

Variability of individual quality and dressing percentage of roe deer in the Lublin Upland

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A study of the body weight and carcass weight of roe deer does and fawns harvested in the Lublin Upland was carried out during the 2014/15 hunting season. The analyses indicated that the individual quality of roe deer in the Lublin Upland, defined as the carcass weight of does and fawns, is among the highest in the country. The dressing percentage of the roe deer shows that the proportion of carcass weight to body weight determined immediately after harvesting ranges from 74.0% in fawns to 75.4% in does. These results are significantly higher than the hot dressing percentage in domestic animals of the suborder Ruminantia. In the roe deer, the percentage of edible internal organs was 5.9% in females and 6.1% in fawns, while the percentage of inedible parts in the internal organs was 18.7% in females and 19.9% in fawns. These results indicate that the dressing percentage of adult females is higher than that of fawns, irrespective of their sex. During the hunting season for females, weight loss varied between age groups and was 6.67% on average. The decrease in carcass weight was slightly higher, at 7.73%. These results are a confirmation of environmental pressures, especially climatic and trophic factors, on the individual body condition of roe deer. The greater decrease in carcass weight as compared with body weight may indicate that the response of the organism to adverse environmental conditions mainly affects the muscles and fat, and to a lesser extent the internal organs, which undoubtedly can be linked to the annual cycle of increase in adiposity before winter.

KEY WORDS: Roe deer / body weight / carcass weight / Lublin Upland

Body weight, which is an expression of the individual body condition of wild animals, reflects their health condition, the reproduction potential of the population, and its survivability. This indicator is an expression of the environmental conditions in which the animals live and perform their basic life functions and of their adaptive abilities, which neutralize environmental resistance. The most important environmental factor is the size and quality of the food base. Therefore body weight, which changes with the somatic development of animals, is also an indirect reflection of the environmental conditions in

which the animals live. This indicator is also closely linked to the age of the animal [4, 5, 6, 7, 8, 9, 17, 24, 28, 32, 35]. Body weight is additionally dependent on the density of the population. In the case of roe deer, density is inversely proportional to body weight. Furthermore, a significant difference has been shown between the carcass weights of roe deer from different living environments, which also determine population density [1, 5, 11, 13, 18, 24, 32].

In terms of carcass weight, roe deer in Poland are among the heaviest in Europe. In countries to the west and south they are 1-2 kg lighter, while in Sweden and the Baltic countries they are somewhat heavier [1, 2, 22, 25]. Roe deer from the Lublin region are among the heaviest in Poland, with considerable variation in carcass weight in different parts of the region, while the density of the species in this area is among the lowest in the country, which influences body weight [3, 9, 19].

In game animals of the deer family, evaluation of individual quality takes into account the carcass weight, i.e. the weight of the animal after it has been gutted, and in the case of males after removal of the head and antlers. This value directly reflects the body weight prior to acquisition. There are no data at all concerning the body weight of wild animals of the deer family, as no one involved in harvesting game weighs animals in this manner. Studies on the dressing percentage of roe deer evaluating the share of viscera are also rarely conducted [25, 31].

The aim of the study was to determine the individual quality, expressed as body weight and carcass weight, of roe deer does and fawns harvested in the 2014/15 season in field hunting districts (less than 40% forest cover) of the Lublin Upland, as well as their gut percentage, broken down into edible and inedible parts, i.e. the dressing percentage.

Material and methods

The study was based on direct weighing of harvested roe deer (does and fawns). The carcasses were first weighed immediately after the individual was killed, to determine its body weight. Weighing was performed again after the animal was gutted. The carcasses were gutted on the hunting grounds according to regulations [15, 20, 21]. This weighing made it possible to determine the carcass weight of the individual. Then, also by weighing, the weight of the edible internal organs was established. In this case the lungs, heart, liver and kidneys were weighed. These measurements made it possible to establish the weight of the inedible internal organs. All procedures associated with determination of these indices were performed on the hunting grounds, using a laboratory scale accurate to within 0.1 kg. A combined 83 animals were analysed—56 does and 27 fawns.

In cases where the location of the bullet made measurements impossible, due to damage to or missing portions of certain internal organs or muscle groups, the individual was excluded from the study.

In the case of does, age was established on the basis of wear on the teeth, which is a common method in hunting practice as well as in scientific research. The results were used to divide the does into two age groups: 3, 4 and 5 years, and 6 years and older [26, 33]. In fawns, sex was determined on the basis of secondary sexual characteristics [25].

In addition, an analysis was conducted of changes in carcass weight during the hunting season for female roe deer, which lasts from 1 October to 15 January [27]. Four periods were distinguished within the hunting season: I – from 1 to 31 October, II – from 1 to 30 November, III – from 1 to 31 December, and IV – from 1 to 15 January. This was done because of the changes in climate conditions, and thus trophic conditions, for the species in field environments, associated with the end of the growing season.

To determine differences between means for the characteristics analysed and their level of significance, two-way analysis of variance was performed in Statistica 5.0 statistical software, using Tukey's test for unequal subgroups. Correlations between the features analysed, i.e. for dressing percentage and body weight, carcass weight, and weight of edible internal organs, were determined by calculating the linear correlation coefficient between the features.

The study area consisted of field hunting districts in the Lublin Upland region. This region, due to its chernozem soil, is characterized by a small degree of forest cover [23]. This means that most of its hunting districts (90%) are characterized as field districts. Due to the presence of such fertile soil, the region is one of the most fertile in Poland. The agricultural production space index is 77.3 points, which is the highest in the entire macroregion of east-central Poland [36]. Due to the small degree of forest cover, amounting to about 23%, in combination with the high fertility of the soil, mainly highly demanding crops are cultivated, such as wheat, sugar beet and rapeseed. In recent years the area of maize cultivation, primarily for silage, has been increasing.

Despite these characteristics, the region has a low degree of intensification of agricultural production, which is directly reflected in the fairly substantial fragmentation of crops, which increases the mosaic character of the environment. This creates nearly ideal conditions, in terms of both food and cover, for numerous animal species, including populations of roe deer, which are considered ecotone animals [25, 29]. The high quality of food from crop plants and the fairly high degree of fragmentation of forest complexes, together with the low density of the roe deer population in this region [19], have a beneficial effect on the individual quality of roe deer [4, 5, 9, 11, 13]. During the 2013/14 hunting season harvesting of roe deer in this area was at a level of 0.4 individuals per 100 ha of land, while the population density in the spring of 2014 was 2.2 individuals/100 ha [3].

Results and discussion

Analysis of the body weights of the roe deer does and fawns indicates that it varied with the age of the does and the sex of the fawns (Tab. 1). During the evaluation period no

does were harvested at the age of 2 years. The mean body weight was 23.98 kg for 3-year-old does, 25.92 kg for 4-year-old does, and 26.09 kg for 5-year-old does, which was the highest value in the entire sample. The body weight of the oldest age group (6 years and older) was 25.45 kg. The mean body weight of the sample of 56 animals was 25.35 kg. Carcass weight, determined in each animal immediately after gutting, was 18.18 kg in the 3-year-old does, 19.66 kg in 4-year-old does, 19.57 kg in 5-year-old does, and 19.10 kg in the oldest age group. The mean for the entire sample was 19.11 kg. The mean weight of edible internal organs was 1.50 kg in the group of 3-year-old does, 1.51 kg for 4-year-old does, and 1.44 kg for 5-year-old does. In the oldest group of does edible internal organs were heaviest, with an average weight of 1.53 kg. The mean value for this indicator for the does as a whole was 1.50 kg. The mean weight of the inedible organs of the 3-year-old does was 4.30 kg, while in the next two age groups it increased to 4.75 kg and 5.08 kg. In the oldest age group the inedible organs weighed on average 4.82 kg. In the entire sample of 56 animals the mean weight of the inedible organs was 4.74 kg.

In male fawns (5 individuals) the mean body weight was 18.19 kg and the mean carcass weight was 13.32 kg. The mean weight of edible organs for this group was 1.23 kg, and that of inedible organs was 3.64 kg. In the 22 female fawns, the mean body weight was lower than in the males, at 17.31 kg. The mean carcass weight of the male fawns was 12.85 kg, and the weight of the edible and inedible organs was 1.04 and 3.42 kg, respectively. For the entire group of 27 fawns the mean body weight was 17.46 kg and the mean carcass weight was 12.93 kg. The mean value for the weight of edible organs was 1.07 kg and that of inedible organs was 3.46 kg.

Two-way analysis of variance of the carcass weight of does in age groups and fawns in sex groups found no statistically significant ($P \geq 0.05$) differences in the traits (body weight, carcass weight, weight of edible organs and weight of inedible organs) in either the age groups of does or the sex groups of fawns. Statistically significant differences ($P \leq 0.05$) were noted between the means for all traits analysed between does and fawns (Tab. 1).

The analyses of the percentage share of elements of the gut in the total body weight of the animals show that in does the percentage of edible organs was 5.9%, while that of inedible organs was 18.7% (Fig. 1). Therefore the mean carcass weight in relation to the body weight established immediately after shooting, referred to as the hot dressing percentage, was 75.4% in does. In the fawns, the proportion of the carcass weight in the body weight was lower, on average 74.0%, and was lower in male fawns than in females. The mean percentage of edible internal organs in the fawns was similar to that noted for the does, at 6.1%, while the percentage of inedible organs was markedly higher, at 19.9%.

The linear correlation coefficients between the dressing percentage of roe deer and their body weight, carcass weight, and weight of edible organs indicate that the dressing percentage in does decreases with increasing body weight ($r = -0.176$) and an increasing percentage of edible organs ($r = -0.144$); Table 2. In male fawns, dressing percentage

Table 1
Body weight and dressing percentage of roe deer does and fawns

Age, in years (n)	Trait				
	body weight	carcass weight	weight of edible internal organs	weight of inedible internal organs	
Does (♀)					
3 (n=13)	\bar{x} SD	23.98 2.28	18.18 1.75	1.50 0.24	4.30 0.98
4 (n=12)	\bar{x} SD	25.92 2.24	19.66 1.93	1.51 0.21	4.75 0.73
5 (n=12)	\bar{x} SD	26.09 1.76	19.57 1.44	1.44 0.26	5.08 0.75
6 and older (n=19)	\bar{x} SD	25.45 1.65	19.10 1.27	1.53 0.18	4.82 1.12
Total (n=56)	\bar{x} SD	25.35* 2.07	19.11* 1.63	1.50* 0.22	4.74* 0.96
Male fawns (♂)					
(n=5)	\bar{x} SD	18.19 2.59	13.32 2.25	1.23 0.15	3.64 0.57
Female fawns (♀)					
(n=22)	\bar{x} SD	17.31 2.51	12.85 1.69	1.04 0.16	3.42 0.96
Total fawns (♂♀)					
Total (n=27)	\bar{x} SD	17.46* 2.50	12.93* 1.76	1.07* 0.17	3.46* 0.89

*Mean values in columns for total females and fawns differ statistically significantly ($P \leq 0.05$)

Table 2
Correlation coefficients between dressing percentage and roe deer body weight and weight of edible internal organs

Dressing percentage (%)	Body weight (kg)	Weight of edible internal organs (kg)
Does (♀)	-0.176	-0.144
Fawns (♂)	0.494*	0.277
Fawns (♀)	-0.460*	-0.176

*Statistically significant correlation coefficients between dressing percentage and body weight of fawns ($P \leq 0.05$)

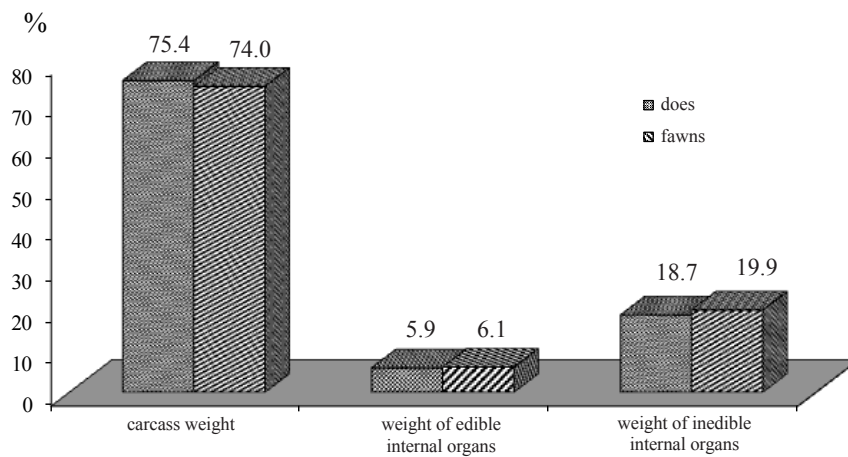


Fig. 1. Percentage of particular elements in the body weight of roe deer does and fawns

was positively correlated with body weight ($r=0.494$) and the weight of edible organs ($r=0.277$), whereas in the female fawns dressing percentage was found to be negatively correlated with body weight ($r=-0.460$) and the weight of edible organs ($r=-0.176$).



Fig. 2. Variability of body weight and carcass weight of roe deer females in selected periods of the hunting season

Statistically significant correlations ($P \leq 0.05$) were found only between dressing percentage and body weight in fawns of both sexes; the correlation was positive in males and negative in females. However, due to the small sample size of the fawns, particularly the males, no generalized conclusions can be drawn from these results.

The study included an analysis of variation in the body weight and carcass weight of female roe deer during four periods of the hunting season. During the hunting season, despite fluctuating distribution of mean body weights and carcass weights of female roe deer, a downward tendency was noted for these characteristics (Fig. 2). The decrease between the first and final period was 6.67% in the case of body weight and 7.73% in the case of carcass weight. This was confirmed by the values for the trendline equation: $y = -0.259x + 26.185$ for body weight and $y = -0.398x + 19.94$ for carcass weight.

The analysis of changes in the carcass weight of female roe deer harvested in different periods of the hunting seasons indicates substantial variation in this trait. The main factor influencing the body weight of does during the hunting season is the end of the growing season, when the food base is considerably poorer in both fields and forests. In addition, part of the hunting season is in winter, which due to the poor food base during this period is associated with increased energy expenditures resulting from locomotion and thermoregulation. Moreover, expenditures associated with the development of a foetus or foetuses are undoubtedly significant for does.

Comparison of the results obtained with those found in the literature shows that the mean carcass weights of female roe deer are currently higher in all age groups than the carcass weight of does obtained in the 2008/09 hunting season in the field hunting districts of the Lublin Upland and Polesie [11, 12]. The current mean carcass weight of does in the oldest age group, i.e. 6 years and older, is 0.9 kg higher than the previous values obtained in the Lublin Upland and 0.7 kg higher than in Polesie. In the case of male fawns, currently the carcass weight of harvested animals is higher than that of animals obtained in the 2008/09 hunting season in the field hunting districts of the Lublin Upland and Polesie. In the case of female fawns, the mean carcass weight is currently lower than in the 2008/09 season in the Lublin Upland and higher than in Polesie [11, 12]. Janiszewski et al. [18], in a study on the carcass weight of roe deer in northern Poland, reported an average carcass weight of 16.5 kg for does and 11.2 kg for fawns. The results for carcass weight are 2.6 kg higher than in northern Poland in the case of does, and 1.7 kg higher in the case of fawns. Sporek [30], in an analysis of the carcass weight of roe deer in the Sudety mountains in 2005-2011, reported a mean carcass weight for does of 16.45 kg, which was 2.66 kg lower than in the case of does currently harvested in the Lublin Upland. The results obtained for the dressing percentage of roe deer show that it is higher than among domesticated ruminants. Wajda et al. [34] reported a varied dressing percentage for bulls with a body weight of about 570 kg, ranging from 54.2% to 55.9%, depending on the fat class. According to data from the Central Statistical Office (GUS) [16], the hot dressing percentage is 51.78% for cattle and 60.0% for calves. In the case of sheep it is much lower, at 44.0%. The

percentage of edible internal organs is 14.4% in cattle and 15.9% in calves. It is lower in sheep, at 11.8%.

Flis reports [10] that during the doe hunting season the decrease in carcass weight varied depending on the age of the animals. In the oldest group the decrease was 12.7%, while in the currently harvested does it was lower, at 7.7%. In northern Poland, the carcass weight of does during the season varied depending on the region and was highest in November and December [18].

The results of the present study confirm previous reports by other authors indicating that the European roe deer exhibits high variation in body weight depending on its geographical location, as well as on its living environment and the period when the study is conducted, which is determined by the phenological season of the year, and thus the availability of the food base and nutritional demands associated with the physiological state of the animals [1, 10, 11, 14, 18, 30]. The results also confirmed the hypothesis put forth by Gaillard et al. [14] that there is no pronounced differentiation of body weight in fawns of different sexes.

The results obtained indicate that the individual development of female roe deer in the Lublin Upland, assessed as body weight and carcass weight, culminates at the age of 4-5 years. At the same time, current mean carcass weight values, i.e. for the 2014/15 season, are nearly 1 kg higher than in a study conducted in the same region six years earlier. This suggests that the individual quality of roe deer in the region, expressed as carcass weight as a reflection of body weight, is higher than in other regions of the country and shows an upward trend.

In fawns, no significantly significant difference was noted in body weight or carcass weight depending on sex, but markedly higher values were noted for male fawns.

The dressing percentage noted for the roe deer shows that the carcass weight percentage in relation to body weight, determined immediately after the animals were killed, ranged from 74.0% in fawns to 75.4% in does. These values were markedly higher than in domesticated ruminants.

The percentage of edible internal organs was 5.9% in does and 6.1% in fawns. These results indicate a much lower percentage of edible internal organs than in livestock animals. The percentage of inedible internal organs was 18.7% in does and 19.9% in fawns. Therefore the results suggest that the dressing percentage of adult females is higher than that of fawns, irrespective of sex.

During the hunting season for does the decrease in body weight varied depending on the age group and averaged 6.7%. The decrease in carcass weight was somewhat greater, at 7.7%. These results are a confirmation of environmental pressure, especially climatic and trophic factors, on the body condition of the animals. The greater decrease in carcass weight in comparison with body weight may indicate that the body's response to unfavourable environmental conditions mainly involves the muscles and fat, and to a lesser degree the internal organs, which may be linked to the yearly cycle of increased fat cover before the winter.

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