants for each wavelength, which is the basis for calculation of the values of parameters analyzed. The measurement time is approximately 50 seconds, the spectral range having limits between 730 - 1100 nm.

The display is located on the upper part of the front panel. It is the user interface for the integrated Omega software and displays menu options, dialogs, measurement results, error messages etc. The display serves as a touch screen at the same time. Meat samples thorough grounded are located on a glass plate that ulterior will be introduced in the analyzer for analyzing. The obtained results will be displayed on the screen.

RESULTS AND DISCUSSIONS

Were determined the main biochemical constituents from the same four muscle categories taken in study, respectively *M. Longissimus*, semitendinosus muscle (*M. Semitendinosus*), triceps brachii muscle (*M. Triceps brachii*) and trapezius muscle (*M. Trapezius cervicalis*).

Table 1

Protein value in deer *Capreolus capreolus* males

Nr. crt.	Protein value % ♂			
	Semitendinosus muscle	Triceps brachii muscle	*Longissimus dorsi* muscle	Trapezius muscle
1	21,3	21,5	20,9	21,3
2	21,7	21,6	21,7	21,4
x(average)	21,50	21,55	21,30	21,35
sx(mean standard deviation)	0,200	0,050	0,400	0,050
s(standard deviation)	0,28	0,07	0,57	0,07
v%(coefficient of variation)	1,32	0,33	2,66	0,33
min	21,30	21,50	20,90	21,30
max	21,70	21,60	21,70	21,40

Concerning the overall image of each muscle group highlighted slightly superior content of total proteins for all muscles harvested from the second carcass towards the muscles from the first carcass, establishing percentage differences that ranged from 0.1% for trapezius muscle and triceps brachii muscle, up to 0.8% for *Longissimus dorsi* muscle.

For the first carcass is noticed a constant in total protein value by 21.3% corresponds to semitendinosus and trapezius muscles, which is preceded by a difference of 0.2% the gross protein maximum (21.5%), it also constitutes the minimum protein for the triceps brachii muscle harvested from the two carcasses (Table 1).

The values for standard deviation and also for mean standard deviation are numerically constant for triceps brachii and trapezius muscle (0.07 respectively 0.05) (Table 1). The maximum of total protein substances (21.7%) corresponds both to *Longissimus dorsi muscle* as well as for semitendinosus muscle belonging to the carcass of the second male (Table 1).

Table 2

Collagen value in deer *Capreolus capreolus* males

Nr. crt.	Collagen value % ♂			
	Semitendinosus muscle	Triceps brachii muscle	*Longissimus dorsi* muscle	Trapezius muscle
1	19,5	19,8	19	19,7
2	20,1	19,9	19,9	19,8
x(average)	19,80	19,85	19,45	19,75
sx(mean standard deviation)	0,300	0,050	0,450	0,050

s(standard deviation)	0,42	0,07	0,64	0,07
v%(coefficient of variation)	2,14	0,36	3,27	0,36
min	19,50	19,80	19,00	19,70
max	20,10	19,90	19,90	19,80

Concerning the overall image of each muscle group highlighted slightly superior content of total collagen for all muscles harvested from the second carcass towards the muscles from the first carcass, establishing percentage differences that ranged from 0.1% for trapezius muscle and triceps brachii muscle, up to 0.9% for *Longissimus dorsi* muscle (Table 2).Total muscular collagen registers a maximum value of 20.1% corresponding to semitendinosus muscle harvested from the second carcass, value counterweighted by the minimum percentage of superior limits (19.7%) corresponding to trapezius muscles from the first carcass (Table 2). For standard deviation and for mean standard deviation were found numerically constant values for triceps brachii muscle and also for trapezius muscle (0.07 respectively 0.05), while the coefficient of variation framed between a minimum of 0.36 for trapezius and triceps brachii muscles and a maximum of 3.27 corresponding to *Longissimus dorsi* muscle (Table 2).The average of total collagen is highlighted through the difference of 0.4% between the maximum (19.85%) corresponding to triceps brachii muscle and minimum value (19.45%) calculated for *Longissimus dorsi* muscle, between intermediary values determined for this statistical indicator, taken two by two, with differences between 0.05% and 0.35% (Table 2).

From the analysis of the total lipid content of the muscle of the two carcasses, it is found the downward slope of the parameter for each muscle group, the maximum being represented by the values of the muscles that have their origin in the first carcass. Within this carcass, is noted the variation of gross lipid content between a minimum of 3.3% corresponding to triceps brachii muscle and a maximum of 5.4% *Longissimus dorsi* muscle, value that represents the absolute superior limit of the item for all muscles subjected to analyses (Table 3).

Table 3

Lipid value in deer *Capreolus capreolus* males

Nr. crt.	Lipid value % ♂			
	Semitendinosus muscle	Triceps brachii muscle	*Longissimus dorsi* muscle	Trapezius muscle
1	3,9	3,3	5,4	4
2	2,5	2,8	2,9	3,8
x (average)	3,20	3,05	4,15	3,90
sx(mean standard deviation)	0,700	0,250	1,250	0,100
s(standard deviation)	0,99	0,35	1,77	0,14
v%(coefficient of variation)	30,94	11,59	42,60	3,63
min	2,50	2,80	2,90	3,80
max	3,90	3,30	5,40	4,00

The minimums parameter variations highlights the difference 1.4% between their extremes (superior 3.9% and inferior 2.5% - recorded in muscles of the second carcass) (Table 3).

The mean values highlight the maximum of total fat content in *Longissimus dorsi* muscle (4.15%), followed at a difference of 0.25% by the content of trapezius muscle (3.90%), the limit of decrease of this statistical parameter being about 3.05% corresponding to triceps brachii muscle (Table 3).

The coefficient of variation presents superior values to its correspondent, of the same parameter studied in common deer, framing limits for values being superior of 42.6 for *Longissimus dorsi* muscle and inferior of 3.63 for trapezius muscle (Table 3).

The amount of water had percentage variations for semitendinosus muscle of the first carcass (74.2%) and is also maintained constant for trapezius muscle of the same carcass. The minimum value (73.1%) corresponding to the *Longissimus dorsi* muscle it is counterweighted by the maximum moisture content (74.8%) recorded in Triceps brachii muscle (Table 4).

For carcass number 2 is distinguished the superiority of all values for each muscle towards the moisture content of the first carcass, highlighting a difference of 1.2% between the minimum of 74.4% for trapezius muscle and the maximum of 75.6% for semitendinosus muscle (Table 4).

Table 4

Water content identified in meat of deer *Capreolus capreolus* males

Nr. crt.	Water value % ♂			
	Semitendinosus muscle	Triceps brachii muscle	*Longissimus dorsi* muscle	Trapezius muscle
1	74,2	74,8	73,1	74,2
2	75,6	75,3	75,2	74,4
x(average)	74,90	75,05	74,15	74,30
sx(mean standard deviation)	0,700	0,250	1,050	0,100
s(standard deviation)	0,99	0,35	1,48	0,14
v%(coefficient of variation)	1,32	0,47	2,00	0,19
min	74,20	74,80	73,10	74,20
max	75,60	75,30	75,20	74,40

Concerning the statistical measures is noticed a maximum value (2.0) of the coefficient of variation in *Longissimus dorsi* muscle while in the trapezius muscle registered a minimum value of 0.19 (Table 4). For minimum values, the water content fluctuates between the following limits: 73.1% in *Longissimus dorsi* muscle of the first carcass and 74.8% for Triceps brachii muscle of the same carcass (Table 4).

Table 5

Protein value in deer *Capreolus capreolus* females

Nr. crt.	Protein value % ♀			
	Semitendinosus muscle	Triceps brachii muscle	*Longissimus dorsi* muscle	Trapezius muscle
1	21,7	21,6	21,5	21,3
2	21,6	21,3	21,6	21,4
x(mean)	21,65	21,45	21,35	21,55
sx(mean standard deviation)	0,050	0,150	0,050	0,050
s(standard deviation)	0,07	0,21	0,07	0,07
v%(coefficient of variation)	0,33	0,99	0,33	0,33
min	21,60	21,30	21,30	21,50
max	21,70	21,60	21,40	21,60

Total protein content varies between an inferior limit of 21.3% corresponding to the trapezius muscle harvested from the first carcass and to triceps brachii muscle from the second carcass (Table 5). Calculating the mean of the parameter, is distinguished that this average is framed by the minimum measure (21.35%), corresponding to *Longissimus dorsi* muscle and the maximum of 21.65% for Semitendinosus muscle (Table 5).

The coefficient of variation is framed between two strict values, a minimum of 0.33 for semitendinosus muscle, *Longissimus dorsi* muscle and Trapezius muscle, with a maximum of 0.99 for Triceps brachii muscle (Table 5).

Table 6

Collagen value in deer *Capreolus capreolus* females

Nr. crt.	Collagen value % ♀			
	Semitendinosus muscle	Triceps brachii muscle	*Longissimus dorsi* muscle	Trapezius muscle
1	20,1	19,9	19,9	19,7
2	19,9	19,7	20	19,7
x(average)	20,00	19,80	19,95	19,70
sx(mean standard deviation)	0,100	0,100	0,050	0,000
s(standard deviation)	0,14	0,14	0,07	0,00
v%(coefficient of variation)	0,71	0,71	0,35	0,00
min	19,90	19,70	19,90	19,70
max	20,10	19,90	20,00	19,70

By processing and analyzing the samples was highlighted the same content in total collagen (19.7%) for trapezius muscle harvested from both carcasses, a value that is maintained also in triceps brachii muscle from the second carcass. However, this represents the minimum numerical value of this compositional index, while the superior limit of 20.1% is indicated in semitendinosus muscle from the first carcass (Table 6).

The mean value of 19.8% is maintained for triceps brachii muscle, and the calculated maximum (20%) is attributed to semitendinosus muscle. The value for the standard deviation (0.14) and coefficient of variation (0.71) remain constant for two muscles: semitendinosus and triceps brachii muscles, and for trapezius muscle these are null (Table 6).

Table 7

Lipid value in deer *Capreolus capreolus* females

Nr. crt.	Lipid value % ♀			
	Semitendinosus muscle	Triceps brachii muscle	*Longissimus dorsi* muscle	Trapezius muscle
1	2	3,2	3,7	4,4
2	3	4,2	2,9	3,9
x(average)	2,50	3,70	3,30	4,15
sx(mean standard deviation)	0,500	0,500	0,400	0,250
s(standard deviation)	0,71	0,71	0,57	0,35
v%(coefficient of variation)	28,28	19,11	17,14	8,52
min	2,00	3,20	2,90	3,90
max	3,00	4,20	3,70	4,40

The content of total lipids for semitendinosus muscle presents a unitary difference between registered values for the two carcasses, value of 2% being also the inferior limit of all the values that characterize the total lipid content of the two carcasses. The maximum of 4.4% was registered for trapezius muscle harvested from the first carcass (Table 7).

Calculated, the parameters mean fits between a minimum of 2.5% for semitendinosus muscle and a maximum of 4.15% for trapezius muscle. The values of the standard deviation and mean standard deviation are represented thus: 0.71 respectively 0.5 for semitendinosus and triceps brachii muscles and 0.35 for trapezius muscle (Table 7).

The percentage of total water from muscles from the two carcasses fits between a minimum of 74.1% triceps brachii muscle and a maximum of 76% corresponding to semitendinosus muscle (Table 8).

Maximum mean values (75.5%) corresponding semitendinosus muscle, it correlates to mean standard deviation by 0.5 and to a maximum coefficient of variation (0.94), while the standard deviation maintains the value of 0.35 for *Longissimus dorsi* muscle (Table 8).

Table 8

Water content identified in meat of deer *Capreolus capreolus* females

Nr. crt.	Water value % ♀			
	Semitendinosus muscle	Triceps brachii muscle	*Longissimus dorsi* muscle	Trapezius muscle
1	76	74,8	74,6	73,9
2	75	74,1	75,1	74,3
x(average)	75,50	74,45	74,85	74,10
sx(mean standard deviation)	0,500	0,350	0,250	0,200
s(standard deviation)	0,71	0,49	0,35	0,28

v%(coefficient of variation)	0,94	0,66	0,47	0,38
min	75,00	74,10	74,60	73,90
max	76,00	74,80	75,10	74,30

CONCLUZII

The study highlights that the features of chemical composition of deer meat are similar to meat from domestic ruminants under poor fattening condition;

The ratio between analyzed parameters reflects higher values for nutritional, biological and alimentary quality of meat obtained from deer, this being found in the actual preferences of consumers (the fat content reported to a low content of collagen)

The harvesting period of the studied specimens should be considered, given that the males were in the breeding period, which was reflected in lower organoleptic properties of meat obtained from males, a fact demonstrated also by different results for chemical composition of meat between sexes. The report of the chemical constituents is more favorable in females, determined by a higher percentage of fat with beneficial consequences on the energy value and culinary qualities.

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