

Short note

An attempt to deworm European bison (*Bison bonasus*) in the European Bison Breeding Center of Białowieża National Park with Alphasen (albendazole)

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ABSTRACT. Parasitic infections are one of the most important factors affecting the health and condition of wild ruminants, including bison, particularly those kept in closed breeding, and regular deworming is important. The aim of this study was to investigate the effectiveness of deworming European bison in BNP (Białowieża National Park) reserves with Alphasen (albendazole). The drug was administered orally at a dose of 15 mg/kg body weight. To assess the effectiveness of the treatment, samples of bison faeces were examined by flotation, sedimentation and Baermann methods before deworming and 14 days after drug administration. Treatment efficacy was calculated according to the Faecal Egg Reduction Test (FERCT). Deworming was not effective against gastrointestinal nematodes of the Trichostrongylidae family, *Fasciola hepatica* or *Paramphistomum cervi* flukes, or *Eimeria bovis* coccidia. A deworming efficacy of 100% was recorded against the lung nematodes *Dictyocaulus viviparus*, the nematodes *Nematodirus* sp. and *Aonchotheca* sp., the tapeworms *Moniezia* sp. and the coccidia *Eimeria zuernii*, *E. cylindrica*, *E. brasiliensis* and *E. subspherica*. The ineffectiveness of deworming against the most dangerous bison parasites (gastrointestinal nematodes and flukes) may indicate the development of albendazole-resistant parasite strains, possibly due to long-term, repeated administration.

Keywords: albendazole, deworming, drug resistance, effectiveness, European bison

Introduction

The European bison is the largest mammal living in Europe. It was saved from extinction through the actions of several generations of Polish naturalists, foresters and veterinarians. A key role in the restitution process was played by the BNP, which currently is home to various wild bison herds and animals in its closed reserves. However, the species was reproduced from only 12 individuals, and hence shows little genetic variation; as such, European bison are particularly susceptible to various pathogens due to inbreeding depression. The resources of the BNP include approximately 30 bison [1,2].

Some of the most common diseases in bison are

parasitoses. So far, 73 species of internal parasites have been found, including 22 species of protozoa, 51 species of helminths and 15 species of ectoparasites [3,4]. The extensity and intensity of parasitic infections are also influenced by keeping bison restricted areas on closed reserves. Such living conditions negatively affect the health of infected animals, may lead to clinical forms of parasitosis, and even fatalities. As such, any bison kept in reserves must be regularly dewormed [5], and the effectiveness of this treatment should be assessed after deworming.

In the current study, deworming treatment was given to bison maintained in closed reserves using Alphasen (albendazole). After deworming, the effect of the drug was assessed.

Materials and Methods

The study was conducted in April 2022 in the closed reserves of the BNP. In order to determine the infection of animals before deworming, samples of fresh faeces were collected in the BNP from 13 bison kept there, aged 1 to 18 years. The faeces samples were tested for the presence of gastrointestinal nematode eggs and coccidian oocysts by direct flotation in a saturated sucrose solution. The fluke eggs were examined by sedimentation and the lungworm larvae by Baermann's method [6]. The samples were examined using a JENAVAL microscope under 100–400× magnification. Any identified parasite eggs, oocysts or larvae were classified based on their morphometric features [6,7]. The intensity of infection was measured by the number of dispersive forms of parasites found in 3 g of faeces.

The bison were dewormed with Alpalben: an oral suspension for cattle and sheep, containing 100 mg/ml albendazole. It is recommended for the treatment of parasitoses caused by gastrointestinal nematodes, pulmonary nematodes, *Moniezia* spp.

tapeworms and adult flukes of *F. hepatica* and *Dicrocoelium dendriticum*. The drug was administered to bison after mixing with concentrate feed in the form of crushed oats and ground corn at a dose of 15 mg/kg body weight.

After 14 days, the faeces were collected again from nine bison from the same enclosures. Treatment efficacy was calculated using the FECRT formula, a method recommended by the WAAVP (World Association for the Advancement of Veterinary Parasitology). A FECRT score of less than 90% indicates the occurrence of drug resistance [8,9].

Results and Discussion

Before deworming, all examined bison were found to be infected with parasites. The faeces samples were found to contain eggs of gastrointestinal nematodes (*Aonchotheca* sp., *Nematodirus* sp. and *Strongyloides* sp.), nematodes (Trichostrongylidae), larvae of the lung nematode *D. viviparus*, tapeworm eggs (*Moniezia* sp.), oocysts of coccidia from five species of *Eimeria* (*E.*

Table 1. Effectiveness of deworming European bison in the reserves of the Białowieża National Park (n – number of examined animals)

Parasites	Before deworming (n=13)			After deworming (n=9)			Effectiveness %
	Number of infected	Prevalence %	Average intensity of infection (min–max)	Number of infected	Prevalence %	Average intensity of infection (min–max)	
Trichostrongylidae	13	100	86(1–696)	4	44.4	254(11–556)	-195
<i>Nematodirus</i> sp.	1	7.7	8(0–8)	0	0	0	100
<i>Aonchotheca</i> sp.	1	7.7	1(0–1)	0	0	0	100
<i>Strongyloides</i> sp.	2	15.3	1(0–1)	1	11.4	1(0–1)	0
<i>Dictyocaulus viviparus</i>	6	46.1	13.5(1–65)	0	0	0	100
<i>Fasciola hepatica</i>	9	69.2	4.7 (1–28)	3	33.3	7.6(2–18)	-61
<i>Paraphistomum cervi</i>	9	69.2	6.4(1–27)	7	77.7	7.2(1–22)	-12
<i>Moniezia</i> sp.	1	7.7	1(0–1)	0	0	0	100
<i>Eimeria bovis</i>	9	69.2	23.1(1–87)	4	44.4	48.5(14–125)	-109
<i>E. zuernii</i>	8	61.5	3.7(2–10)	0	0	0	100
<i>E. cylindrica</i>	4	30.7	3.5(2–5)	0	0	0	100
<i>E. brasiliensis</i>	1	7.7	1(0–1)	0	0	0	100
<i>E. subspherica</i>	1	7.7	1(0–1)	0	0	0	100

bovis, *E. zuernii*, *E. brasiliensis*, *E. cylindrica* and *E. subspherica*) and eggs of *F. hepatica* (liver fluke) and *P. cervi* (rumen fluke).

Of the identified parasites, the Trichostrongylidae eggs showed the highest prevalence, reaching 100%. The maximum intensity of infection with these nematodes, expressed as the number of parasite eggs per gram of faeces (EPG), was 696. In addition, *F. hepatica* (max 28) and *P. cervi* eggs (max 27) and *E. bovis* coccidia oocysts (max 87) were found in nine bison. *E. zuernii* was found in eight bison with the maximum number of 10 oocysts, and *E. cylindrica* was detected in four bison with the maximum number of 5 oocysts. A maximum of 65 *D. viviparus* larvae were found in a single bison. Nematode eggs (*Nematodirus* sp., *Aonchotheca* sp., *Strongyloides* sp.), coccidian oocysts (*E. brasiliensis* and *E. subspherica*), and tapeworm eggs (*Moniezia* sp.) were recorded only in individual bison, with their number reaching only a few specimens.

The deworming process with Alphasen (albendazole) was not effective against the Trichostrongylidae gastrointestinal nematodes, *F. hepatica*, *P. cervi* or *E. bovis*. However, 100% efficacy was recorded against the lung nematodes *D. viviparus*, nematodes *Nematodirus* sp., *Aonchotheca* sp., tapeworms *Moniezia* sp. and coccidia *E. zuernii*, *E. cylindrica*, *E. brasiliensis* and *E. subspherica* (Tab. 1).

Many studies have evaluated the effectiveness of deworming European bison in the closed reserves of the BNP [10–13]. The first attempt, in 1997, used the preparation Ivomec Premix (ivermectin). It was found to be effective against the gastrointestinal nematodes of the Trichostrongylidae (91.6% efficiency), as well as against the lung nematode *D. viviparus* and the large intestine nematode *Trichuris ovis* (100%) [10]. A second study, in 1999, examined the use of Vermitan 20% granules achieving a deworming efficiency of 96% against nematodes of the Trichostrongylidae family, 99% against *D. viviparus*, and 100% against *P. cervi* and *Moniezia* sp. tapeworms [11]. This was the first use of the preparation containing albendazole in bison in the Bison Breeding Center of BNP.

Another study on the effectiveness of deworming with a preparation containing albendazole (Valbazen 10%) was carried out in 2012, 13 years after the first application of albendazole in European bison [13]. This deworming turned out to be highly effective against

the nematodes *Aonchotheca* spp. and *D. viviparus* (100%). However, the FECRT regarding *Nematodirus* spp. was 85%, Trichostrongylidae nematodes 90%, and *F. hepatica* flukes 82%, which, according to WAAVP guidelines, already indicates the occurrence of drug resistance.

In the present study, conducted 23 years after the first use of albendazole-based drugs, the FECRT values with regard to Trichostrongylidae nematodes and the flukes *F. hepatica* and *P. cervi* turned out to be negative. The deworming was not found to be effective against the most important parasites of bison: the gastrointestinal nematodes of the Trichostrongylidae and the liver fluke *F. hepatica*. It appears that the resistance of gastrointestinal nematodes and flukes to albendazole has intensified.

The first studies to demonstrate resistance to benzimidazoles by bison nematodes were carried out in a European Bison Breeding Center in Sweden, where the FECRT test was performed to determine the effectiveness of fenbendazole treatment for bison. In addition, to detect the bloodsucking species *Haemonchus contortus*, stage III nematode larvae were cultured from bison faeces and subjected to molecular testing. Faeces samples were collected one day before deworming, and again eight days afterwards. The treatment was effective against nematodes of the genera *Nematodirus* and *Trichuris*; however, the FECRT was only 30% against nematodes of the subfamily Ostertagiinae, indicating resistance. Polymerase chain reaction (PCR) analysis of the cultured third-stage larvae (L3) indicated the presence of *H. contortus*, *Ostertagia ostertagi* and *Cooperia oncophora* before treatment, but only *H. contortus* after treatment. These findings confirm the development of resistance to fenbendazole in *H. contortus* in this bison breeding center [14].

Our findings clearly show that albendazole treatment had low effectiveness against gastrointestinal nematodes and flukes in bison in the BPN. This confirms the possibility of drug resistance to this benzimidazole anti-helminthic drug. Resistance is driven by many factors, such as the chemical properties of the drug, the adaptability of the parasites and the administration of insufficient doses; it is also affected by long-term use of the drug and inappropriate timing and frequency of treatment [15]. In the current study, the likely reason for the development of albendazole-resistant strains of parasites may be long-term, repeated drug

administration.

The appearance of drug-resistant populations of parasites in European bison poses a threat to this species. As such, the effectiveness of deworming should be systematically controlled using methods recommended by the WAAVP. To ensure effective deworming of bison in the BPN reserves, it is necessary to select a preparation belonging to a another chemical group, with a different mechanism of action from those used so far.

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