SOME CHARACTERISTICS OF THE MEAT QUALITY OF THE RED DEER (Cervus elaphus elaphus L)

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The term "game" has always been associated with hunting, and game meat used as a specialty, available only to a limited number of people. Contemporary eating habits have influenced people in some European countries to use it, as an ideal food that is safe and healthy, residues free, natural, unprocessed (Frohn,1990). In accordance with these new habits, game have become less a trophy species, and more and more supplementary animal resources. The way of living (intensive) and feeding, a free choice of residence - all this has made their meat different from the meat of domestic animals. Thus, deer meat is considered a dietetic foodstuff, due to its high protein content, low fat and cholesterol contents and a satisfactory balance of saturated and unsaturated fatty acids (Popović,1964; Ristić,1987, Bastić,1995). Deer have,also,proved to be an excellent bioindicator of the environment contamination (Hecht,1994, Saičić,1995). The objective of this study was to point to some characteristics of the meat quality of the red deer (Cervus elaphus elaphus L), that is significantly present in our country.

MATERIAL AND METHODS

The muscular tissue (P.major and P.minor) of the red deer (Cervus elaphus elaphus L),aged 3 months to 14 years (32 samples) was used in our investigation. All the animals came from the same region - Northern Bačka, and were killed during IX-XII 1995 in an organized selective hunting. Prior to the analysis the samples were kept in polyethylene bags, at the t = -24^{o}C. The analysis of the chemical composition was made by AOAC (1995), methods and because of an insufficient amount of samples it was performed only on 5 animals. Hydroxy-proline (Hy-Pro) content was determined by spectrophotometry (Arheth,1971) and cholesterol by direct saponification, followed by GLC analysis (Adams,1986). A Varian 3400 gas chromatograph with DB-1, 30 m fused silica capilary colum with a programed heating rate of 4^{o}/min from 200-300^{o}C, was used for wuantitative analysis. Mineral values (Cu,Fe,Zn, Mg) were determined by AAS after dry ashing (Whiteside,1984). The data were analysed by analysis of variance (Statgraphics program) using age as source of variation.

RESULTS AND DISCUSSION

The examined muscular tissue samples of the red deer have the following chemical composition: water **75,39%**, proteins **22,57%**, fats **1,46%**. Energy value was **463kJ/100 g.** According to Seuss (1990) game meat contains 21,4% of protein, 1,3% fat, 75,7% water and 1,2% ash; whereas energy value was 429kJ/100 g. Ristić et al.,(1987) found the protein content in the red deer leg to be 24,26%, fat content 1-2%. Bastić et al.,(1995) found that M.semimembranosus of fallow deer contain 1,39% lipids (deer), i.e. 1,78% (does). The differences in the lipid content with are sex dependent Popović (1964) considered to have been caused by deer emaciation at the time of mating, namely gravidity in does. Higher fat content in does (1,5-2%) in comparison to deer meat (<1%), we noticed even at the time of this investigation, but due to a small amount of samples, the values are not individually stated.The obtained results conform to the literature data and point to the fact that deer meat has low lipid content and high protein content, and, as for its energy value, it comes right after veal (Seuss I.,1990).

Wild game has low amounts of connective and adipose tissues (Belitz,1987). Our results show that mean Hy-Pro amounted to **0,050%**, Sd = 0,02. The range is **0,028%-0,046%.** In the animals up to 5 years old the mean value was **0,046%**, Sd = 0,01; whereas in those aged from 5-14 years it was **0,055%**, Sd = 0,02. No statistically significant differences in the Hy-Pro content ($p > 0,05$) were found in relation to age dependency of animals. The mean collagen value (Hy-Pro x 8) in total proteins was , on average, **1,77%; 1,64%** for up to 5 years old, **1,92%** > 5 years old. The mean Hy-Pro content for lean beef was 0,122% and for lean pork 0,098% (Đorđević,1986). The red deer leg contains 0,19% Hy-Pro; whereas shoulder has 0,17% (Ristić,1987). Our results are lower that the ones Ristić obtained, in the first place due to different methods used in the determination of Hy-Pro content. In comparison to the mean, Hy-Pro content values of lean beef and pork, the investigated deer muscle showed lower values. Consult Popović's results (1964); he found that deer muscle fibres were tenderer (thickness 40 u) compared to beef.

In addition to some beneficial components meat also contains some that might be harmful to consumers, if present in greater quantities. This is valid for cholesterol mostly.

The mean value is **64,85 mg/100 g.** It has been noticed that the highest values were obtained in the youngest animals **(Fig.1).** The mean value in the group up to 1 year is **93,55,** up to 5 years **56,35** up to 10 years **45,72** and in the oldest group **66,98 mg/100 g.** The same has been noticed in domestic animals, as well. Veal contains more cholesterol than beef (90 and 70 mg/100 g, respect. Seuss,1990). The same author gives for game the following mean cholesterol content 110/mg/100 g, having in mind all kinds of game. Therefore, it is clear why our values are lower.

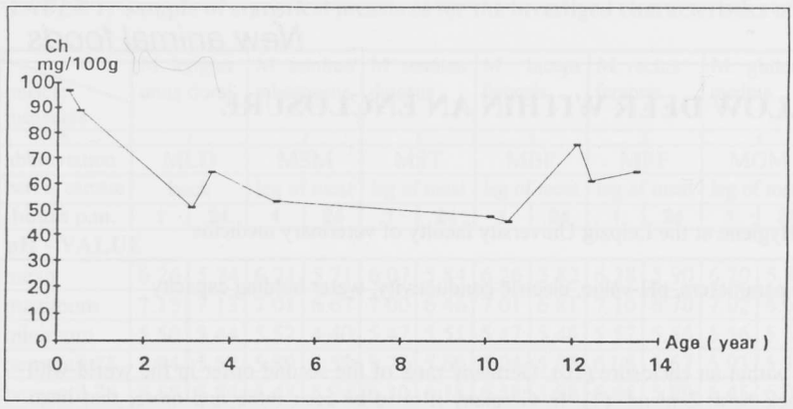

Fig.1. Age dependency of cholesterol contents (mg/100 g) in deer meat

Meat is the best source of Fe,Zn and Mg, due to its high biovalibility (Linder,1985). Table 1, contains mineral values for Fe,Zn,Cu and Mg (mg/kg) in muscular tissue of deer. No statistically significant differences in Fe,Zn and Cu contents in relation to age dependency of animals were found ($p > 0,05$). As for Mg content, there exists a statistically

Age (year)	n	Fe		Zn		Cu		Mg	
		$\bar{x}$	Sd	$\bar{x}$	Sd	$\bar{x}$	Sd	$\bar{x}$	Sd
< 1	7	31,58	9,71	21,50	4,84	0,59	0,30	25,76[a]	2,36
1-5	8	30,91	10,06	24,26	5,92	0,73	0,21	22,88	3,54
5-10	6	28,94	6,74	24,40	5,44	0,74	0,13	23,39	1,41
10-14	11	26,62	6,44	25,26	4,94	0,71	0,18	21,17[a]	2,44

Table 1. Mean Mineral values of deer meat (mg/kg)

[a] $p<0,01$

significant difference ($p<0,01$) only between the youngest (up to 1 year) and the oldest animals (>10 years); as for other groups there is no statistically significant difference ($p>0,05$). According to referential data (Doornenbal,1981) Fe content increases in lean meat with age, opposite to Ca and Mg. Function and vascularity influence the mineral content of lean meat. This is particularly valid for Zn and Fe whose concentration is usually higher in dark (aerobic type) muscles with tonic contraction than in the white (anaerobic type) muscles with phasic contraction (Cassens,1971). According to Underwood,1977), nutrition, season, breed and environment are the factors that can bring about some differences in mineral contents. According to the fundings of Hecht(1986), M.rectus abdominus in the fallow deer, Cu and Zn contents vary depending on whether the animal has been kept at enclosed premises or lived freely in nature. According to Vavak,(1976), Zn,Fe,CO and Ca contents are in positive correlation to meat tenderness and collagen content. According to Seideman(1984), there is a correlation between meat textural properties and Zn content, as well as Fe/Zn relation. It appears that a lower Zn content may be related to the tenderness of meat. The results we obtained are in favour to this statement; a lower Zn content in relation to beef (Radović,1990), and lower connective-tissue content are consistent with the findings of Popović(1964, i.e. that muscle fibres of the deer leg are tenderer compared to the meat of domestic animals. The Cu content is lower than in beef muscular tissue (Đorđević,1986). Deer meat is rich in Fe and exceeds the values of the same in pork and beef(Anderson,1985). The Mg content is identical to that in beef,pork and mutton (Krilova,1973), with the exception of the youngest animals.

CONCLUSIONS

The red deer meat represents a high quality foodstuff with high protein content, low lipid content and favourable energy balance. Low cholesterol content makes it very acceptable from the health aspect; whereas the Zn and collagen contents contribute to its cullinary value. It contains significant amounts of Fe and Mg, as well.

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