

CHARACTERISTICS OF SELECTED PARAMETERS OF ANTLERS OF THE FARMED FALLOW DEER (*DAMA DAMA*) IN POLAND

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ABSTRACT

The aim of the study was to estimate antler parameters (mass, volume, density) of fallow deer (*Dama dama*) kept in in the Research Station of the Institute of Parasitology, Polish Academy of Sciences, Kosewo Górne. The study involved 25 stags divided into 4 age groups: 2 years old (n = 4); 3 years old (n = 4); 4 years old (n = 12); 5 years old (n = 5). Antlers were cut before rutting when animals already rubbed velvet off. The analyses showed the significant differences in the mass and volume between age groups. Mass and volume increase with age while density was levelled.

Key words: fallow deer, *Dama dama*, antlers, fallow deer farming

INTRODUCTION

The fallow deer (*Dama dama*) belonging to *Cervidae* family is not a native species but due to a great ecological adaptability it became common in Poland [Łabudzki 2011]. Moreover, due to small body size and variable coat colour, the fallow deer is popular breeding species [Janiszewski et al. 2014]. Farm breeding of *Cervidae* is still developing in Polish agriculture but its importance is increasing. The fallow deer as well as red deer have been included in the list of farm animals [Ustawa 2020]. It is an alternative meat source and enables to utilise less productive agricultural areas [Cilulko 2011]. The main aim of breeding animals of the *Cervidae* family is production of meat but also leather and antlers, which is the goal of such farms worldwide [Jugli et al. 2019]. Deer farms arose interest among tourists, therefore more and more farms provide tourist and educational services [Borys et al. 2012]. Apart from meat, leather and antlers production, farm breeding allows for understanding deer biology and specific reproductive behaviour of these animals [Cilulko 2011]. A characteristic feature of the fallow deer males is antlers – a bone structure shed and re-grown ev-

ery year [Wajdzik and Okarma 2011, Contreras-Moreno et al. 2019]. Unlike a red deer a fallow deer's antlers takes on a palmate form, multi-point antlers whose length reaches on average up to 80–90 cm and weight up to 5–6 kg. The first antlers appear in two-year-old stags, their mass increases and their shape changes with age. The antlers are usually shed annually in April and the new ones are regrown and free of velvet by August [Wajdzik and Okarma 2011]. This cycle is associated with seasonal variations of many hormones like testosterone, grow factor (GH), insulin-like growth factor 1 (IGF-1), thyroid hormones, parathyroid and adrenal hormones, [Elliott et al. 1996, Sadighi et al. 2001, Bartos et al. 2012, Tajchman et al. 2019]. Moreover, nutrition influences the development of antlers, in particular the adequate levels of protein and energy, as well as micronutrients (Ca, P) especially during the period of antler growth [Dryden 2016]. Antlers are not exclusively an ornament attracting females; they are also a weapon during male fights in rut. Males fight with each other for harem and territory using mainly their antlers [Jensz and Finley 2013].

The aim of this study was to estimate antler parameters (mass, volume, density) of farmed fallow deer based

on data collected in the Research Station of the Institute of Parasitology, Polish Academy of Sciences in Kosewo Górne.

MATERIAL AND METHODS

Study area

Cervid farm in Kosewo Górne functions within the structure of the Research Station of the Institute of Parasitology, Polish Academy of Sciences. It is situated in an attractive landscape of Masurian Lakeland. The farm established in 1984 was one of the first cervid farms in Poland. The animals bred there include the fallow deer (*Dama dama*), red deer (*Cervus elaphus*) and sika deer (*Cervus nippon*). The farm meets the requirements of ecological farms. On 700-ha land there are pens for animals, croplands and a lake. Fallow deers spend winter (December–April) indoors, where they had constant access to water and roughage, and once a day they were given concentrated feed as recommended by Janiszewski et al. [2014]. From May to August, the animals were kept in a separate pasture with conditions similar to their natural habitat. During both the winter and grazing periods, the deer were provided with adequate living space recommended by [DEFRA 2023, FEDFA 2023, Mattiello 2009].

Data collection

Antlers were acquired in September 2018 from 25 individuals. Based on the breeding documentation, the age of the stags was recorded and the animals were divided into 4 age groups: 2 years old (n = 4); 3 years old (n = 4); 4 years old (n = 12); 5 years old (n = 5). Study material was antlers of the fallow deer (*Dama dama*) obtained by cutting by qualified staff of the farm. Cutting the antlers is one of routine zootechnical treatments performed for the reason of security of both stags (to avoid injuries) and farm personnel (fallow deer males are aggressive during rut). Antlers were cut before rutting when animals already rubbed velvet off. Males were immobilised in small crush (2 m × 2 m × 0.6 m) and antlers were carefully cut off with a handsaw 1–2 cm from the pedicle with no need of sedation [Janiszewski et al. 2014]. After cutting, the antlers were kept for two months in a dry and ventilated room until the analyse. Antlers were weighed and their hydrostatic volume was determined with the method of Archimedes. Antlers were immersed in a container filled with water and the volume of displaced water was determined. Density was calculated from mass and volume [McDonald et al. 2005; Paramio et al. 2012] with the following equation:

$$\rho = \frac{m}{V}$$

where:

ρ – density, g · cm⁻³,

m – mass, g,

V – volume, cm³.

Statistical calculations were performed using one-way analysis of variance with IBM SPSS Statistics 25.0 software [SPSS 2019].

RESULTS

Table 1 shows the comparison of mass, volume and density of fallow deer antlers. Test done on analysed data shows significant differences in mass and volume of antlers between age groups of fallow deer stags especially between two and three years stags and older stags. The lowest mass was recorded in 2 years old males (606.25 g) and the highest mass were found in four and five years old males, which were similar values (respectively 1501.56 g vs 1545.00 g, $P \geq 0.05$). The same situation occurred with the volume measurement results. The density in each group had similar values ($P \geq 0.05$). but antlers of 2 years old male had the greatest density (1.30 g · cm⁻³). It has been observed that the mass and volume of 4–5 years stags is approximately 2.5 times greater as compared to 2 year males. Significant differences in studied antlers parameters between the right and left beam were not found.

DISCUSSION

The fallow deer (*Dama dama*), due to its biological features is an attractive breeding species and antlers of fallow deer are a characteristic bone structure, which needs closer examination, although publications devoted to these issues are scarce. Presented study showed the significant differences in the mass and volume between age groups. This confirms other findings [Wajdzik and Okarma 2011, Contreras-Moreno et al. 2019] that antler's mass increases with age. The same results were obtained from studies of the roe deer (*Capreolus capreolus*) and red deer (*Cervus elaphus*), whose antlers were also heavier in older than in younger individuals [Pis et al. 1994, Lehoczki et al. 2011, Putman et al. 2019, Smolko et al. 2022]. Studies by Pelabon and Joly [2000] demonstrated directional asymmetry of antlers in the fallow deer. Left beam is significantly bigger than the right one and the difference increases with age, which is, however, not related to the domination of individuals. Analyses of the density of antlers were performed in many representatives of the *Cervidae* family but not in the fallow deer. Results of red deer antlers density reported by Currey [1979], Lees [1982] and Landete-Castillejos et al. [2010] were higher and were respectively: 1.86 g · cm⁻³, 1.74 g · cm⁻³, 1.75 g · cm⁻³. The density of white tailed deer (*Odocoileus virginianus*) was 1.59 g · cm⁻³ [McDonald et al. 2005]. However results obtained in this study was similar to results conducted on red deer of

Table 1. Comparison of selected parameters of antlers between age groups of stags

Parameter	n	Age (years)			
		2	3	4	5
Mass of right beam, g	\bar{x}	307.75 ^{AB}	557.25 ^{Aa}	730.17 ^{Ba}	793.60 ^A
	SE	56.80	56.80	32.79	50.80
Mass of left beam, g	\bar{x}	298.50 ^{ABC}	596.50 ^{Aa}	795.75 ^{Ba}	751.40 ^C
	SE	71.65	71.65	41.37	64.08
Total mass, g	\bar{x}	606.25 ^{ABC}	1153.46 ^{Abc}	1501.46 ^{Bb}	1545.00 ^{Cc}
	SE	121.72	121.72	67.52	108.87
Volume of right beam, cm ³	\bar{x}	234.25 ^{AB}	464.25 ^{Aa}	615.00 ^{Ba}	645.60 ^A
	SE	49.02	49.02	28.30	43.84
Volume of left beam, cm ³	\bar{x}	221.25 ^{ABC}	515.75 ^A	637.83 ^B	623.60 ^C
	SE	67.37	67.37	38.90	60.26
Total volume, cm ³	\bar{x}	455.50 ^{ABC}	980.00 ^A	1224.62 ^B	1269.20 ^C
	SE	112.93	112.93	62.64	101.01
Density of right beam, g · cm ⁻³	\bar{x}	1.30	1.20	1.19	1.23
	SE	0.05	0.05	0.03	0.04
Density of left beam, g · cm ⁻³	\bar{x}	1.38	1.16	1.27	1.22
	SE	0.11	0.11	0.06	0.10
Total density, g · cm ⁻³	\bar{x}	1.33	1.18	1.24	1.22
	SE	0.05	0.05	0.03	0.05

Values with the same letter in the row statistically significant at: A, B, C, – $P \leq 0.01$; a, b – $P \leq 0.05$.

Chen et al. [2009] and Paramio et al. [2012], where density was $1.35 \text{ g} \cdot \text{cm}^{-3}$ and $1.12 \text{ g} \cdot \text{cm}^{-3}$. The density in our studies were similar in each stag groups but the highest was found in the youngest group ($1.30 \text{ g} \cdot \text{cm}^{-3}$). Paramio et al. [2012] demonstrated that the density of antlers in the Iberian red deer (*Cervus elaphus hispanicus*) depends on: growth phase of antlers, the share of spongy bone, mineral composition of antlers and age and status of an individual. Therefore, this parameter can be useful to assess stags conditions or to monitor their environmental conditions.

CONCLUSIONS

An assessment of selected parameters of antlers presented here and elaboration of available literature data allowed for describing biological and breeding specifics of the fallow deer and for formulating the following conclusions:

1. Studies demonstrated the effect of age on antler mass – antlers of younger individuals are lighter. The older is the stag the heavier are its antlers. Comparison of age groups showed significant differences in mass

and volume of antlers. Mass and volume increase with age while density is levelled.

2. Analyses presented in this paper do not show significant differences in studied antlers parameters between the right and left beam.
3. Such studies need to be continued since there are not many publications pertaining to antlers of the fallow deer. An assessment might be enlarged by other antler parameters and the effect of different factors on their development.

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CHARAKTERYSTYKA WYBRANYCH PARAMETRÓW POROŻY DANIELI ZWYCZAJNYCH (*DAMA DAMA*) HODOWANYCH W POLSCE

STRESZCZENIE

Celem badań była charakterystyka parametrów (masy, objętości i gęstości) poroża danieli zwyczajnych (*Dama dama*) utrzymywanych w Stacji Badawczej Instytutu Parazytologii PAN w Kosewie Górnym. Badaniami objęto 25 byków podzielonych na 4 grupy wiekowe: 2-letnie (n = 4); 3-letnie (n = 4); 4-letnie (n = 12); 5-letnie (n = 5). Poroże zostało ścięte przed bekowiskiem, kiedy zwierzęta zdążyły już zetrzeć scypuł. Analizy wykazały istotne różnice w masie i objętości pomiędzy grupami wiekowymi. Masa i objętość wzrastały wraz z wiekiem, podczas gdy gęstość była wyrównana.

Słowa kluczowe: *Dama dama*, poroże, hodowla fermowa danieli

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