

Opinions and knowledge of veterinary students relating to exotic non-mammal pet animals and their welfare

Mario Ostović^{1*}, Ivana Sabolek¹, Aneta Piplica², Ivona Žura Žaja³, Tomislav Mikuš⁴, Sven Menčik², Kristina Matković¹, Željko Pavičić¹, and Željka Mesić⁵

¹Department of Animal Hygiene, Behaviour and Welfare, Faculty of Veterinary Medicine, University of Zagreb, Zagreb, Croatia

²Department of Animal Breeding and Livestock Production, Faculty of Veterinary Medicine, University of Zagreb, Zagreb, Croatia

³Department of Physiology and Radiobiology, Faculty of Veterinary Medicine, University of Zagreb, Zagreb, Croatia

⁴Department of Hygiene, Technology and Food Safety, Faculty of Veterinary Medicine, University of Zagreb, Zagreb, Croatia

⁵Department of Marketing in Agriculture, Faculty of Agriculture, University of Zagreb, Zagreb, Croatia

OSTOVIĆ, M., I. SABOLEK, A. PIPLICA, I. ŽURA ŽAJA, T. MIKUŠ, S. MENČIK, K. MATKOVIĆ, Ž. PAVIČIĆ, Ž. MESIĆ: Opinions and knowledge of veterinary students relating to exotic non-mammal pet animals and their welfare. *Vet. arhiv* 92, 349-358, 2022.

ABSTRACT

This study aimed to identify the opinions and knowledge of Croatian veterinarians-to-be relating to exotic pet birds, reptiles, amphibians and fish, and their welfare. A total of 589 (87%) veterinary students from all six years of the integrated undergraduate and graduate study programme were surveyed in the 2019-2020 academic year. Student opinions and knowledge were assessed using a 5-point Likert scale and the following statements: the level of cognition, sentience and welfare compromise in pet animals observed; the importance of biological functioning, emotional states and natural living for their welfare; their acceptability as pets and owner awareness; the level of risk posed by these pet animals to other animals, public health and safety, and the environment; and the level of knowledge students considered themselves to have about their feeding, housing, health and behaviour. Students provided neutral responses to or disagreement with most of the statements, in particular for animals other than birds, with no significant differences between study years. Accordingly, the study results point to the need for additional student education on exotic non-mammal pets, and can serve for the upgrading of the veterinary curriculum in the field, having implications not only for the welfare of these animals but also for other animals, public health and safety, and environmental protection.

Key words: veterinary students; opinion; knowledge; exotic pets; animals; animal welfare

*Corresponding author:

Mario Ostović, Associate Professor, PhD, DVM, Department of Animal Hygiene, Behaviour and Welfare, Faculty of Veterinary Medicine, University of Zagreb, Heinzelova 55, 10000 Zagreb, Croatia, Phone: +385 1 2390 294, Fax: +385 1 2441 390, e-mail: mostovic@vef.unizg.hr

Introduction

Non-traditional or exotic pets are becoming increasingly popular worldwide (SCHUPPLI et al., 2014; GRANT et al., 2017), referring generally to animals that are either non-native to a region or non-domesticated (WARWICK et al., 2018). It is estimated that there are 52.01 million ornamental pet birds, 29.95 million small mammals, 10.39 million aquaria and 9.05 million reptiles in Europe alone (STATISTA, 2021).

The trade in and keeping of exotic pets raise a number of ethical concerns, including issues of animal welfare, public health and safety, and biodiversity conservation (HERREL and VAN DER MEIJDEN, 2014; PASMANS et al., 2017; WARWICK et al., 2018). The annual trade in exotic vertebrates as pets is a multi-billion dollar global business. Thousands of species and tens of millions of individual animals are shipped internationally, as well as within countries, to meet this demand (LOCKWOOD et al., 2019), including increasing illegal trade as a worldwide issue (KIESWETTER, 2017; VAN ROON et al., 2019). Many animals may suffer or die at any point in the trade and keeping chain, including capture, handling, storage, transportation, intensive captive breeding, poor housing conditions, captivity stress, injuries and diseases. Many species are endangered due to individual animals being taken away from wildlife, while many animals are released accidentally or deliberately to a new area and may become an invasive alien species (WARWICK, 2014). Many exotic pets may cause injuries or poisoning (WARWICK and STEEDMAN, 2012), or transmit diseases to their keepers or to other species (SCHUPPLI et al., 2014).

Although most people, veterinarians in particular, are familiar with the needs and problems related to domesticated animals, not only is less known about exotic species but their needs and problems are generally by far more specific (GRANT et al., 2017; WARWICK et al., 2018). For instance, little is known about the prevention and treatment of diseases in many non-traditional pet species, while for some others this information may exist, but only a few veterinarians have relevant knowledge of the issue. In any case, these

animals may suffer from inappropriate therapy, for example, due to between-species extrapolation, resulting in morbidity or mortality (SCHUPPLI et al., 2014).

Therefore, exotic pet medicine presents new challenges for the veterinary profession and requires future veterinarians to have knowledge and skills in this aspect of veterinary medicine as well, especially in relation to exotic non-mammal pet animals (VERMEULEN et al., 2008; SİĞIRCI et al., 2019). The latter authors performed self-evaluation of the competency and knowledge of small pet practitioners about exotic pets in Istanbul, Turkey. The results of their study revealed that 90% of veterinarians consider that their education on exotic pet animal practice received during undergraduate study was inadequate, while more than half of veterinarians stated that they had appropriate skill and knowledge related to birds but not to turtles, other reptiles and fish.

This study investigated and compared the opinions and knowledge of veterinary students in Croatia regarding different exotic non-mammal pets and their welfare.

Materials and methods

A total of 589 (87%) veterinary students from the first to sixth year of the integrated undergraduate and graduate study programme at the Faculty of Veterinary Medicine, University of Zagreb, Zagreb, Croatia, were surveyed in the autumn semester of the 2019-2020 academic year. The survey was voluntary and anonymous, approved by the Faculty Board for Quality Management. Before completing the questionnaire, students were informed that study results would be used for educational and scientific purposes. All students had attended an obligatory course on animal welfare in their first study year, but knowledge of and practice with exotic pets were also acquired in other subjects during their study programme, with several elective subjects focusing only on birds, reptiles, amphibians and fish. All students had followed the same curriculum. The study included first-year student responses after they had completed the animal welfare course.

The questionnaire was written and divided into two parts. The first part aimed to obtain basic

demographic information about the students. As shown in Table 1, 78.8% of subjects were female and 54% were in the 18-21 age group; 69.9% reported having been raised in urban setting; 88.8% had completed high school; the greatest proportion of students (40.6%) aspired to a career with pet animals; and 97.3% of students owned or kept pet animals, including exotic pets (51.6%).

Table 1. Demographic data on the student sample (N=589)

	%
Study year:	
first	20.9
second	18.3
third	17.8
fourth	15.3
fifth	11.5
sixth	16.2
Gender:	
male	21.2
female	78.8
Age (yrs):	
18-21	54
22-24	24.1
>24	21.9
Setting where they grew up:	
rural	30.1
urban	69.9
Secondary school:	
high school	88.8
veterinary	7.8
other	3.4
Previous owning/keeping pets:	
yes	97.3
no	2.7
Previous owning/keeping exotic pets ^{EP} :	
yes	51.6
no	48.4
Favoured/chosen study track ST :	
pet animals	40.6
farm animals and horses	15.1
hygiene and technology of animal foodstuffs and veterinary public health	12.7
I do not know	31.6

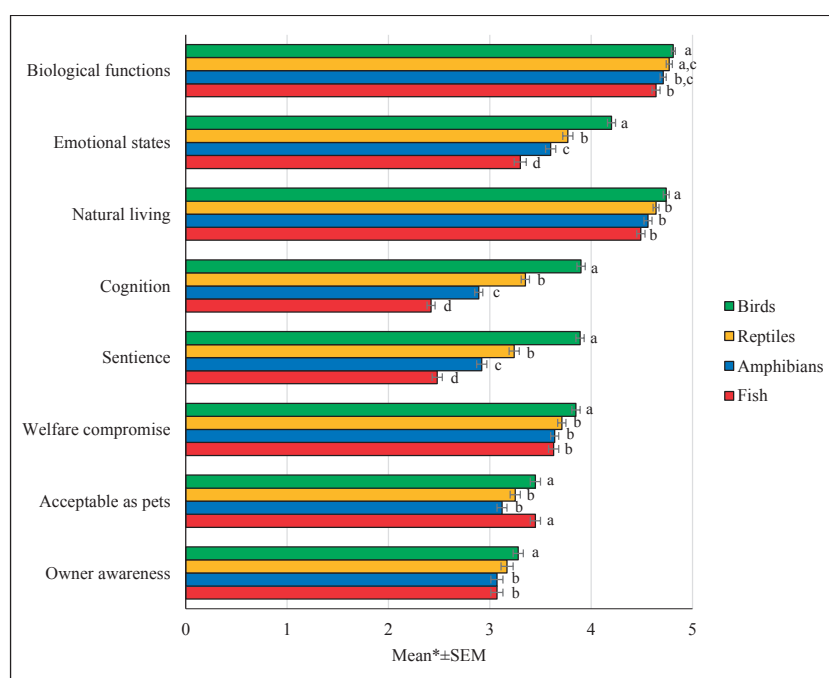
EP – exotic pets considered all pet species except for dogs and cats; ST – study track is chosen in 10th semester, with enrolment quota for particular study tracks

The second part of the questionnaire contained a set of 15 Likert type questions (1 for ‘fully disagree’ through 5 for ‘fully agree’) designed to assess their opinions and knowledge relating to exotic non-mammal pet animals, i.e., birds, reptiles, amphibians and fish, and their welfare. The statements referred to the level of cognition, sentience and welfare compromise in these pet animals; the importance of biological functions, emotional states and natural living for their welfare; their acceptability as pet animals, and owner awareness; the level of risk that these pet animals represent for the health and safety of other animals and humans, and the environment; and the level of knowledge the students considered themselves to have on feeding, housing, and the health and behaviour of these pets.

The IBM SPSS Statistics v. 21.0 program (IBM Corp., 2012) was used on all analyses. The frequencies of student responses were determined by use of univariate analysis. Descriptive analysis indicated that the data did not follow normal distribution, therefore differences in total mean student responses (mean values of all study years) and mean responses between study years according to the pet animals observed were tested by the Kruskal-Wallis test and the Mann-Whitney *U*-test. The results were expressed as mean (\pm SEM) student responses.

Results

The students fully agreed that biological functioning and natural living are important for the welfare of pet birds, reptiles, amphibians and fish. They also agreed that emotional states were an important component in bird, reptile and amphibian welfare, but were undecided in the case of fish. Students believed that birds are capable of having cognitive abilities and sentience, were undecided about this in relation to reptiles and amphibians, and stated that fish had no such abilities. Students were undecided whether keeping birds, reptiles, amphibians and fish as pet animals was acceptable, and whether their owners had collected adequate information on such pets before getting them, the welfare of which, according to the students’ opinions, might be compromised (Fig. 1).

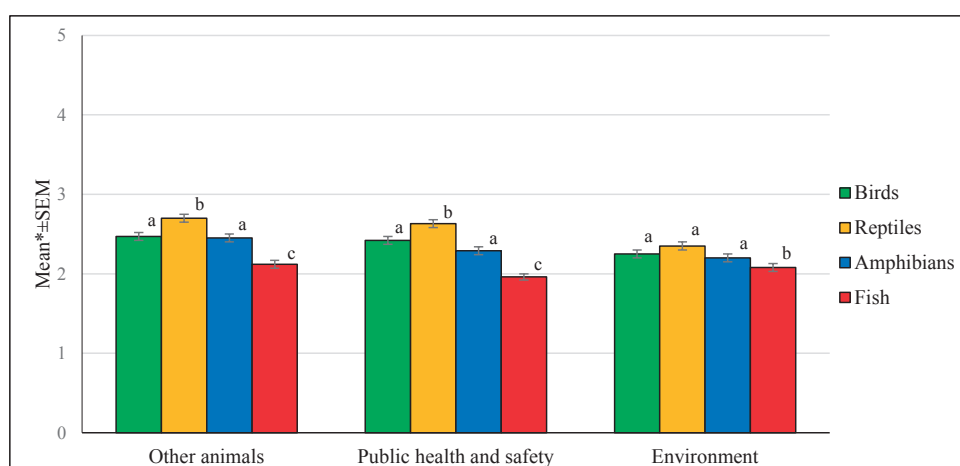


*1 - fully disagree, 5 - fully agree; a,b,c,d values within the same item marked with different letters differ significantly ($P < 0.05$)

Fig. 1. Total mean student responses regarding the level of cognition and sentience, and welfare compromise in pet birds, reptiles, amphibians and fish, the importance of biological functioning, emotional states and natural living for their welfare, their acceptability as pets and owner awareness on these pets.

Students believed that keeping birds, amphibians and fish as pet animals did not pose a risk for the health and safety of other animals and

humans, whereas they were undecided in the case of reptiles. They also agreed that none of these pet animals posed an environmental risk (Fig. 2).

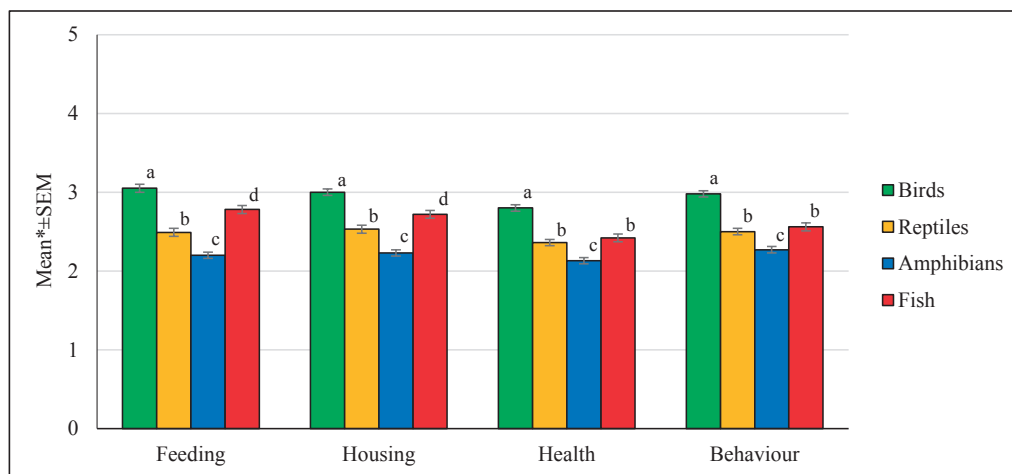


*1 - fully disagree, 5 - fully agree; a,b,c values within the same item marked with different letters differ significantly ($P < 0.05$)

Fig. 2. Total mean student responses regarding the level of risk that keeping pet birds, reptiles, amphibians and fish represents for other animals, public health and safety, and environment.

Students stated they had inadequate knowledge about the feeding, housing, health and behaviour

of amphibians, whereas in the case of other non-mammal pets they were mostly undecided (Fig. 3).



*1 - fully disagree, 5 - fully agree; a,b,c,d values within the same item marked with different letters differ significantly ($P < 0.05$)

Fig. 3. Total mean student responses regarding the level of knowledge they considered themselves to have about feeding, housing, health and behaviour of pet birds, reptiles, amphibians and fish.

Although expressing neutral opinions, students considered keeping birds and fish as pet animals significantly more acceptable ($P < 0.05$) compared with keeping reptiles and amphibians. They considered keeping reptiles to pose a significantly higher risk ($P < 0.05$) for the health and safety of other animals and humans, and keeping fish a significantly lower risk ($P < 0.05$) including environmental risk, as compared with other pet animals observed. In almost all other statements, the total mean score was significantly higher ($P < 0.05$) for birds compared with other pets (Figs. 1-3).

Both first-year and sixth-year students gave neutral responses to or expressed disagreement with most of the statements, in particular those referring to pet reptiles, amphibians and fish, without significant differences between these two study years. Mainly there were no significant differences in the mean responses provided by students of other study years either. The statements referring to the importance of emotional states for the welfare of pet birds, the compromised welfare of pet reptiles and amphibians, the acceptability of all animals observed as pets, owner awareness of

pet birds, the risk posed by pet reptiles for other animals and humans, and the knowledge students considered themselves to have about the feeding, housing, health and behaviour of these pets, with the exception of fish feeding, yielded no significant differences between individual study years.

Discussion

Veterinarians should be the main actors who ensure and promote the welfare of all animals (OIE, 2012; OSTOVIĆ et al., 2017), taking into consideration different animal welfare concepts, i.e., basic animal health and functioning, their emotional states and natural life, at least to some degree (FRASER, 2008; OSTOVIĆ et al., 2016). At first sight, this may seem consistent with the present study of Croatian veterinarians-to-be opinions and their knowledge on pet birds, reptiles, amphibians and fish, and their welfare. However, students were not sure whether emotional state was an important component in fish welfare. They considered fish incapable and birds capable of having cognitive abilities and sentience, and were undecided whether reptiles and amphibians had such abilities, although

they believed that emotional state was important for reptile and amphibian welfare. Study results of student opinions and knowledge on pet reptiles and their welfare have already been thoroughly reported previously (OSTOVIĆ et al., 2021).

It appears that students associated cognition with sentience in all animals investigated. In addition, most likely they were focused on whether animals had and could express pleasant feelings, while failing to consider unpleasant ones such as pain, which is known to be experienced by all vertebrates (NRC, 2009). As reported by BROOM (2016), the information on learning, awareness, and capacity for pain and other feelings in reptiles, amphibians and fish is clear enough to justify argumentation for their protection when used in experiments, as food, or for other purposes. Sentience does not require advanced cognition and can be demonstrated independently. Defining sentience through cognitive ability can be potentially harmful for animal welfare. It could raise the risk of a sentient species being neglected for their lower cognitive ability, rather than their capacity to suffer (DAWKINS, 2006; PROCTOR, 2012; VALLORTIGARA, 2017).

Beside the usual welfare challenges encountered in keeping traditional pet species such as dogs and cats, ensuring the welfare of non-traditional pets is additionally complicated by the factors such as inadequate knowledge, difficulties in meeting their needs at home, and where and how animals are obtained (for more information on welfare issues in exotic pets, see the studies by SCHUPPLI et al. (2014) and GRANT et al. (2017)). Currently, ever better scientific understanding reveals that the biological needs of animals are by far more complex than previously believed. Thus, the more we learn about animals and their needs, the greater is the challenge to take humane care of them in captivity. This is supported by the recently published recognition of play behaviour in fish, frogs and reptiles, posing the challenge to provide novel stimulation (BURGHARDT, 2015; WARWICK et al., 2018). This is in line with our veterinary students' responses, showing them to be undecided whether keeping birds, reptiles, amphibians and fish as pet animals is acceptable, and whether their owners had

collected adequate information on these pets and their needs. The students found the welfare of all pet animals observed to be jeopardized, obviously not associating it with their cognition and sentience in the case of reptiles, amphibians and fish.

Students considered that keeping birds, amphibians and fish as pet animals does not pose a danger to the health and safety of other animals and humans, whereas they were not sure whether this was true for reptiles. Yet, keeping reptiles was found to be a significantly higher risk to other animals and humans, and keeping fish a significantly lower risk, including an environmental risk compared to other pets observed. We can presume that students were focused exclusively on animal-linked injuries; however, their indecisiveness about reptiles was quite surprising. For instance, deaths of humans have been known to be caused by exotic pet snakes (TEGEDER, 2015). Therefore, either students do not think or have inadequate information about the issue, and/or in Croatia they encounter pet reptiles for which they are not sure whether they are able to inflict fatal or some other injuries to humans or other animals, or not. People are likely to forget that these pets are essentially wild animals with intact defensive and aggressive behaviour, along with robust physical characteristics (WARWICK and STEEDMAN, 2012).

Nevertheless, veterinary students are expected to be aware that these pets can also endanger the health of humans and other animals *via* other routes, i.e., transmission of diseases such as salmonellosis (JORN et al., 2009; PEES et al., 2013; CORRENTE et al., 2017). It has been estimated that exposure to reptiles and amphibians is associated with 74,000 human *Salmonella* infections *per* year in the United States (MERMIN et al., 2004). A study by LUKAC et al. (2015) on the prevalence of *Salmonella* in captive reptiles in Croatia showed that 13% of reptiles belonging to private owners or the Zagreb ZOO were positive for *Salmonella*, and that these animals could harbour serovars that are not generally encountered in veterinary or human microbiological practice.

Exotic pets can pose the highest health risk to newborns and toddlers because these population groups are prone to infections due to their

suboptimal hygienic routine and naive immune system, along with their size and innate curiosity, predisposing them to injuries from attacks, bites and scratches inflicted by such pets (SMITH et al., 2012). According to MERMIN et al. (1997), paediatricians, veterinarians and pet shop owners should inform their patients and clients of the potential risks associated with ownership of exotic pets, and should ensure appropriate preventive education.

It was quite surprising that our students agreed that none of these animals kept as pets posed a risk to the environment. There are many examples of introducing exotic pets into non-native environments, where they pose a threat because they may replace the native species through predation, hybridization, pathogen transmission, or competence for resources (SCHUPPLI et al., 2014). Florida is one of the best known examples, with the greatest number of established (i.e., reproducing) non-native herpetofaunal species in the world. At least 180 non-native herpetofaunal taxa have been introduced to the state, 63 of them established (KRYSKO et al., 2016). One-third of the worst aqueous invasive species in the world have resulted from aquarium or ornamental releases (PADILLA and WILLIAMS, 2004). The most common reason for releasing fish into wildlife is that they have become boring or too large or too fertile for accommodation (SCHUPPLI et al., 2014). CARRETE and TELLA (2008) report on 50 non-native breeding pet bird species in wildlife in Spain, with pet birds escaping from cages as the main source of avian invasions by exotic species. LANGTON et al. (2011) report on at least 51 non-native species, subspecies, intergrades or hybrids of amphibians and reptiles recorded as living wild in the London area. Imported pet red-eared slider turtles are frequently released, having invaded wetland habitats in Europe, Asia, Africa (SCHUPPLI et al., 2014) and Australia (HENDERSON and BOMFORD, 2011). The European Commission publication on 49 invasive alien plant and animal species of Union concern appeared in 2017 (EC, 2017). Seventeen species from the list, including the pond slider, i.e., its most popular subspecies in

the pet trade, the red-eared slider turtle, have been recorded in Croatia (BORŠIĆ et al., 2018).

Although students were not so convinced whether keeping birds, reptiles, amphibians and fish as pet animals was acceptable, and whether their owners had collected adequate information on such pets before purchasing, they considered keeping birds and fish as pet animals significantly more acceptable than reptiles and amphibians. It was no surprise considering that birds and fish are more commonly kept as pets compared to reptiles, and amphibians in particular, which require more complex living conditions. In addition, when asked about their level of knowledge of the feeding, housing, health and behaviour of these pet animals, students considered themselves to have the least knowledge about amphibians, followed by reptiles.

For most statements, the total mean score was significantly higher for birds as compared with other animals. Similar results have been reported by SIĞIRCI et al. (2019) on small pet practitioners in relation to exotic pets in Turkey. Beside the fact that birds and fish are more common pets than reptiles and amphibians, these findings could also be explained by the fact that birds are more frequently encountered as patients in comparison to other animals observed, as supported by other studies (NIELSEN et al., 2014). It could additionally be attributed to the fact that people come in contact with birds more frequently, and that birds are more prone to bonding, and so are more preferred than other animals observed (BATT, 2009; BORGHI and CIRULLI, 2015).

Throughout the study years, most of the statements received neutral responses or disagreement, in particular those referring to pet animals other than birds. Mostly there were no significant differences between individual study years, including differences in the responses given by first-year and sixth-year students on the knowledge they considered themselves to have about the pets observed.

Conclusions

In this study of the opinions and knowledge of Croatian veterinarians-to-be on exotic non-mammal pet animals and their welfare, students provided

neutral responses to or disagreement with most of the questionnaire statements, in particular those related to exotic pets other than birds. Therefore, the study results suggest the need for additional student education on exotic non-mammal pets, and can be used for upgrading the veterinary curriculum in the field, thus contributing to the welfare of these animals, other animals, human health and safety, and environmental protection.

Conflicts of Interest

The authors declare no conflict of interest.

Acknowledgements

The authors appreciate the voluntary participation of all the students included in the study. This paper was presented in the form of abstract at the 1st RAWC Scientific Conference 2020 "Better Science for Better Animal Welfare" held online, 24-25 June 2021.

References

- BATT, S. (2009): Human attitudes towards animals in relation to species similarity to humans: a multivariate approach. *Biosci. Horiz.* 2, 180-190.
DOI: 10.1093/biohorizons/hzp021
- BORGI, M., F. CIRULLI (2015): Attitudes toward animals among kindergarten children: species preferences. *Anthrozoös* 28, 45-59.
DOI: 10.2752/089279315X14129350721939
- BORŠIĆ, I., A. JEŠOVNIK, T. MIHINJAČ, P. KUTLEŠA, S. SLIVAR, M. CIGROVSKI MUSTAFIĆ, S. DESNICA (2018): Invasive alien species of Union concern (Regulation 1143/2014) in Croatia. *Nat. Croat.* 27, 357-398.
DOI: 10.20302/NC.2018.27.26
- BROOM, D. M. (2016): Considering animals' feelings: précis of sentience and animal welfare (Broom 2014). *Anim. Sentience* 5, 1-12.
DOI: 10.51291/2377-7478.1015
- BURGHARDT, G. M. (2015): Play in fishes, frogs and reptiles. *Curr. Biol.* 25, R9-R10.
DOI: 10.1016/j.cub.2014.10.027
- CARRETE, M., J. L. TELLA (2008): Wild-bird trade and exotic invasions: a new link of conservation concern? *Front. Ecol. Environ.* 6, 207-211.
DOI: 10.1890/070075
- CORRENTE, M., G. SANGIORGIO, E. GRANDOLFO, L. BODNAR, C. CAPELLA, A. TROTTA, V. MARTELLA, D. BUONAVOGLIA (2017): Risk for zoonotic *Salmonella* transmission from pet reptiles: a survey on knowledge, attitudes and practices of reptile-owners related to reptile husbandry. *Prev. Vet. Med.* 146, 73-78.
DOI: 10.1016/j.prevetmed.2017.07.014
- DAWKINS, M. S. (2006): Through animal eyes: what behaviour tells us. *Appl. Anim. Behav. Sci.* 100, 4-10.
DOI: 10.1016/j.applanim.2006.04.010
- EC (2017): Invasive alien species of Union concern. European Commission, Publications Office of the European Union, Luxembourg.
- FRASER, D. (2008): Understanding animal welfare. *Acta Vet. Scand.* 50, Suppl. 1, 1-7.
DOI: 10.1186/1751-0147-50-S1-S1
- GRANT, R. A., V. T. MONTROSE, A. P. WILLS (2017): ExNOTic: should we be keeping exotic pets? *Animals* 7, 47.
DOI: 10.3390/ani7060047
- HENDERSON, W., M. BOMFORD (2011): Detecting and preventing new incursions of exotic animals in Australia. Invasive Animals Cooperative Research Centre, Canberra, Australia.
- HERREL, A., A. VAN DER MEIJDEN (2014): An analysis of the live reptile and amphibian trade in the USA compared to the global trade in endangered species. *Herpetol. J.* 24, 103-110.
- IBM Corp. (2012): IBM SPSS Statistics for Windows, Version 21.0. Armonk, New York, USA.
- JORN, K. S., K. M. THOMPSON, J. M. LARSON, J. E. BLAIR (2009): Polly can make you sick: pet bird-associated diseases. *Clev. Clin. J. Med.* 76, 235-243.
DOI: 10.3949/ccjm.76a.08018
- KIESWETTER, S. (2017): The motivations behind obtaining exotic pets: a discussion paper. Available at: https://www.zoocheck.com/wp-content/uploads/2017/10/The-Motivations-Behind-Obtaining-Exotic-Pets_September-2017.pdf (accessed on 11 February 2022).
- KRYSKO, K. L., L. A. SOMMA, D. C. SMITH, C. R. GILLETTE, D. CUEVA, J. A. WASILEWSKI, K. M. ENGE, S. A. JOHNSON, T. S. CAMPBELL, J. R. EDWARDS, M. R. ROCHFORD, R. TOMPKINS, J. L. FOBB, S. MULLIN, C. J. LECHOWICZ, D. HAZELTON, A. WARREN (2016): New verified nonindigenous amphibians and reptiles in Florida through 2015, with a summary of over 152 years of introductions. *Reptiles Amphib.* 23, 110-143.
DOI: 10.17161/randa.v23i2.14119
- LANGTON, T. E. S., W. ATKINS, C. HERBERT (2011): On the distribution, ecology and management of non-native reptiles and amphibians in the London area. Part 1. Distribution and predator/prey impacts. *Lond. Nat.* 90, 83-156.
- LOCKWOOD, J. L., D. J. WELBOURNE, C. M. ROMAGOSA, P. CASSEY, N. E. MANDRAK, A. STRECKER, B. LEUNG, O. C. STRINGHAM, B.

- UDELL, D. J. EPISCOPIO-STURGEON, M. F. TLUSTY, J. SINCLAIR, M. R. SPRINGBORN, E. F. PIENAAR, A. L. RHYNE, R. KELLER (2019): When pets become pests: the role of the exotic pet trade in producing invasive vertebrate animals. *Front. Ecol. Environ.* 17, 323-330.
DOI: 10.1002/fee.2059
- LUKAC, M., K. PEDERSEN, E. PRUKNER-RADOVICIC (2015): Prevalence of *Salmonella* in captive reptiles from Croatia. *J. Zoo. Wildl. Med.* 46, 234-240.
DOI: 10.1638/2014-0098R1.1
- MERMIN, J., B. HOAR, F. J. ANGULO (1997): Iguanas and *Salmonella* Marina infection in children: a reflection of the increasing incidence of reptile-associated salmonellosis in the United States. *Pediatrics* 99, 399-402.
DOI: 10.1542/peds.99.3.399
- MERMIN, J., L. HUTWAGNER, D. VUGIA, S. SHALLOW, P. DAILY, J. BENDER, J. KOEHLER, R. MARCUS, F. J. ANGULO (2004): Reptiles, amphibians, and human *Salmonella* infection: a population-based, case-control study. *Clin. Infect. Dis.* 38, Suppl. 3, 253-261.
DOI: 10.1086/381594
- NIELSEN, T. D., R. S. DEAN, N. J. ROBINSON, A. MASSEY, M. L. BRENNAN (2014): Survey of the UK veterinary profession: common species and conditions nominated by veterinarians in practice. *Vet. Rec.* 174, 324.
DOI: 10.1136/vr.101745
- NRC (2009): Recognition and Alleviation of Pain in Laboratory Animals. National Research Council (US) Committee on Recognition and Alleviation of Pain in Laboratory Animals, The National Academies Press, Washington, D.C., USA.
- OIE (2012): OIE recommendations on the competencies of graduating veterinarians ("Day 1 graduates") to assure National Veterinary Services of Quality. World Organisation for Animal Health, Paris, France.
- OSTOVIC, M., T. MIKUS, Z. PAVICIC, K. MATKOVIC, Z. MESIC (2017): Influence of socio-demographic and experiential factors on the attitudes of Croatian veterinary students towards farm animal welfare. *Vet. Med.-Czech* 62, 417-428.
DOI: 10.17221/172/2016-VETMED
- OSTOVIĆ, M., I. SABOLEK, A. PIPLICA, I. ŽURA ŽAJA, S. MENČIK, S. NEJEDLI, Ž. MESIĆ (2021): A survey study of veterinary student opinions and knowledge about pet reptiles and their welfare. *Animals* 11, 3185.
DOI: 10.3390/ani11113185
- OSTOVIĆ, M., Ž. MESIĆ, T. MIKUŠ, K. MATKOVIĆ, Ž. PAVIČIĆ (2016): Attitudes of veterinary students in Croatia toward farm animal welfare. *Anim. Welf.* 25, 21-28.
DOI: 10.7120/09627286.25.1.021
- PADILLA, D. K., S. L. WILLIAMS (2004): Beyond ballast water: aquarium and ornamental trades as sources of invasive species in aquatic ecosystems. *Front. Ecol. Environ.* 2, 131-138.
DOI: 10.1890/1540-9295(2004)002[0131:BBWAAO]2.0.CO;2
- PASMANS, F., S. BOGAERTS, J. BRAECKMAN, A. A. CUNNINGHAM, T. HELLEBUYCK, R. A. GRIFFITHS, M. SPARREBOOM, B. R. SCHMIDT, A. MARTEL (2017): Future of keeping pet reptiles and amphibians: towards integrating animal welfare, human health and environmental sustainability. *Vet. Rec.* 181, 450.
DOI: 10.1136/vr.104296
- PEES, M., W. RABSCH, B. PLENZ, A. FRUTH, R. PRAGER, S. SIMON, V. SCHMIDT, S. MÜNCH, P. G. BRAUN (2013): Evidence for the transmission of *Salmonella* from reptiles to children in Germany, July 2010 to October 2011. *Euro Surveill.* 18, 20634.
DOI: 10.2807/1560-7917.es2013.18.46.20634
- PROCTOR, H. (2012): Animal sentience: where are we and where are we heading? *Animals* 2, 628-639.
DOI: 10.3390/ani2040628
- SCHUPPLI, C. A., D. FRASER, H. J. BACON (2014): Welfare of non-traditional pets. *Rev. Sci. Tech. Off. Int. Epiz.* 33, 221-231.
DOI: 10.20506/rst.33.1.2287
- SIĞIRCI, B. D., S. IKIZ, B. ÇELİK, S. AK (2019): A survey study on self-evaluations of small pet practitioners about exotic pets in Istanbul in 2016. *Acta Vet. Eurasia* 45, 9-15.
DOI: 10.26650/actavet.2019.433657
- SMITH, K. M., K. F. SMITH, J. P. D'AURIA (2012): Exotic pets: health and safety issues for children and parents. *J. Pediatr. Health Care* 26, e2-e6.
DOI: 10.1016/j.pedhc.2011.11.009
- STATISTA (2021): Number of pet animals in Europe in 2020, by animal type (in 1000s). Available at: <https://www.statista.com/statistics/453880/pet-population-europe-by-animal/> (accessed on 11 February 2022).
- TEGEDER, G. C. (2015): A research framework for the geographic study of exotic pet mammals in the USA. PhD Thesis, University of Nebraska-Lincoln, Lincoln, Nebraska, USA.
- VALLORTIGARA, G. (2017): Sentience does not require "higher" cognition. *Anim. Sentience* 17, 1-9.
DOI: 10.51291/2377-7478.1226
- VAN ROON, A., M. MAAS, D. TOALE, N. TAFRO, J. VAN DER GIESSEN (2019): Live exotic animals legally and illegally imported via the main Dutch airport and considerations for public health. *PLoS ONE* 14, e0220122.
DOI: 10.1371/journal.pone.0220122
- VERMEULEN, P., N. ENDENBURG, J. T. LUMEIJ (2008): Numbers of dogs, cats, birds, and exotic animals in veterinary practices in the Netherlands 1994-2005 and possible consequences for the veterinary curriculum. *Tijdschr. Diergeneeskd.* 133, 760-763. (in Dutch)

- WARWICK, C. (2014): The morality of the reptile “pet” trade. *J. Anim. Ethics* 4, 74-94.
DOI: 10.5406/janimaethics.4.1.0074
- WARWICK, C., C. STEEDMAN (2012): Injuries, envenomations and stings from exotic pets. *J. R. Soc. Med.* 105, 296-299.
DOI: 10.1258/jrsm.2012.110295
- WARWICK, C., C. STEEDMAN, M. JESSOP, P. ARENA, A. PILNY, E. NICHOLAS (2018): Exotic pet suitability: understanding some problems and using a labeling system to aid animal welfare, environment, and consumer protection. *J. Vet. Behav.* 26, 17-26.
DOI: 10.1016/j.jveb.2018.03.015

Received: 1 April 2020

Accepted: 15 April 2022

OSTOVIĆ, M., I. SABOLEK, A. PIPLICA, I. ŽURA ŽAJA, T. MIKUŠ, S. MENČIK, K. MATKOVIĆ, Ž. PAVIČIĆ, Ž. MESIĆ: Mišljenja i znanje studenata veterinarske medicine o egzotičnim kućnim ljubimcima, izuzevši sisavce, te njihovoj dobrobiti. *Vet. arhiv* 92, 349-358, 2022.

SAŽETAK

Ovo istraživanje imalo je za cilj ispitati mišljenja i znanje budućih hrvatskih doktora veterinarske medicine o egzotičnim kućnim ljubimcima, pticama, gmazovima, vodozemcima i ribama te njihovoj dobrobiti. Anketno je ispitivanje provedeno u akademskoj godini 2019./2020. i obuhvatilo je ukupno 589 studenata (87 %) svih šest godina integriranog preddiplomskog i diplomskog studija veterinarske medicine. Mišljenja i znanje studenata ispitani su pomoću Likertove mjerne ljestvice od pet stupnjeva i izjava koje su se odnosile na sljedeće: razinu kognitivnih sposobnosti, emocija i narušenosti dobrobiti u istraživanih životinja – kućnih ljubimaca; važnost biološkog funkcioniranja, emocionalnih stanja i prirodnog načina života za njihovu dobrobit; prihvatljivost tih životinja kao kućnih ljubimaca i osviještenost vlasnika; razinu rizika koji te životinje kao kućni ljubimci predstavljaju za druge životinje, javno zdravlje i sigurnost te okoliš; razinu znanja koje studenti smatraju da posjeduju o njihovoj hranidbi, držanju, zdravlju i ponašanju. Na većinu izjava studenti su odgovorili neutralnim odgovorima ili su izrazili neslaganje, osobito u slučaju gmazova, vodozemaca i riba, bez utvrđenih znakovitih razlika među godinama studija. Dobiveni rezultati upućuju na potrebu dodatne izobrazbe studenata o istraživanim egzotičnim kućnim ljubimcima i mogu poslužiti za unapređenje nastavnog plana i programa ovog područja, a time i dobrobiti tih životinja, drugih životinja, javnog zdravlja i sigurnosti te zaštite okoliša.

Ključne riječi: studenti veterinarske medicine; mišljenje; znanje; egzotični kućni ljubimci; životinje; dobrobit životinja
