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Estimation of Red-Deer (Cervus elaphus) Condition from Central-Eastern Poland on the Basis of the Thickness of External Fat Layer and Kidney Fat Index

Ocena kondycji jeleni (*Cervus elaphus*) pozyskanych w makroregionie Polski środkowowschodniej na podstawie grubości podskórnej tkanki tłuszczowej i wskaźnika tłuszczu okołonerkowego

Energetical needs of red-deer change depending on the season, weather conditions, age and physiological state of the animal were studied. Seasonal and habitat differences of availability and quality of a fodder, the fear on a hunting area making the animal change its localization are reasons why very often the amount of fodder taken by red-deer do not provide for their energetical needs. The energy spent on the animals movements is a major part of its maintenance costs.

Those factors directly affect the animals condition. Not only the weight of carcass or trophy weight in the case of males is the measure of the condition, but also the fat stored. Such estimation lets us find out the extent to which number of animals maintained on the hunting area corresponds to the nutritional capacity, which is practically the measure of rightly managed hunting economy.

In wild herbivorous mammals, the external fat layer and kidney fat index (KFI) can be, among others, the measure of their condition (1, 5, 6).

MATERIAL AND METHODS

Carcasses of male and female red-deer (*Cervus elaphus*) obtained in central-eastern Poland in 1998-1999 were the material for studies. Measurements were made only up to 10 hrs after the hunting.

Estimation of the external fat layer was made measuring its thickness by *musculus longissimus dorsi* at the last rib. It was done using ultrasonograph Aloka SSD-210 DX II with linear sensor 3.5MHz of UST-5020 type. The recorded pictures were collected in a database CSS Multiscan 5.1 with video card AVER 2000.

Both kidneys with kidney fat were prepared in order to calculate the kidney fat index according to the formula:

$$KFI = \frac{\text{weight of kidneys with fat}}{\text{weight of kidneys themselves}}$$

RESULTS AND DISCUSSION

The highest mean carcass weight was found at male red-deer from the beginning of the hunting season. The average carcass weight from the 1st of September to the 31st of October amounted to about 102.91 kg (Table 1). Males obtained after the rut were clearly lighter and their weight was from 77.25 kg (in November) to 93.70 kg at the end of hunting season (statistically significant difference at $P \leq 0.01$).

The external fat layer was also the highest at the beginning of the hunting season and it amounted to 2.98 mm, which is about 0.5 mm thicker than in animals obtained later (statistically significant difference at $P \leq 0.01$).

Table 1. Carcass weight (kg), thickness of external fat layer (mm) and kidney fat index in male red-deer in central-eastern Poland during hunting season

Date of obtaining deer	Carcass weight (kg)			Thickness of external fat layer (mm)			Kidney fat index (KFI)		
	n	LSM	SE	n	LSM	SE	n	LSM	SE
1.09.-31.10.	33	26.17^{A}	26.17	33	2.98^{A}	0.58	33	1.78A	0.12
1.11.-30.11.	4	18.19^{B}	18.19	4	2.46^{B}	0.49	4	1.55^{B}	0.07
1.12.-31.12.	20	7.27^{B}	7.27	20	2.48^{B}	0.27	20	1.52^{B}	0.05
1.01.-28.02.	10	16.55^{B}	16.55	10	2.52^{B}	0.48	10	1.63^{B}	0.06

$^{A-B}$Mean values in columns marked with different letters differ significantly at $P \leq 0.01$.

Kidney fat index was similar. At the beginning it amounted to 1.78 while decreasing to 1.52 in December and 1.63 in January-February (statistically significant difference at $P \leq 0.01$).

Utilization of stored fat begins with the external fat layer combustion when the kidney fat is used. When KFI ranges between 1.00 and 1.05, not only external fat, but also that in abdominal cavity is utilized (1). When studying the carcasses of 16-months-old farming red-deer in a quite good condition and obtained in September, 3.63-mm external fat layer and 1.21 KFI were found [3]. Taking all this into account, it can be concluded that red-deer are in good condition in middle-eastern Poland.

It was found that males had a thicker mean external fat layer than females obtained in the Lublin region (Table 2). It amounted to 2.72 mm and 2.53 mm, respectively. And vice versa, KFI at females was higher (1.73) than at males (1.67) (statistically significant difference at P≤0.01).

Table 2. Thickness of external fat layer (mm) and kidney fat index in red-deer in central-eastern Poland during hunting season – according to sex

Sex	Carcass weight (kg)			Thickness of external fat layer (mm)			Kidney fat index (KFI)		
	n	LSM	SE	n	LSM	SE	n	LSM	SE
Males	67	94.92^{A}	21.80	67	2.72A	0.53	67	1.67A	0.15
Females	32	71.40^{B}	13.61	32	2.53^{B}	0.67	32	1.73^{B}	0.05

$^{A-B}$Mean values in columns marked with different letters differ significantly at P≤0.01.

Table 3. Thickness of external fat layer (mm) and kidney fat index in red-deer males in central-eastern Poland during hunting season – according to age

Age	Carcass weight (kg)			Thickness of external fat layer (mm)			Kidney fat index (KFI)		
	n	LSM	SE	n	LSM	SE	n	LSM	SE
Below 5 years of age	6	66.83^{A}	15.66	6	2.24A	0.69	6	1.58A	0.14
Above 5 years of age	61	97.69^{B}	20.39	61	2.77^{B}	0.50	61	1.67^{B}	0.15

$^{A-B}$Mean values in columns marked with different letters differ significantly at P≤0.01.

Table 4. Thickness of external fat layer (mm) and kidney fat index in red-deer females in central- eastern Poland during hunting season – according to age

Age	Carcass weight (kg)			Thickness of external fat layer (mm)			Kidney fat index (KFI)		
	n	LSM	SE	n	LSM	SE	n	LSM	SE
Below 5 years of age	10	64.20^{A}	9.60	10	2.49^{A}	0.57	10	1.72A	0.06
Above 5 years of age	22	73.53^{B}	14.11	22	2.54^{A}	0.71	22	1.73^{A}	0.05

$^{A-B}$Mean values in columns marked with different letters differ statistically significantly at P≤0.01.

Such results do not differ from the data published by other authors. D z i ę c i o ł o w s k i *et al.* (4) conducting the studies upon red-deer in the Słowiński National Park calculated the KFI in lactating females as 1.64 and in non-lactating as 1.75.

Changes of parameters under study depending on the red-deers' age were analyzed as well. Males over 5 years of age had a thicker external fat layer (2.77 mm) than those below 5 years (2.24 mm) (Table 3). KFI was also higher and

amounted to 1.58 for younger and 1.67 for older males (there was always a statistically significant difference at P≤0.01).

In young females, the external fat layer was 2.49, whereas in older ones 2.54. KFI amounted to 1.72 and 1.73, respectively (Table 4) (statistically significant difference at P≤0.01).

As it is presented by B o b e k *et al.* (2), higher efficiency of deposition process in older females is a result of the fact that proportions of deposited protein and fat are 18.0% and 28.1% of daily gain, respectively. While losing the weight, protein and fat are combusted at the same proportions. Moreover, females relatively easily survive even hard winter in a good habitat and spares associated with embryo development are very low as compared to lactation costs.

CONCLUSIONS

1. It was found that the external fat layer and KFI as well as their stability between 1st of September and the end of February proved good conditions of red-deer in hunting areas of middle-eastern Poland.

2. A thicker external fat layer was found in males than in females, but the latter were characterized by higher KFI (statistically significant difference at P≤0.01).

3. Males above 5 years of age had more adipose tissue than those below 5 years (statistically significant difference at P≤0.01).

4. Females above 5 years of age also had more adipose tissue than those below 5 years (statistically significant difference at P≤0.01).

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STRESZCZENIE

Badano grubość tłuszczowej tkanki podskórnej i wskaźnik KFI u jeleni pozyskanych w makroregionie środkowowschodniej Polski. Analizą objęto samce i samice w grupach wiekowych do 5 lat oraz powyżej 5 lat. Stwierdzono, że zarówno grubość podskórnej tkanki tłuszczowej, jak i wskaźnik KFI świadczy o dobrej kondycji jeleni w łowiskach makroregionu. Wskazuje to na dobre warunki bytowania tych zwierząt, brak niepokoju w łowiskach oraz właściwą gospodarkę łowiecką.