Uningá Review

doi.org/10.46311/2178-2571.39.eURJ4691

Lumbosacral osteoarthritis in lioness (*Panthera leo*)

Osteoartrose lombossacra em leoa (*Panthera leo*)

Eduardo Augusto Terra Rossi de Barros[1*], Jorge Aparecido Salomão Júnior[2], Henrique Scomparin Guardia[2], Sônia Rumiko Suzuki França[2], Giovani Dal'Bó[2], Everton dos Santos Cirino[3], Michelle Falcade Forti[3], Guilherme Guidolin Galassi[3], Fábio Henrique Viaceli Conforti[2], Daniela Pereira Bonini[2], Renato Leite Leonardo[2], Renata Paulino Xavier[2], Luciana Facco de Andrade[2], Giovanna Valverde Magalhães Barbosa[1], Paulo Fernandes Marcusso[1]

[1]São Paulo State University – UNESP, Botucatu, SP, Brazil.

[2]Americana College – FAM, Americana, SP, Brazil.

[3]Americana Municipal Ecological Park – Americana, SP, Brazil.

[*]eduardo.rossi@unesp.br

Received: September 12th, 2024.
Accepted: December 03rd, 2024.
Published: December 20th, 2024.

ABSTRACT

Osteoarthritis is a chronic disorder that deteriorates articular cartilage and periarticular structures, being a major cause of joint pain in elderly felines. Cats frequently develop arthritis due to aging, obesity, and a sedentary lifestyle – factors that are common in captivity. Therefore, arthritis in wild felines can be considered to be triggered by the same factors, given the similar physiology of domestic cats (*Felis catus*) to other members of the Felidae family. This study aimed to report a case of lumbosacral osteoarthritis in a lioness (*Panthera leo*). The 20-year-old animal from the Americana Ecological Park in São Paulo showed signs of apathy and hyporexia and was sent to the Veterinary Hospital of Americana College (FAM) for a check-up. The complete blood count was normal, while the biochemical profile showed slight hypoalbuminemia and a significant increase in amylase. Ultrasound revealed subtly irregular kidney contours. Endoscopy showed hyperemia in the respiratory tract and polypoid nodules in the nasopharynx. The larynx had bilateral subglottic ulcers, and the bronchi exhibited malacia and bronchial ring fractures. Radiography showed mineralization processes of the sternocostal joints and xiphoid luxation. In the spine, there were enthesophytes in vertebrae, ankylosing bridges, intervertebral foramen opacification, loss of articular facet definition, vertebral body remodeling, and mineral radiopaque structures overlaying the spinous processes. Therefore, it is concluded that due to genetic and evolutionary proximity, attention should be paid to signs of arthritis in wild felines as predisposing factors common in captive environments, along with advanced age, may trigger osteoarthritis similar to that of domestic felines.

Keywords: Arthrosis. Captivity. Felines. Orthopedics. Radiology.

RESUMO

A osteoartrose é um distúrbio crônico, deteriorando a cartilagem articular e estruturas periarticulares, sendo uma grande causa de dor articular nos felinos senis. Gatos frequentemente desenvolvem artroses devido ao envelhecimento, obesidade e sedentarismo, fatores comuns em cativeiro. Assim, pode-se considerar que artroses em felinos selvagens são desencadeadas pelos mesmos fatores, considerando a fisiologia do gato doméstico (*Felis catus*) como similar aos demais membros da família Felidae. Este trabalho objetivou relatar um caso de osteoartrose lombossacra em uma leoa (*Panthera leo*). O animal de 20 anos de idade, do Parque Ecológico de Americana – SP, apresentava sinais de apatia e hiporexia, sendo encaminhado para o Hospital Veterinário da Faculdade de Americana (FAM), onde foram realizados exames de check-up. Não havia alterações em hemograma, enquanto no bioquímico foram observados leve hipoalbuminemia e grande aumento de amilase. Na ultrassonografia, rins apresentaram contornos sutilmente irregulares. Na endoscopia, havia hiperemia em vias respiratórias e nódulos polipoides em nasofaringe. Na laringe, foram observadas úlceras bilaterais em região subglótica e, em brônquios, malácia e fratura de anéis brônquicos. Na radiografia, foram vistos processos de mineralização das articulações esternocondrais e luxação xifoide. Na coluna vertebral, havia presença de entesófitos em vértebras, pontes anquilosantes, opacificação de forame intervertebral, perda de definição de facetas articulares, remodelamento de corpos vertebrais e estruturas puntiformes de radiopacidade mineral sobrepondo processos espinhosos. Conclui-se, portanto, que pela proximidade genética e evolutiva, deve-se atentar aos sinais de artrose em felinos selvagens, pois assim como ocorre em felinos domésticos, os fatores predisponentes comumente presentes em ambiente cativo, juntamente com a idade avançada, podem desencadear a osteoartrose.

Palavras-chave: Artrose. Cativeiro. Felídeos. Ortopedia. Radiologia.

INTRODUCTION

The lion (*Panthera leo*) is a mammal belonging to the order Carnivora, family Felidae, currently classified as globally vulnerable by the IUCN Red List (Nicholson et al., 2023). Extinct throughout northern Africa and most Asian countries, its current distribution includes populations in most Sub-Saharan African countries and isolated groups in India (Nowell & Jackson, 1996). However, there has been a significant decline in both the species' range and population sizes (Trinkel & Angelici, 2016).

In this context, the maintenance of these animals in captivity becomes crucial for *ex-situ* conservation. Captive settings enable the development of reproductive and management techniques, studies on species biology, genetic characterization, monitoring, exchange programs, and environmental education initiatives. These measures promote long-term wildlife conservation (Felippe & Adania, 2014).

Since lions are native only to Africa and Asia, in Brazil, they are found exclusively in zoos and wildlife facilities. However, the captive environment may compromise their well-being, as it differs significantly from their natural habitat, leading to physiological issues (Felippe & Adania, 2014).

Osteoarthritis, also known as degenerative joint disease, is a pathological condition that can affect domestic felines (Denny & Butterworth, 2006). It is characterized by the degeneration of joint components, resulting in the destruction and remodeling of subchondral bone, osteophyte formation, and synovitis (Fujita et al., 2005).

Domestic cats tend to develop arthritis, especially in old age, often caused by processes associated with senility and exacerbated by obesity, sedentary behavior, and altered body condition scores (Mele, 2007)—factors often observed in animals under human care. Similar to domestic felines, osteoarthritis in large wild felines is likely triggered by the same factors, given that the physiology of domestic cats (*Felis catus*) is comparable to that of other members of the Felidae family (Adania, Silva & Felippe, 2014).

With a life expectancy of around 15 years in the wild and over 20 years under human care (Eloff, 1998; Junginger et al., 2015), lions (*Panthera leo*) are considered to be susceptible

to degenerative joint diseases, such as osteoarthritis, particularly in captivity. This is partially due to their increased lifespan under human care (Barton, 2022).

This report aims to describe a case of a captive lioness with lumbosacral osteoarthritis.

CASE REPORT

A 20-year-old lioness from the Americana–SP Ecological Park shared her enclosure with a male lion. After the death of her companion, the lioness began exhibiting signs of apathy and hyporexia. Consequently, the zoo's veterinary medical team decided to perform a health check-up. A multidisciplinary team was assembled to carry out the examinations, including a complete blood count, biochemical tests, ultrasonography, radiography, and endoscopy.

The zoo team placed a transport crate with a guillotine-style door inside the animal's shifting area. On the night prior to the handling procedure, the lioness voluntarily entered the crate without requiring prior sedation. The animal was then transported to the Veterinary Hospital of the Americana College (FAM), where anesthesia and the aforementioned procedures were performed.

For pre-anesthetic medication, the following were administered: Zoletil® (a dissociative agent combined with a benzodiazepine) at a dose of 5 mg/kg, detomidine (an α-2 adrenergic agonist) at 0.01 mg/kg, and atropine (an anticholinergic) at 0.05 mg/kg, based on an estimated weight of 150 kg. Anesthetic maintenance was carried out using inhalation anesthesia with isoflurane.

Once the lioness was anesthetized, blood was collected via venipuncture of the lateral saphenous vein using a 10-ml syringe and a 40x12 needle. A volume of 4 ml was added to tubes containing EDTA-K_2 for the complete blood count (Table 1). The remaining 6 ml was placed in a dry tube for biochemical tests (Table 2). The tubes were stored in an insulated container with auxiliary ice and sent to the Clinical Veterinary Laboratory at the Veterinary Hospital (HV) of the School of Veterinary Medicine and Animal Science (FMVZ) at São Paulo State University, Botucatu Campus.

Table 1

Hematological results of the lioness' complete blood count obtained from the Clinical Veterinary Laboratory at the Veterinary Hospital (HV) of the School of Veterinary Medicine and Animal Science (FMVZ), State University of São Paulo (UNESP), Botucatu.

Analyte	Hematogram	Unit	Reference
Red Blood Cells (RBCs)	6.7	x10⁶/µL	5.22 – 11.0
Hemoglobin	11.6	g/dL	7.3 – 18.0
Hematocrit	32	%	25 – 52
MCV	47.8	fL	33.3 – 64
MCHC	36.3	%	—
PT	8.6	g/dL	6.0 – 9.5
Platelets	118.675	g/dL	117.000 – 737.000
Metarubricytes	0	/100	—
Leukocytes	18.375	/µL	6.610 – 26.700
Myelocytes	0	/µL	—
Metamyelocytes	0	/µL	—
Band Neutrophils	0	/µL	—
Segmented Neutrophils	14.700	/µL	3.800 – 22.700
Lymphocytes	2.756	/µL	33 – 6.400
Eosinophils	0	/µL	0 – 2.880
Basophils	0	/µL	0 – 386
Monocytes	919	/µL	0 – 2.873

Source: The authors.

Note. The International Species Information System (ISIS) was used as reference.

In the ultrasonographic examination (Figure 1), it was found that the kidneys had subtly irregular contours, and the gallbladder contained echogenic material deposited in the gallbladder fundus, with thinner walls. In the left thoracic region, a hyperechoic, homogeneous structure of an amorphous shape was observed, in contact with the diaphragm but apparently without adhesion to it.

Table 2

Biochemical results of the lioness' tests obtained from the Clinical Veterinary Laboratory at the Veterinary Hospital (HV) of the School of Veterinary Medicine and Animal Science (FMVZ), State University of São Paulo (UNESP), Botucatu.

Analyte	Biochemical	Ubit	Reference
Urea	88.0	mg/dL	64.37 – 298.88
Creatinine	2.7	mg/dL	0.7 – 4.79
ALT	22.0	UI/L	0 – 195.0
AST	16.0	UI/L	0 – 173.0
ALP	7.0	UI/L	0 – 96.0
GGT	3.2	UI/L	0 – 17.0
LDH	91.0	UI/L	21.0 – 722.0
Fructosamine	95.9	µmol/L	—
Total Serum Protein	6.9	g/dL	6.0 – 9.5
Albumin	2.0	g/dL	2.2 – 4.8
Globulin	4.9	g/dL	2.5 – 6.2
Total Bilirubin	0.2	mg/dL	0 – 0.99
Direct Bilirubin	0.1	mg/dL	0 – 0.18
Indirect Bilirubin	0.1	mg/dL	0 – 0.53
Glucose	173.0	mg/dL	43.0 – 296.9
Cholesterol	138.0	mg/dL	55.1 – 324.5
Triglycerides	12.0	mg/dL	4.0 – 163.15
Amylase	5.955.0	UI/L	29.6 - 1.579
Lipase	3.0	UI/L	0 – 3.89
CK	158.0	UI/L	29.0 - 5.261.0
Calcium	8.6	mg/dL	0 – 12.95
Phosphorus	3.9	mg/dL	0 – 9.42
Magnesium	2.6	mg/dL	0 – 2.77
Sodium	144.0	mEq/L	0 – 381.62
Potassium	4.0	mEq/L	0 – 23.85
Chloride	110.3	mEq/L	287.17 – 489.25

Source: The authors.

Note. The International Species Information System (ISIS) was used as reference.

In the endoscopic examination (Figure 2), hyperemia was observed in all airways of the respiratory system. Additionally, in the nasopharynx, multiple sessile, polypoid, hypochromic, shiny, and firm nodules were present, with no evidence of vascularization. There were also signs of healing in the nasal turbinates, consistent with fibrotic formation in the nasal cavity. The laryngotracheobronchoscopy revealed thickening of the laryngeal walls, bilateral thickening and hypochromia of the vocal cords, the presence of a medium-sized sessile nodule, and bilateral ulcers in the subglottic region. In the main bronchi, slight thickening and vascular congestion of the cartilaginous rings were seen. The right lobar bronchi showed malacia and fracture of the bronchial rings, leading to collapse of these airways, while the left lobar bronchi exhibited vascular congestion and intense edema, causing a reduction in the bronchial lumen.

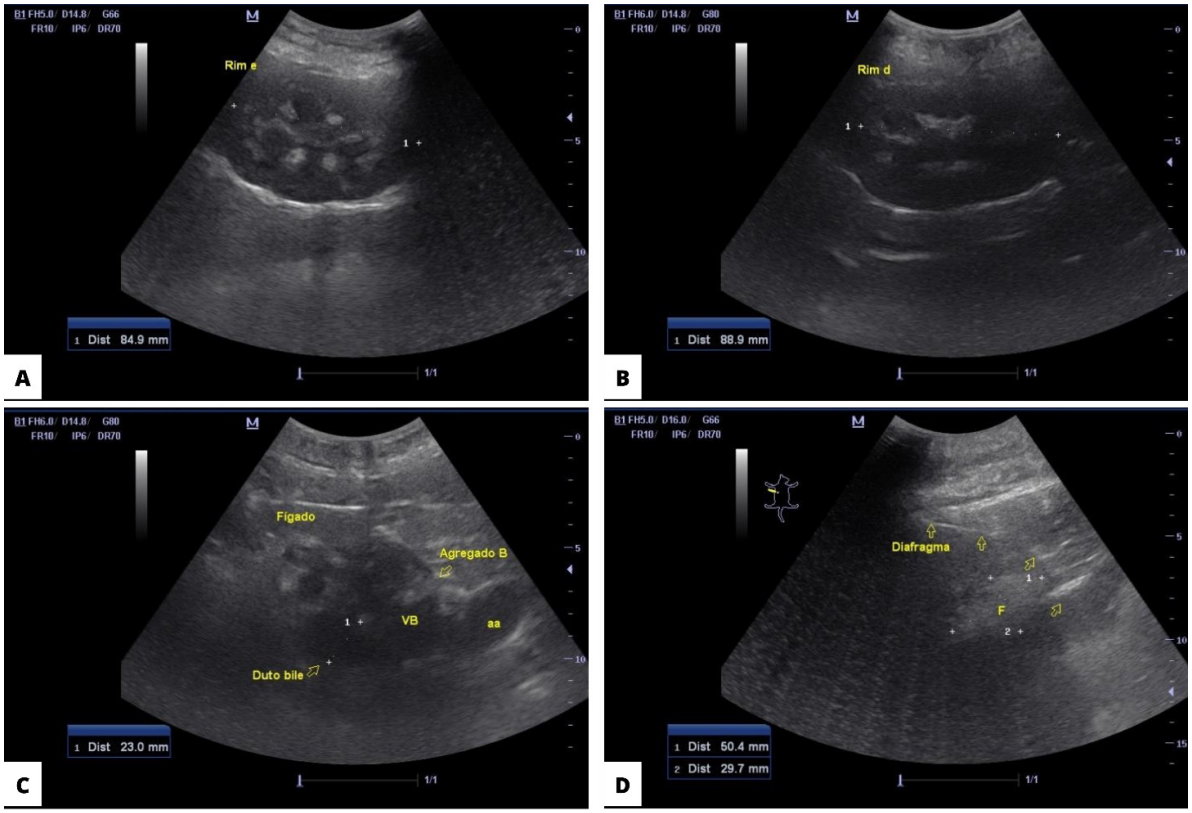
In the radiographic examination (Figure 3), in the thoracic region, the pulmonary parenchyma showed air bronchograms, suggestive of an inflammatory infiltrative disease, diffuse punctate mineralizations indicating senescence, and a linear interstitial pattern, revealing an image at the boundary between senescence and inflammatory infiltrative disease. Regarding the sternum, there were signs of mineralization in the sternocostal joints and dislocation of the xiphoid process, consistent with osteoarthritis.

Concerning the left thoracic limb, there was irregularity in the cortical region of the proximal second metacarpal, suggestive of an inflammatory process. Also, in the same limb, there was adjacent soft tissue on the medial surface of the second metacarpal bone and around the fourth phalanx, indicating a gas infiltrate, which could suggest a cutaneous lesion.

In the radiographic examination of the vertebral column in the lumbar and lumbosacral portions, several changes were

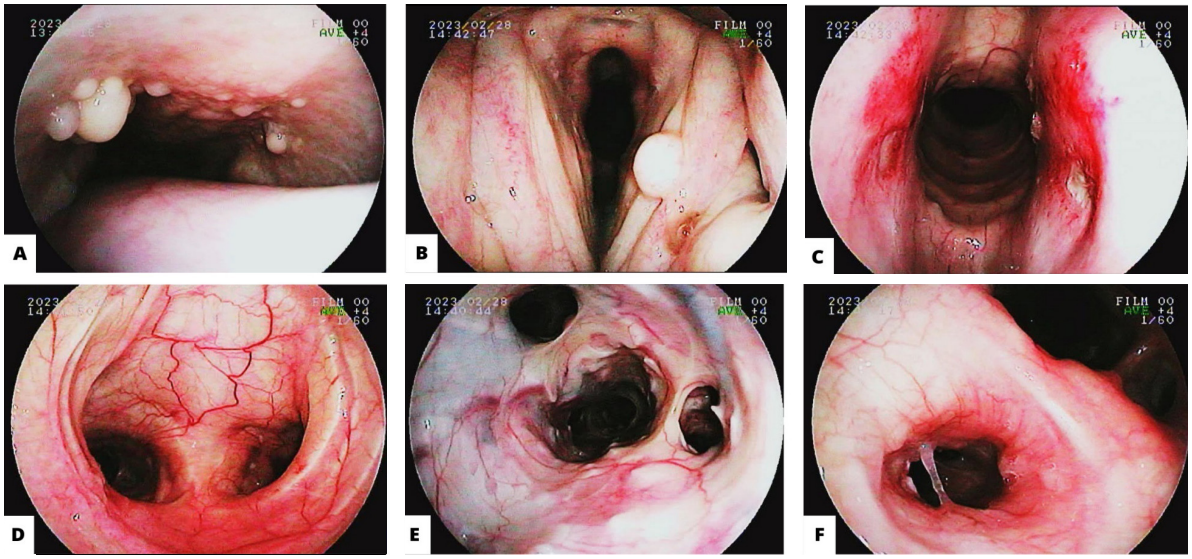
observed, including the presence of enthesophytes on various vertebrae (T13, L1, L4, L5, L7, S1), ankylosing bridges between L1-L2, L2-L3, L3-L4, and L5-L6, with the largest one between L2-L3, opacification of the foramen at L4-L5, which could suggest a disc protrusion, loss of definition in the facet joints, indicating osteoarthritis, and remodeling of the vertebral bodies at L4 and L5. There was also adjacent dorsal tissue overlapping the spinous processes, with numerous diffuse punctate structures of mineral radiopacity, following a linear pattern along the vertebral segment.

Figure 1
Ultrasonographic images.



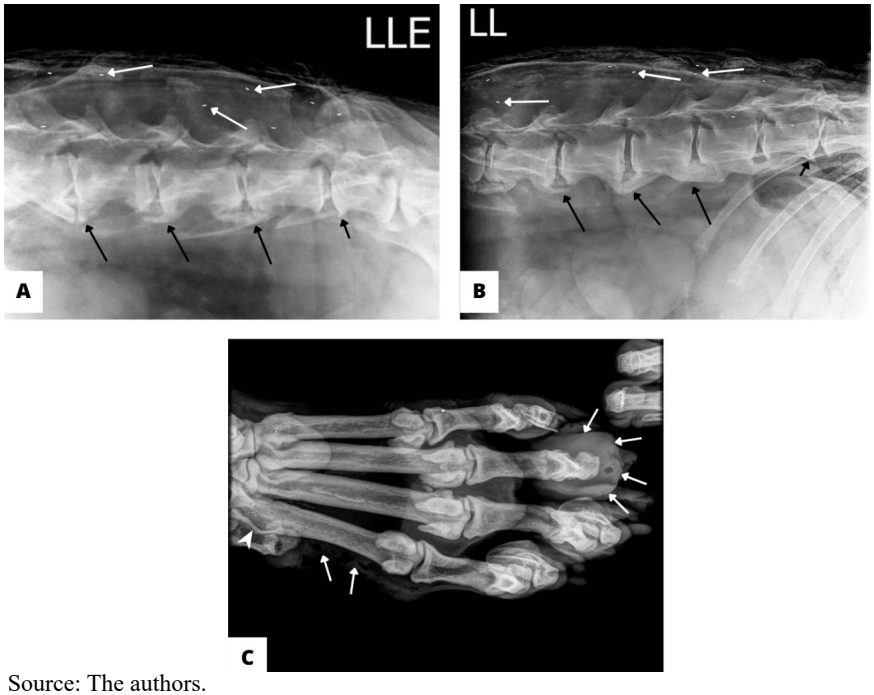
Source: The authors.
Note. (A) Left kidney with subtly irregular contours ("*Rim e*" stands for left kidney); (B) right kidney with subtly irregular contours ("*Rim d*" stands for right kidney); (C) liver and gallbladder ("*Fígado*" stands for liver, "*Agregado B*" stands for aggregate B, "*VB*" stands for gallbladder, and "*Duto bile*" stands for bile duct); (D) left thoracic region with the presence of amorphous content in contact with the diaphragm ("Diafragma" stands for diaphragm).

Figure 2
Laryngotracheobronchoscopy.



Source: The authors.
Note. (A) Sessile polypoid nodules in the oropharyngeal region; (B) sessile nodule in the glottic region; (C) bilateral ulcers in the glottic region; (D) hyperemia and congestion in the tracheal carina region; (E) malacia and fracture of chronic bronchial rings; (F) congestion, edema, and presence of mucous secretion in the lobar bronchus.

Figure 3
Radiography.



Source: The authors.
Note. (A and B) Diffuse punctate structures (white arrows) in the region of the spinous processes, ankylosing bridges (larger black arrows), and enthesophytes (smaller black arrows); (C) distal portion of the left thoracic limb with cortical irregularity (arrow tip on left corner) and gas infiltrate (white arrows).

DISCUSSION

Keeping wild animals in captivity, whether for conservation, research, or environmental awareness purposes, along with advances in veterinary medicine, both lead to increased longevity in these animals. This is because the captive environment provides protection against a variety of factors present in the natural environment that help regulate population control, such as predation, scarcity of food and water, intraspecific competition, and diseases (Tidière et al., 2016). As a result, the lifespan of the animal is extended, which leads to the development and worsening of chronic diseases associated with senility (Owston, Ramsay & Rotstein, 2018).

Osteoarthritis is a chronic condition associated with aging, characterized by the degeneration of articular cartilage. This leads to joint destabilization, which in the case of the spine, is associated with the rupture of Sharpey's fibers—structures that connect the annulus fibrosus of the intervertebral disc to the cortical bone to maintain joint stability. In the areas where the fibers rupture, the body begins to form enthesophytes as a way to stabilize the joint. Over time, enthesophytes from different vertebrae fuse, forming ankylosing bridges, a condition known as deforming spondylosis (Thrall, 2019).

The fusion of enthesophytes between adjacent vertebrae increases stress and tension on the facet joints, which may lead to intervertebral disc prolapse. Over time, this can compress the spinal cord and cause signs such as pain, ataxia, urinary incontinence, paresis, and paralysis (Jericó, Andrade & Kogika, 2023). In the lioness described, increased radiopacity between L4 and L5 suggests the possible onset of disc protrusion.

In this case, the animal was exposed to factors closely related to the routine of wild animals under human care, and such factors do align with predisposing causes of osteoarthritis in domestic cats, such as sedentary behavior and senility.

In the biochemical profile, albumin was found to be below reference values for the species, which could be a consequence of hyporexia. However, other measurements that could have been altered due to this condition remained within reference values. This can be explained by the large reference values, which were determined based on a small sample size of animals, and by the fact that these values are lacking in detailed information in the literature. The same applies to the measurement of amylase and chloride, which were above reference values but may be clinically insignificant when correlated with other measurements and tests.

Other findings support alterations related to senility, such as osteoarthritis of the sternebrae, polypoid nodules, thickened walls of the respiratory tract, diffuse mineralized points, and a linear interstitial pattern in the lungs.

CONCLUSION

It can be concluded that, as in domestic cats due to physiological and phylogenetic similarities, wild felids are also vulnerable to joint diseases, primarily affecting the spine, as the predisposing factors for these alterations described in cats are highly related to the captive environment in which wild animals are housed.

COMPETING INTERESTS
The authors declare that there are no conflicts of interest.

FUNDING ACKNOWLEDGMENTS
The authors declare that they have no financial interests.

AUTHOR CONTRIBUTIONS
Conceptualization: E. A. T. R. B., P. F. M. *Data curation*: E. A. T. R. B., P. F. M. *Formal analysis*: E. A. T. R. B., P. F. M. *Investigation*: E. A. T. R. B., P. F. M. *Methodology*: E. A. T. R. B., P. F. M. *Project administration*: E. A. T. R. B., P. F. M. *Resources*: J. A. S. J., H. S. G., S. R. S. F., G. D., E. S. C., M. F. F., G. G. G., F. H. V. C., D. P. B., R. L. L., R. P. X., L. F. A., G. V. M. B. *Supervision*: E. A. T. R. B., P. F. M. *Validation*: E. A. T. R. B., P. F. M. *Visualization*: E. A. T. R. B., P. F. M. *Writing the initial draft*: E. A. T. R. B., P. F. M. *Revision and editing of writing*: E. A. T. R. B., P. F. M.

PEER REVIEW
Uningá Review thanks the anonymous reviewers for their contribution to the peer review of this work.

REFERENCES

Adania, C, H., Silva, J. C. R., & Felippe, P. A. N. (2014). Carnivora – Felidae (Onça, Suçuarana, Jaguatirica e Gato-do-mato). In Cubas, Z. S., Silva, J. C. R., & Catão-Dias, J. L. (ed.), *Tratado de Animais Selvagens - Medicina Veterinária* (v. 1, 2nd ed., pp. 779-818). Rio de Janeiro, RJ: Grupo GEN.

Barton, L. (2022). *Radiographic characteristics and clinical presentation of DJD in captive cheetahs (Acinonyx jubatus), lions (Panthera leo) and tigers*. [PhD Thesis, Sydney School of Veterinary Science, Faculty of Science, University of Sydney].

Denny, H. R., & Butterworth, S. J. (2006). *Cirurgia ortopédica em cães e gatos*, (4th ed., pp. 39-48). São Paulo, SP: Roca.

Eloff, F. C. (1998). The life of the Kalahari lion (*Panthera leo vernayi*). *Transactions of the Royal Society of South Africa*, *53*(2), pp. 267–269. doi: 10.1080/00359199809520393

Felippe, P. A. N., & Adania, C, H. (2014). Conservação e Bem-estar Animal. In Cubas, Z. S., Silva, J. C. R., & Catão-Dias, J. L. (ed.), *Tratado de Animais Selvagens - Medicina Veterinária* (v. 1, 2nd ed., pp. 2-9). Rio de Janeiro, RJ: Grupo GEN.

Fujita, Y., Hara, Y., Nezu, Y., Yamaguchi, S., Schulz, K. S., & Tagawa, M. (2005). Direct and indirect markers of cartilage metabolism in synovial fluid obtained from dogs with hip dysplasia and correlation with clinical and radiographic variables. *American Journal of Veterinary Research*, *66*(12), pp. 2028-2033. doi: 10.2460/ajvr.2005.66.2028

Jericó, M. M., Andrade, J. P. D. A., Neto, & Kogika, M. M. (2023). *Tratado de Medicina Interna de Cães e Gatos* (2nd ed.). Rio de Janeiro, RJ: Grupo GEN.

Junginger, J., Hansmann, F., Herder, V., Lehmbecker, A., Peters M., Beyerbach, M., Wohlsein, P., & Baumgärtner, W. (2015). Pathology in Captive Wild Felids at German Zoological Gardens. *Public Library of Science, 10*(6). doi: 10.1371/journal.pone.0130573

Mele, E. (2007). Epidemiologia da osteoartrite. *Veterinary Focus, 4th ed., 17*(3), pp. 1-7.

Nicholson, S., Bauer, H., Strampelli, P., Sogbohossou, E., Ikanda, D., Tumenta, P. F., Venktraman, M., Chapron, G. & Loveridge, A. (2023). *Panthera leo*. *The IUCN Red List of Threatened Species,* p. 30. https://dx.doi.org/10.2305/IUCN.UK.2023-1.RLTS.T15951A231696234.en

Nowell, K., & Jackson, P. (1996). *Wild cats: conservation status and species action plan*. Gland, Switzerland: IUCN.

Owston, M. A., Ramsay, E. C., & Rotstein, D. S. (2018). Neoplasia in Felids at the Knoxville Zoological Gardens. *Journal of Zoo and Wildlife Medicine*, *39*(4), pp. 608-613. doi: 10.1638/2008-068.1

Thrall, D. (2019). *Veterinary Diagnostic Radiology (7th ed.).* St. Louis, MO: Elsevier Sounders.

Tidière, M., Gaillard, J.-M., Berger, V., Müller, D. W. H., Lackey, L. B., Gimenez, O., Clauss, M., & Lemaître, J.-F. (2016). Comparative analyses of longevity and senescence reveal variable survival benefits of living in zoos across mammals. *Scientific Reports*, 6. doi: 10.1038/srep36361

Trinkel, M., & Angelici, F. M. (2016). The decline in the lion population in Africa and possible mitigation measures. *Problematic wildlife*, pp. 45-68. doi: 10.1007/978-3-319-22246-2_4