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Behavioral assessment of shelter dogs submitted to different methods of environmental enrichment

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ABSTRACT: *Environmental enrichment is a dynamic process consisting of a set of activities designed to meet the ethological and psychological needs of animals. It stimulates the natural behavior of each animal species improving the well-being of the individual and avoiding the development of stereotyped behaviors. The present study aimed to assess the potential benefits that four different types of environmental enrichment would bring to the quality of life of shelter dogs. Twenty dogs were observed for 6 hours daily for 5 consecutive days in the first week in order to assess and document their behavior patterns in an experimental kennel. Between the second to the fourth week, 3 forms of game and 1 type of food enrichment were used in the first 4 days of each week. On the fifth day of each week, behavioral patterns were recorded and later compiled and analyzed according to the Tukey test. Statistical analysis showed significant differences in behaviors associated with lying down, standing up, and licking. Based on our findings, we concluded that the use of environmental enrichment methods through different types of games and toys in shelters decreased signs of depression and stereotyped behavior of kennelled dogs. Results of the present study showed that these tools may help improve life quality of these animals.*
Key words: *well-being, animal welfare, behavior, abandoned dogs, behavioral disorders.*

Avaliação comportamental de cães de abrigo submetidos a diferentes métodos de enriquecimento ambiental

RESUMO: *O enriquecimento ambiental é um processo dinâmico que consiste em um conjunto de atividades com a finalidade de atender às necessidades etológicas e psicológicas dos animais, estimulando os comportamentos naturais de cada espécie, melhorando o bem estar e evitando comportamentos estereotipados. O objetivo deste trabalho foi observar o benefício que quatro diferentes formas de enriquecimento ambiental trariam para melhorar a qualidade de vida de cães de abrigo. Vinte cães foram observados durante 6 horas diárias por cinco dias consecutivos na primeira semana, com a finalidade de se obter o padrão de comportamento no ambiente estéril do abrigo. Da segunda à quarta semana foram aplicadas três formas de brincadeiras e uma forma de enriquecimento alimentar nos primeiros quatro dias de cada semana. No quinto dia de cada semana os padrões de comportamento foram registrados e, posteriormente, compilados e analisados pelo teste de Tukey. A análise estatística demonstrou diferença significativa nos comportamentos de deitar, de ficar em pé e de lamber-se. Conclui-se que a aplicação do enriquecimento ambiental, por meio de diferentes formas de brincadeiras, empregado em abrigo para cães, diminuiu os sinais de depressão e os comportamentos estereotipados, demonstrando ser uma ótima ferramenta para aumentar a qualidade de vida destes animais.*
Palavras-chave: *bem estar, comportamento, animais abandonados, distúrbios comportamentais.*

INTRODUCTION

Environmental enrichment is a method that improves the quality of life of animals in captivity including kennelled dogs. Physical and physiological welfare indicators are influenced by environment stimulation. Thus, environmental enrichment is a method that provides better living conditions to animals (BOERE, 2001). BLOOMSMITH et al. (1991) classifies five types of environmental enrichment: (1) Social enrichment; (2) Occupational enrichment; (3) Physical enrichment; (4) Sensorial enrichment; (5) Nutritional enrichment.

Environmental enrichment benefits include stress reduction and decrease of behavioral disorders (CARLSTEAD & SHEPHERDSON, 2000) such as pacing (DE ROUCK et al., 2005), licking, food regurgitation (LYONS et al., 1997), hiding from

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others, and apathy (WIELEBNOWSKI et al., 2002). These are some examples of abnormal behavior which may be manifested in animals in captivity and are considered stereotypical.

Many dogs live a significant part of their lives in overcrowed non-governmental organizations which house an excessive number of animals (overpopulation). Environmental enrichment for shelter dogs should be part of a care plan for animals involving physical and psychological well-being (MILLER; ZAWISTOWSKI, 2013) for the animals to be adopted.

All dog shelters should provide sufficient space for animals to stand up, turn around, walk, stretch themselves, and avoid injurious stimuli. These facilities should have separated areas for rest, food, water intake, exercise, regular movement, and defecation (GOURKOW; FRASER, 2006), including forms to expand and diversify the space and provide resources for observation and rest. Social interaction provides physical and mental exercise, stimulation of senses, contact, interaction between animals, comfort, and new experiences (MILLER; ZAWISTOWSKI, 2013).

Toy supply is probably the most common method towards enrichment in dog shelters. Success in using toys depends on a number of factors including age, experience with toys (toys may scare naïve dogs as younger animals may not be familiar with these objects), mental and physical states (depressed, stressed or sick animals usually do want to play around with toys), toy features, presence of other dogs in the same room/environment, and habituation (most animals lose interest in a toy within a day). For older animals, rotation of toys (regular change or replacement with new toys) may have greater importance than the introduction/use of these inanimate objects into the kennel environment (WELLS, 2004). Toys should be gradually introduced to the environment of fearful, anxious, shy dogs. Enrichment provided by the supply of food and toys may increase the dog's activity level, resulting in less barking, and allowing greater behavioral expression and freedom (SCHIPPER et al., 2008).

The use of environmental enrichment have had positive results in different animal species including rabbits (SILOTO et al., 2009), felids ("big cats" - cougars and lions) (CARNIATTO et al., 2008), marmosets (BORGES et al., 2011), pigs (MAIA et al., 2013), chimpanzees (PULLEN et al., 2010), snow leopards (DIAS, 2010), broilers (SANS et al., 2014) and shelter dogs (COPPOLA et al., 2006).

MATERIALS AND METHODS

In this research proposal, 20 dogs from a canine shelter located in the city of Campina Grande, State of Paraiba, northeast Brazil, including castrated males and spayed females of different ages. All dogs were housed in 4 kennels. In kennel I, there were 6 animals, in kennels II and III 5 animals each, and in kennel IV 4 dogs. Each kennel was used as a control. The size/measurements/dimensions of each kennel were: kennel I: 7,50mx8,50m; kennel II: 7,50mx3,70m, kennel III: 5,30mx3,10m, and kennel n 4: 5,10mx3,05m. Bedding in each kennel was made of rubber from car tires, and there was one bed for each dog. Moreover, food and water was available to all dogs.

Initially, the behavior of all dogs in each kennel was observed *in loco*, without environmental enrichment, for 6 hours daily, i.e. 3 hours in the morning and 3 hours in the afternoon for 5 consecutive days. This week was named week zero (0) or week of observation. Week zero (0) was used as a control for the analysis of the following 3 weeks of the study and was used as criteria to choose the major behavior patterns and behavioral changes to be recorded.

All types and patterns of behavior were documented in individual sheets. Dogs had no interaction with the researcher. Behavioral patterns consistently observed on a regular basis included: laying down, sitting down, standing up (stance), growling, licking, and scratching. The experimental trial was carried 4 days a week for 3 weeks and were named week 1 (1), week 2 (2) and week 3 (3).

Environmental enrichment consisted of three different type of games to play with dogs and 1 type of food enrichment. Games included tennis, tug of war, and bottle with snacks and frozen food. These games were organized so that each kennel had 90 minutes of each activity daily, from the 1st to the 4th day of weeks 1, 2, and 3.

However, to adjust the sum of hours of monitoring of the dogs' behavior, a game was repeated from the first to the third day each week, and on the fourth day another type of enrichment was applied in order to achieve a total of 3 hours in the morning and 3 hours in the afternoon of environmental enrichment, from the first to the fourth day of each week, and taking into account/computing 6 hours of enrichment daily. Each researcher recorded in worksheets the behavior changes and patterns of dogs from each kennel while monitoring these animals. A spreadsheet was used to record data. The behavior of the dogs was coded every 10 minutes. Observation occurred on the

fifth day of each week (weeks 1, 2, and 3), during 3 hours in the morning and 3 hours of the afternoon.

The timespan that the nutritional enrichment with frozen food (size 8x15cm) stuffed with cooked meat was available varied according to the dog's willingness to eat. In the fifth day of each week, the dogs' behavior was recorded in sheets. The types of enrichment used were:

Tug of war (social enrichment): a rope with a knot on each end was given for each dog to play with. The purpose of this game was to stimulate the dog to play tug of war with the researcher (Figure 1A) or with another dog from the same kennel. The researcher remained in the kennel until the dogs showed disinterest in the game.

Plastic bottle with holes and filled with snacks (sensory enrichment): A bottle was given to each dog at a kennel. After 90 minutes, if the animals were unable to remove the snacks from the bottles, then researcher opened the bottles themselves and the snacks inside were offered to the dogs (Figure 1B).

Tennis ball (social enrichment): A tennis ball was given for each dog of a kennel to play around. The ball was thrown several times towards each dog until it showed interest in playing with it. Otherwise, the researcher stopped trying to play with the dog using this tennis ball (Figure 1C).

Frozen food: cooked frozen ground beef with the shape of milk boxes was offered to each dog. The dog kept licking the frozen food several times until the ice melted (Figure 1D).

Each week data/observations were annotated in sheets for each dog. This information was subjected to the General linear model considering the negative binominal distribution. Averages were compared using the Tukey test.

RESULTS

In the present study, all dogs remained less time lying down during the weeks in which environmental enrichment was introduced into the shelter kennels when compared with week 0 of observation. The difference between the week 0 and the week 3 was significant. However, there was no significant difference between weeks 1, 2, and 3 (Figure 2A).

With regard to standing up, the frequency was significantly higher in the three weeks that the environmental enrichment was used in the kennels than the week of observation (zero) (Figure 2B). In the behavior week observation (week zero) before

Figure 1 - Types of games conducted with dogs in order to reduce stress. Tug of war (A) Game with a plastic bottle with holes and filled with snacks (B) game with a tennis ball (C) Game with frozen food (D).

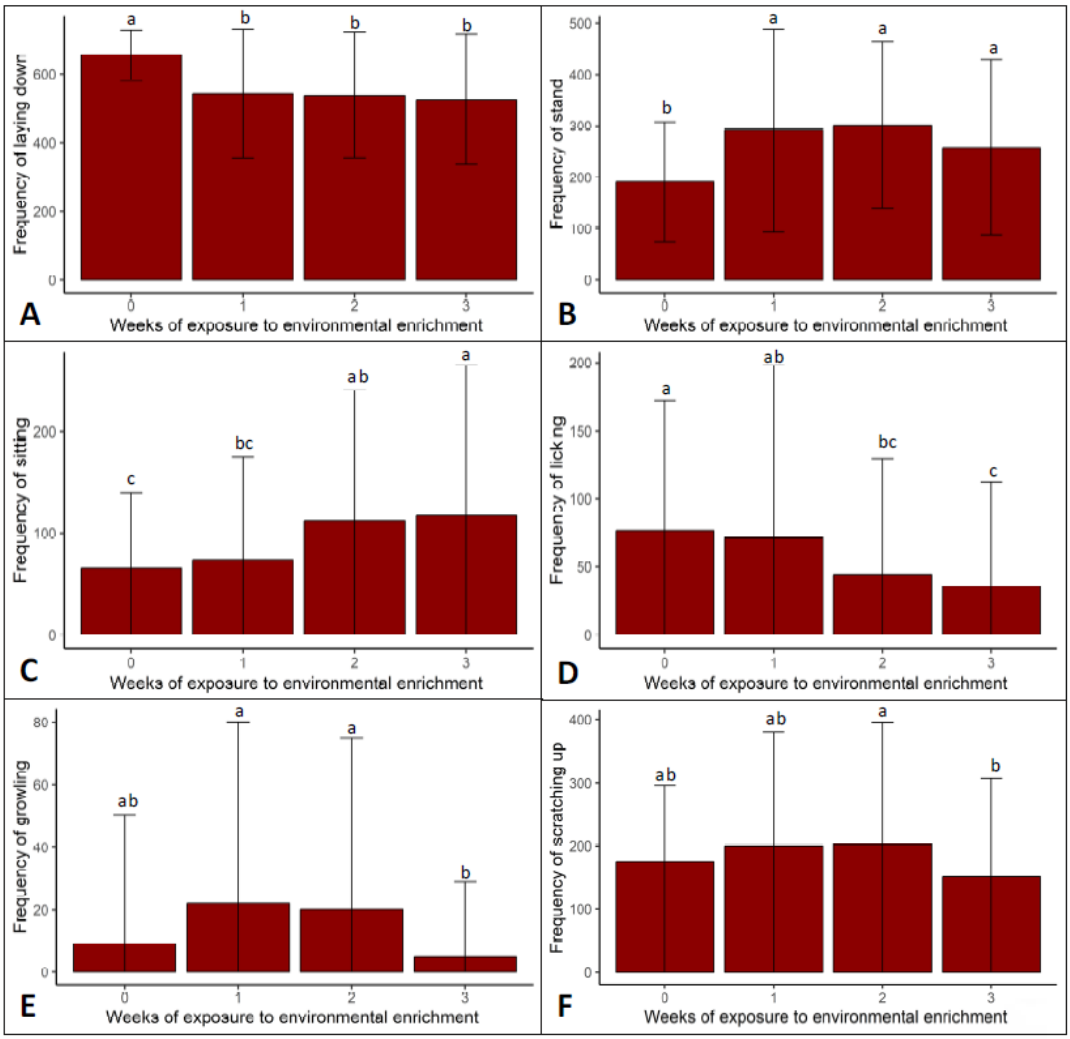

Figure 2 - Implementation of different environmental enrichment methods for 20 shelter dogs. The averages followed by the same letters are equal amongst themselves by the Tukey test at 5% probability. A: Total number Frequency observation of laying down behavior before (week 0) and after the introduction of environmental enrichment (weeks 1, 2 and 3). B: Total number Frequency observation of stand before (week 0) and after environmental enrichment was introduced (weeks 1, 2 and 3). C: Total number Frequency observation of sitting before (week 0) and after environmental enrichment was introduced (weeks 1, 2 and 3). D: Total number Frequency observation of licking before (week 0) and after the introduction of an environmental enrichment (weeks 1, 2 and 3). E: Total number Frequency observation of growling before (week 0) and after environmental enrichment was introduced (weeks 1, 2 and 3). F: Total number Frequency of observations of scratching up before (week 0) and after environmental enrichment was introduced (weeks 1, 2 and 3). Different letters indicated significant difference.

the introduction of environmental enrichment, the frequency of sitting down was lower for all dogs. With the inclusion of an environmental enrichment, these behavioral values gradually increased during the following three weeks. These values were significantly high/increased in weeks 2 and 3 (Figure 2C).

During these weeks, the frequency of licking decreased gradually with the use of an environmental enrichment method. Differences were significant during the 2th and 3th week (Figure 2D). Dogs showed higher frequency of growling during weeks 1 and 2 compared with the zero week (0). No significant difference was noted though. In the third

week, the frequency of growling was significantly lower than weeks 1 and 2 in an environmental enrichment was included (Figure 2E). There was a significant difference in the frequency of scratching in the third week of environmental enrichment for 20 shelter dogs (Figure 2F).

Dogs were more willing to play with plastic bottle with holes filled with snacks. Otherwise, dogs were not interested in playing with a tennis ball. Based on the observations of how the dogs interacted with bottles and for how long these animals played with this object, we were able to assess the degree of excitement and level of interest of these animals.

DISCUSSION

Small spaces and overcrowding in one facility frustrates and bores dogs as movement is restricted limiting their exploratory behavior. In such environment, dogs are predisposed to develop behavioral disorders such as stereotyped behaviors, inactivity, apathy, boredom, anxiety, and even depression (WELLS, 2004).

Based on the observations on week zero (0), sitting, lying, lifting, growling, and licking were behavioral patterns that were considered by the authors as essential in the evaluation since the reduction or increase of each of these behavior patterns would favor the introduction of environmental enrichment in the kennels.

In the canine shelter where the study was conducted, dogs were divided into groups and housed together. Nevertheless, no interaction was observed between animals which spent most of their time lying down by themselves. Dogs started to be more active in the weeks following the introduction of an environmental enrichment. Moreover, the frequency of their sitting and standing increased significantly thus reducing the time they spent lying down. The frequency of their sitting and standing increased significantly thus reducing their time lying down. The third week of enrichment had the highest value in the graph with respect to the behavior of sitting down. This finding may indicate that the enrichment a positive impact with respect to the agitation/ excitement of animals that stopped lie down so often and spent an increased amount of time sitting or standing up.

One of the factors that may have triggered a feeling of sadness in dogs may be the physical environment of kennels, with regard to food, water, and bedding (beds made of rubber from car tires). According to MARSTON and BENNETT (2003), many animal shelters have limited space and resources destined to housing and health care. Overcrowding is common in shelters for dogs and cats in developing countries. Both are housed in the same kennel as there are large numbers of stray dogs.

Many abnormal stereotyped behaviors in dogs including excessive itching and licking (LYONS et al., 1997) as well as stressful events (LEGAUX, 2001) may cause physical injury to the dog compromising its physical health and behavioral patterns (CELOTTI, 1990). In this present study, the frequency of licking gradually decreased with the use of an enrichment method (Figure 2D).

Grunting increased during the first and second week of environmental enrichment and significantly decreased during the third week of the study (Figure 2E). Thus, it may be inferred that dogs were growling prior to the introduction of environment enrichment as they were subjected to stress in a research kennel. Dogs increased this behavior with the use of environmental enrichment due to the aggressiveness by the dominance or the possession of a toy. Intense reduction of growling in the third week may be explained by the fact that the dogs became familiar with the game and/or toy, which influenced them not to manifest a possessive behavior at the same intensity as in previous occasions.

Generally, repetition of the same object in games caused habituation (WELLS, 2004), and decrease the amount of interaction of the dog with the same toy. According to WELKER (1961), familiarization is a direct consequence of habituation, which shows the importance of periodic replacement of objects during the enrichment process. Frequent, regular replacement of inanimate objects is an essential component of the enriched environment method (WELLS, 2004). In this study, the plastic bottle containing snacks was the favorite toy of dogs possibly due to the smell of this type of food.

In the present study, dogs displayed depressive behavioral patterns and certain stereotypes which seem to decrease in intensity or frequency with the introduction of environmental enrichment in shelter kennels. Environmental enrichment is particularly important in kennels with limited space.

CONCLUSION

The introduction of a number of environmental enrichment methods using different types of games and food in in shelters for stray dogs decreased the intensity and frequency of depression and other stereotyped behaviors. Environmental

enrichment methods are useful tools to increase the life quality of animals living in these facilities.

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BIOETHICS AND BIOSSECURITY COMMITTEE APPROVAL

This research proposal was approved by the research committee of the Universidade Federal da Paraíba (UFPB) in Brazil. Our study was carried out according to the guidelines established Ethics Committee on Animal Use in Research (CEUA) of the Universidade Federal da Paraíba (UFPB) in Brazil. The present study was approved by the Ethics Committee on Animal Use in Research (CEUA) of the Universidade Federal da Paraíba (UFPB) in Brazil (permit No. 138/2017/CEUA-UFPB).

DECLARATION OF CONFLICT OF INTEREST

If there is any conflict about the content to be published with your institution or company to which the paper it is linked, it should be declared. If it does not exist, just write " The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

AUTHORS' CONTRIBUTIONS

All authors contributed equally for the conception and writing of the manuscript. All authors critically revised the manuscript and approved of the final version.

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