

Benefits of environmental enrichment in animal welfare: A literary review*(Benefícios do enriquecimento ambiental no bem-estar animal: revisão de literatura)*RAMPIM, Letícia Vinhas^{1*}; OLIVA, Valéria Nobre Leal de Souza²¹ Faculdade de Medicina Veterinária de Araçatuba da Universidade Estadual Paulista* Autor para correspondência letvinhas@gmail.com;² Faculdade de Medicina Veterinária de Araçatuba da Universidade Estadual Paulista.

Artigo enviado em 03/08/2016, aceito para publicação em 29/08/2016

DOI: <http://dx.doi.org/10.4025/revcivet.v3i1.32981>**ABSTRACT**

With the increase of popular concern regarding the welfare of animals in captivity, environmental enrichment is a crucial tool for environment adaptation and maintenance of animals out of their natural habitat. Such a procedure aims to promote habitat characteristics to animals in captivity so that they can express a natural behavior of their own species, remain less time in idleness and to reduce or extinguish stereotypical behaviors and stress. This way, the objective of this current research was to elaborate a bibliographic review of animal welfare and environmental enrichment, and also of physiological and behavioral animal stress.

Key-words: applied ethology; stress; animal management.**RESUMO**

Com a crescente preocupação popular sobre o bem-estar de animais mantidos em cativeiro, o enriquecimento ambiental é uma das ferramentas fundamentais para a ambientação e manutenção de animais fora de seu ambiente natural. Tal procedimento visa promover características do habitat em cativeiro para que os animais possam expressar comportamentos naturais de sua espécie, permanecer menos tempo ociosos e diminuir ou extinguir comportamentos estereotipados e o estresse. Desta maneira, o objetivo do presente trabalho foi elaborar uma revisão bibliográfica sobre bem-estar animal e enriquecimento ambiental, assim como aspectos fisiológicos e comportamentais do estresse animal.

Palavras-chave: etologia aplicada; estresse; manejo.**INTRODUCTION**

The scientific study of animal behavior, knowledge of natural evolution processes and their environment, the neurophysiological reports and genetic similarities between species, produce data to recognize the complexity of individual animal life, all fundamental for the definition of welfare (MOLENTO, 2007).

Hurnik (1992) established welfare as a state of harmony between the animals and their environment, demonstrated by great physical and physiological conditions and great animal life quality. However, these can be in great physical condition and be well nourished, but suffering mentally. The manifestation of behaviors such as pain, anguish, fear, frustration,

aggression and endocrine parameters that show stress, indicate that there is no animal welfare.

Animals are capable of enduring low intensities of stress, without there being any harm to their physiological functions. When an animal can not maintain its homeostasis, it starts presenting low welfare conditions. (TELLES *et al.*, 2015).

A stressing agent is one that possesses the capability of changing homeostasis, provoking the activation of the hypothalamic-pituitary-adrenal axis. These stress agents could be hunger, pain, heat/cold, anxiety, fear and other factors (DUKES, 1996). Animal welfare can be analyzed through behavioral assessments along with physiological evaluations. With vertebrates, many hormones such as estrogen, testosterone, progesterone, prolactin, oxytocin and

Rev. Ciên. Vet. Saúde Públ., v. 3, n. 1, p. 060-066, 2016

vasopressin have a role in behavioral expression. (BREED E MOORE, 2012).

Estrogen, for example, is linked to feminine sexual receptivity and maturation. On the other hand, testosterone, is linked to male sexual receptivity, maturation and dominance. Parental behavior is linked to progesterone and prolactin (BREED E MOORE, 2012).

The hormone cortisol is linked to the behavior that is stress. It is known that stress increases the activity of the hypothalamic-pituitary-adrenal axis (HPA) and results in the increase of corticosteroids secretion from the adrenal cortex. Cortisol and corticosterone therefore are used many times as biomarkers for stress and depressive disorders. (GONG, *et. al*, 2015).

Adrenaline also has a determining factor in state of stress. It is a neurotransmitter and a sympathomimetic derived from the modification of tyrosine and secreted from adrenal glands. In moments of stress, the adrenals glands secrete ample amounts of adrenaline that prepares the organism for physical efforts. (BERECK E BRODY, 1982).

This hormone triggers a "fight or escape" behavior and puts it in a state of awareness. The "fight or escape" behavior is often seen in reactions of fear or discomfort. The effects of an increase of adrenaline in the blood are an increase of the heart rate, respiratory rate and vasoconstriction. Therefore, it can be verified that hormones trigger behaviors, as does the environment influence animal physiology, therefore affecting welfare. (BREED E MOORE, 2012).

Another alternative for evaluating animal welfare is the mensuration of oxytocin, known as the hormone of pleasure. It is a nonapeptide hormone secreted in the paraventricular nucleus of the hypothalamus, and later stored in the neurohypophysis. This hormone betters the response to stress induced by the reduction of secretion of the adrenocorticotrophic hormone and cortisol. Along with other hormones and neurotransmitters, oxytocin participates in essential

behaviors so that social bonds can be made, along with the maintenance of these bonds. (DACOME E GARCIA, 2008).

Captivity environments have effects on physiological, cognitive and behavioral conditions. In these environments, animals are mostly idle and remain in a constant state of boredom. In an appropriate environment and/or poor in stimulus can trigger non-adaptive responses such as: stereotypical behavior, cognitive deficits and emotional disturbances (BOERE, 2001).

Environmental enrichment consists in the use of creative techniques that, according to the behavioral need of each species, maintain the animal busy, raising behavior diversity, thus being an alternative promotion of animal welfare. Offering sensory stimulus, objects and toys, can trigger many different answers. The objective of enrichment is achieved when abnormal behaviors are reduced or when the frequency of desired behavior is increased. (REISFELD *et al.*, 2011).

Environment enrichment has the objective of making the environment more suitable to animals' behavioral needs. It is an area of animal handling the aims at the reduction of stress and the reduction of behavioral disorders so that animals can achieve their physical and psychic welfare. (CAMPOS, *et.*, 2010).

Welfare also depends on available space. Many times a species that needs a lot of space for transport is maintained in small cages or in ones that have too many animals, limiting movement and preventing natural behavioral manifestations (SILOTO *et. al*, 2009).

Techniques used in environment enrichment are divided in physical enrichment (related to the physical structure of the enclosure), sensory enrichment (presenting elements that stimulate the five senses), cognitive enrichment (mechanisms that stimulate intellectual capacities), social enrichment (intraspecific or interspecific interaction created inside the enclosure), nourishment enrichment (establish a

certain difficulty in obtaining food, stimulating food foraging) (DOMINGUEZ, 2008).

The parameters that can be altered by the use of animal environment enrichment techniques are: reduction of the excitability level of animals up for procedures of experimental manipulation, improvement of general health conditions, reduction of level of intraspecific aggression, reduction of the frequency of stereotypical behaviors, improvement of social behavior with the group and idleness reduction (SAAD *et al.*, 2011).

DEVELOPMENT

Concerning animals in laboratories, stress in caused mainly by poor handling, discomfort, fear inducing stimulants and the incapacity of maintaining normal behavior patterns. However, the major cause of stress in these animals is pain. When feeling pain, the animal tries to adapt by using stereotypical postures or behaviors (ANDRADE *et al.*, 2002).

The concern with the welfare of animals being experimented on made that in 1959, RUSSEL & BURCH idealized the 3Rs Principle (Replacement, Reduction and Refinement), which defended the replacement of animals with tissue cultivation and computer generated models, reduction of the number of animals used and the use of less invasive techniques. This principle is still discussed and stimulated currently (CRISSIUMA E ALMEIDA, 2013).

Russel and Burch also consider environmental enrichment an ethical necessity in the environment of animals in laboratories. Environmental enrichment is still under used in vivariums because it represents more work in the routine of cleaning and handling. However, animals kept in artificial environments are less adequate models experimental extrapolation results for humans and the absence of hideouts so that the animal will feel safe, this keeps animals from expressing normal behavior. (NEVES *et al.*, 2013). Beneficial effects of environment enrichment on laboratory animals can be attained without harming the validity of data from researches that use these animals. Decreasing

stress levels and contributing to the expression of natural behavior will result in experimental data that is more reliable and reproducible. (MEDINA, 2012).

Lodging systems for animals have often been based on economical and ergonomical aspects with little to no consideration for animal welfare. Maintenance and care techniques traditionally used on laboratory animals usually don't include specific species necessities in relation to its environment. (BAUMANS *et al.*, 2005).

Siloto *et al.* (2009), concluded in his work that the environmental enrichment of rabbits kept in cages favors the animals welfare and it is a way to satisfy behavioral needs. With the enrichment of cages' floors and temperature regulation, the study aimed to reduce stereotypical behavior.

When promoting the welfare of farm animals, it is necessary not only to remove pain during its slaughter but to also remove pre-slaughter stress, transport and specially during breeding. Because of economic reasons, these animals are usually kept in small environments and/or with too many other animals and monotonous. (MAIA, 2013). Furthermore, it is proven that meat quality is affected by a lack of welfare, resulting in the decline in production and sales. (WARRIS, 2010).

The Farm Animal Welfare Council of the United Kingdom created the five freedoms. These five freedoms determine that animals have the right to be (1) free of hunger or thirst, (2) free from discomfort, (3) free from pain, injury or disease, (4), free to express (most) normal behavior and (5) free from fear and distress. These freedoms can also be extrapolated to animals used for experimentation, household and wild. (WSPA, 2013).

In a Sans *et al.* (2014), reached the conclusion that environment enrichment provided an increase in the behavioral repertoire of chickens used for food, gaining animal welfare. For this improvement, perches, sand boxes, cabbage and suspended items such as smashed cans, bottle caps and colored balls were used.

Campos *et al.* (2010), used toys made out of plastic bottles in the environmental enrichment for piglets in their nursing phases and arrived to the conclusion that this procedure is attractive, but soon animals get used to the objects thus end up interacting with one another and ignoring the toys.

Presently, zoos have goals such as: species preservation, professional development and improvement, scientific research, environmental education and recreation. (SAAD *et al.*, 2011).

To promote the welfare of wild animals in captivity, each species needs correct adequate handling planned based on studies of species-specific animal behavior. It is necessary that balanced diets of water *ad libitum*, enclosure temperature, humidity, lighting and noise control are offered. Nevertheless, enclosure atmosphere is of utmost importance, such that environmental enrichment techniques are recommended (SILVA *et al.*, 2008).

In a Telles *et al.* (2015) research it can be seen that environmental enrichment of parakeets which had a psychogenic removal of feathers presented better results regarding behavioral aspects and plumage, compared to haloperidol treatment. Items used for environmental enrichment were: inserting hanging bananas, leather straps, tree branches, wooden discs with cavities filled with fruits, cashew nuts and corn cobs.

Reisfeld *et al.* (2011), managed to reduce wounds on the paws of penguins with enclosure environmental enrichment. Penguins started spending more time in the water, avoiding new wounds. For their environmental enrichment the following was used: balls and colored plastic rings, bubbles, hula hoops and ice block with fish.

In a Coelho *et al.* (2016), study, behavioral and physiological parameters indicated that maned wolves had a positive response towards environmental enrichment with the use of items for foraging enrichment, promoting a better well-being to the animals.

According to the IBAMA's Normative Instruction number 17 of 2015, wild animal enclosures kept in zoos must have, according to the need of each species, the following: shelter (a place that offers protection against weather, also so that the animals can rest), something that separates visitors from animals (physical barriers so people won't be able to get too close to enclosures), escape route (a place that offers the animal psychological safety), exposition area (enclosure are where animals are exposed to the visiting public), bathing (wet area presenting small depths of water), solid visual barrier (to give the animal privacy and ease) change (confined space for various types of handling), hall (structure to enhance security against escapes), water mirror, solarium (a place that enables animals to be exposed to sun light) and dens.

The chapter "Studies conducted on wild animals kept outside of research or education institutions installments" of the Brazilians guide to production, maintenance and use of animals in education or scientific research of the Science, Technology and Innovation Ministry of 2015 points out the importance of escape routes in their environment. According to the guide, wild animals must have the possibility of free access to hide/protect itself always when the need is felt.

For the musk deer (*Moschus sp.*), for example, the guide indicated the use of grass or other underbrush for its ground, shelter of 2m², arboreal, shrubby vegetation and points for escape. The indication of escape routes is advised for the Cervidae, Antilocapridae and Bovidae families (MCTI, 2016).

Domesticated animals may be kept in lodgings, since they are work or experiment animals, but a large part is kept in zoonoses city control centers or in organizations focused on animal protection, due to high rates of abandonment (DELABARY, 2012). Behavioral alterations kill more pets in the United States of America than any infectious disease process. Animals with inappropriate behaviors are usually

abandoned, mistreated and neglected (HORWITZ E NEILSON, 2008).

Pet dogs and cats may develop many types of abnormal behaviors such as compulsion, aggressiveness, excessive excitement, stress, fear, destructive behavior and anxiety. In captivity, these animals tend to have a bigger predisposition to these behaviors due to inadequate handling which includes the use of inadequate housing in small or over capacity stalls (BEAVER, 2009).

According to the Soares *et al.* (2010) study, behavioral disorders most related in dogs, according to an inquiry conducted with veterinarians are: destructive behavior, aggression and compulsive behaviors.

Some of these behaviors are triggered by the Separation Anxiety Syndrome (SAS). Among the signs of SAS: excessive vocalization, urinate several times around the house while owner isn't present, destructive behavior, increased reception behavior, anxiety caused by signs of parting and behaviors of excessive accompaniment of owner. The SAS treatment can be pharmacological and/or behavioral modification. Behavioral modification comprises the training and raise in physical activities that may be induced by techniques of environmental enrichment (SILVA, 2009).

Environmental enrichment may be, however, used to ease these behavioral problems, mainly aiming at the goal to reduce idleness (BEAVER, 2009).

According to the Herron *et al.* (2014) research, environmental enrichment promotes desirable behaviors and reduces undesirable behaviors in cats kept in kennels. In addition to being exposed to environmental enrichment, dogs also participate in a training protocol.

CONCLUSION

Most studies prove the benefits that environmental enrichment gives to animals in captivity. The use of this procedure tends to recover or induce natural behaviors to its species and reduce, in a noticeable way, stress, stereotypies and self-mutilation.

REFERENCES

- ANDRADE, Antenor; PINTO, Sergio Correia; OLIVEIRA, Rosilene Santos de. **Animais de Laboratório: criação e experimentação**. Rio de Janeiro: Fiocruz, 2002. 388 p.
- BAUMANS, V.. Environmental Enrichment for Laboratory Rodents and Rabbits: Requirements of Rodents, Rabbits, and Research. **Ilar Journal**, v. 46, n. 2, p.162-170, 1 jan. 2005. Oxford University Press (OUP).
- BEAVER, Bonnie V. G.. **Canine Behaviour: Insights and answers**. St. Louis: Elsevier Health Sciences, 2009. 315 p.
- BERECK, K. H.; BRODY, M. J.. Evidence for a neurotransmitter role for epinephrine derived the adrenal medulla. **American Journal Of Physiology**, Washington, v. 242, n. 4, p.242-256, jun. 1982.
- BOERE, Vanner. Environmental enrichment for neotropical primates in captivity. **Cienc. Rural**, [s.l.], v. 31, n. 3, p.543-551, jun. 2001.
- BREED, Michael D.; MOORE, Janice. **Animal Behaviour**. San Diego: Academic Press, 2012. 496 p.
- CAMPOS, Josiane A. et al. Enriquecimento ambiental para leitões na fase de creche advindos de desmame aos 21 e 28 dias. **Revista Brasileira de Ciências Agrárias - Brazilian Journal Of Agricultural Sciences**, Recife, v. 5, n. 2, p.272-278, 6 jul. 2010. *Revista Brasileira de Ciencias Agrarias*. <http://dx.doi.org/10.5039/agraria.v5i2a660>.
- CRISSIUMA, A. L; ALMEIDA, E. C. P. Experimentação e bem-estar animal – artigo de revisão. **Saúde e Ambiente**, Duque de Caxias, v. 1, n. 2, p.1-10, dez. 2013.
- COELHO, Carlyle Mendes et al. Environmental Enrichment Effect on Fecal Glucocorticoid Metabolites and Captive Maned Wolf (*Chrysocyon brachyurus*) Behavior. **Journal Of Applied Animal Welfare Science**, London, p.1-10, 8 abr. 2016.
- DACOME, Ocimar Aparecido; GARCIA, Rosângela Fernandes. Efeito modulador da ocitocina sobre o

- prazer. **Saúde e Pesquisa**, Maringá, v. 2, n. 1, p.193-200, maio 2008.
- DELABARY, Barési Freitas. Aspectos que influenciam os maus tratos contra animais no meio urbano. **Revista Eletrônica em Gestão, Educação e Tecnologia Ambiental**, Santa Maria, v. 5, n. 5, p.835-840, jun. 2012.
- DOMINGUEZ, T. N.. **Enriquecimento ambiental em zoológicos**. 2008. 50 f. TCC (Graduação) - Curso de Zootecnia, Instituto de Zootecnia, Universidade Federal de Viçosa, Viçosa, 2008.
- DUKES, H.H. **Fisiologia dos Animais Domésticos**. 11ª edição. Editora Guanabara Koogan S.A. Rio de Janeiro, 1996.
- GONG, Shuai et al. Dynamics and Correlation of Serum Cortisol and Corticosterone under Different Physiological or Stressful Conditions in Mice. **Plos One**, [s.l.], v. 10, n. 2, 20 fev. 2015.
- HERRON, Meghan E.; KIRBY-MADDEN, Taylor M.; LORD, Linda K.. Effects of environmental enrichment on the behavior of shelter dogs. **Journal Of The American Veterinary Medical Association**, [s.l.], v. 244, n. 6, p.687-692, 15 mar. 2014.
- HORWITZ, Debra F.; NEILSON, Jacqueline C.. **Comportamento canino & felino**. Porto Alegre: Artmed, 2008. 662 p.
- HURNIK, J.F. **Farm animals and the environment**. Wallingford: CAB International, 1992, p. 235-244.
- INSTITUTO BRASILEIRO DO MEIO AMBIENTE E DOS RECURSOS RENOVÁVEIS. **Nº 17: Instrução Normativa**. Brasília: Ibama, 2015.
- MCTI. Estudos conduzidos com animais silvestres mantidos fora de instalações de instituições de ensino ou pesquisa. In: MCTI. **Guia brasileiro para produção, manutenção e utilização de animais em atividades de ensino ou pesquisa científica**. Brasília: Ministério da Ciência, Tecnologia e Inovação, 2016. p. 300-365.
- MAIA, Ana Paula de Assis et al. ENRIQUECIMENTO AMBIENTAL COMO MEDIDA PARA O BEM-ESTAR POSITIVO DE SUÍNOS. **Reget**, Santa Maria, v. 14, n. 14, p.2862-2877, 23 set. 2013. Universidade Federal de Santa Maria.
- MEDINA, Marcelo Pizzio. **Efeitos do enriquecimento ambiental no comportamento e bem-estar de animais de laboratório convencionais**. 2012. 48 f. TCC (Graduação) - Curso de Medicina Veterinária, Faculdade de Veterinária, Universidade Federal do Rio Grande do Sul, Porto Alegre, 2012.
- MOLENTO, Carla Forte Maiolino. Bem-estar animal: Qual é a novidade? **Acta Scientiae Veterinariae**, Paraná, v. 35, n. 2, p.224-226, jun. 2007.
- NEVES, Silvânia M. P.; MANCINI FILHO, Jorge; MENEZES, Elizabete Wendel de. **Manual de cuidados e procedimentos com animais de laboratório do biotério de produção e experimentação da FCF-IQ/USP**. FCF-IQ/USP. São Paulo: Fcf-iq/usp, 2013. 234 p.
- REECE, William O.. **Fisiologia dos animais domésticos**. 11. ed. Rio de Janeiro: Guanabara Koogan, 1996.
- REISFELD, Laura et al. Reducing bumblefoot lesions in a group of captive Magellanic penguins (*Spheniscus magellanicus*) with the use of environmental enrichment. **Pesq. Vet. Bras.**, [s.l.], v. 33, n. 6, p.791-795, jun. 2013. SAAD, Carlos Eduardo do Prado; SAAD, Flávia Maria de Oliveira Borges; FRANÇA, Janine. Bem-estar em animais de zoológicos. **Revista Brasileira de Zootecnia**, Lavras, v. 40, n. 1, p.38-43, jun. 2011.
- RUSSEL, W. M. S.; BURCH, R. L. The principles of humane experimental technique. London: **Universities Federation for Animal Welfare (UFAW)**, 1959. ISBN:0900767782. Special Edition.
- SANS, Elaine Cristina de Oliveira et al. O enriquecimento ambiental sobre o bem-estar de frangos de corte. **Cienc.rural**, Santa Maria, v. 44, n. 10, p.1867-1873, out. 2014.
- SILOTO, Estela Valéria et al. Temperatura e enriquecimento ambiental sobre o bem-estar de coelhos em crescimento. **Cien.rural**, Santa Maria, v. 39, n. 2, p.528-533, mar. 2009.
- Rev. Ciên. Vet. Saúde Públ.*, v. 3, n. 1, p. 060-066, 2016

- SILVA, Jean Carlos Ramos; SIQUEIRA, Daniel Barreto; MARVULO, Maria Fernanda Viana. Ética e bem-estar em animais silvestres: unidades de conservação. **Ciênc. Vet. Trop.**, Recife, v. 11, n. 1, p.61-65, abr. 2008.
- SILVA, Lígia Henz. **Ansiedade de separação em cães e gatos: revisão de literatura**. 2009. 42 f. Monografia (Especialização) - Curso de Clínica Médica de Pequenos Animais, Universidade Federal Rural do Semi-Árido, Curitiba, 2009.
- SOARES, Guilherme Marques et al. Epidemiologia de problemas comportamentais em cães no Brasil: inquérito entre médicos veterinários de pequenos animais. **Ciência Rural**, Santa Maria, v. 40, n. 4, p.873-879, abr. 2010.
- TELLES, Luiz Flávio et al. Arrancamento de penas psicogênico em maritacas: haloperidol e enriquecimento ambiental. **Cienc. Rural**, Santa Maria, v. 45, n. 6, p.1099-1106, jun. 2015.
- WARRIS, Paul. **Meat science: an introductory text**. 2. ed. Washington: Cabi, 2010. 248 p.
- WSPA. **SOCIEDADE MUNDIAL DE PROTEÇÃO ANIMAL**. 2013. Disponível em: <<http://www.wspbrasil.org>>. Acesso em: 06 jul. 2016.