

OCUPAÇÃO DE ESPAÇO E COMPORTAMENTO DE GATOS DOMÉSTICOS MANTIDOS EM CONFINAMENTO

(Spatial occupation and behavior of communally housed domestic cats)

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RESUMO: As instalações de abrigos, centros de controle de animais, hospitais veterinários e laboratórios devem atender às necessidades biológicas dos animais confinados, proporcionando um adequado nível de bem-estar. No caso dos gatos domésticos, poucos estudos têm sido realizados a fim de estabelecer os parâmetros mínimos que garantam a manutenção adequada. O presente trabalho investigou a ocupação espacial de um grupo de gatos confinados. Para este fim, foram registrados o uso do espaço (piso ou áreas elevadas) e o comportamento de cinquenta e um gatos domésticos. Os resultados revelaram que a ocupação de áreas elevadas foi significativamente maior durante o dia e a noite, em comparação com a ocupação de áreas de piso. Em contraste com os outros comportamentos investigados, não foram encontradas diferenças significativas entre o piso e as áreas elevadas em relação ao comportamento "andar". Estes resultados apontam para a importância de fornecer áreas elevadas para os gatos domésticos em confinamento. Em conclusão, a ocupação de áreas elevadas por gatos domésticos confinados é significativamente maior em comparação com a ocupação de áreas de piso. Uma melhor compreensão do uso do espaço por gatos pode permitir um design mais apropriado das instalações no alojamento, a fim de que as necessidades biológicas desses animais sejam garantidas, o que pode influenciar significativamente o seu bem-estar em ambientes de confinamento.

Palavras-chave: abrigo; bem-estar animal; enriquecimento ambiental

ABSTRACT: The housing design of shelters, animal control centers, veterinary hospitals and laboratory facilities should meet the biological needs of the housed animals, in order to provide acceptable welfare. In the case of domestic cats, few studies have been conducted in order to establish the minimum parameters that will ensure the delivery of good care. The present work investigated the spatial occupation of a group of confined cats confined together. To this end, space use (ground or elevated areas) and behavior of fifty-one domestic cats were registered. Results revealed that occupation of elevated areas was significantly greater during both the day and night, compared with occupation of ground areas. In contrast with the other investigated behaviors, there were no significant differences between ground and elevated areas regarding "walking" behavior. These results point to the importance of providing elevated areas to domestic cats in confinement. In conclusion, occupation of elevated areas by confined domestic cats is significantly greater compared to occupation of ground areas. A better understanding of the space use by cats might enable a more appropriate design of housing premises in order to the biological needs of these animals, which may significantly influence their welfare in confinement.

Key Words: animal welfare; environmental enrichment; shelter

INTRODUCTION

Animal welfare can be characterized by the relationship between an animal and its environment (Broom and Johnson, 1993). Definitions of animal welfare involve a broad analysis of several factors related to the animal and its environment, but it can be generally defined as the overall state of the animal during its attempt to adjust its environment (Broom and Fraser, 2007). In the case of domestic cats confined in groups (specially in shelters, veterinary hospitals and laboratory facilities), Kessler & Turner (1999) stated that many factors may influence their welfare, namely relationships within the group, social stability, available space, population density, and relationship with humans, which can all culminate in stress. The minimum of 1.7m² per cat has been recommended when housing groups of cats, but factors such as the degree of socialization and learned experiences with other cats and humans play an important role in dictating how much space an individual will need to maintain control over its environment and social interactions (Rochlitz, 2000).

Additionally, adequate housing of confined cats should provide animals with a stimulating environment that allows the performance of a wide variety of species specific behaviors (Bradshaw, 2000, Rochlitz, 2000). This in turn contributes to the maintenance of healthier and better adapted individuals to confined conditions (Rochlitz, 2000, Ellis and Wells, 2008).

The complexity of areas provided for animals in captivity is as important as its dimensions. Subdivisions and vertical barriers are strategies that are often employed for maximization of environment complexity (Overall, 1998, Genaro and Schmidek, 2000). Environmental enrichment refers to the modifications and interventions made to the available area, to ensure that captive

species live in satisfactory psychological and physiological conditions. This includes physical, social, sensory, and nutritional approaches (Rochlitz, 2005a, Damasceno and Genaro, 2014). There are several ways to implement environmental enrichment, such as systematic changes to the environment via rearrangement of known objects, or introduction of new items, thus ensuring novelty within a familiar setting. One of the main goals of environmental enrichment is to encourage exploratory behavior, thereby preventing or eliminating behavioral problems (like boredom), to provide individual control over the environment, thereby giving animals the ability to make choices, such as to interact (or not) with others and to explore new items (Genaro, 2005).

Animal wellness and welfare should be the main concerns of institutions that keep domestic animals in captivity, especially if animals are kept long term.

This study analyzed the space use of a communally housed group of domestic cats. The spatial distribution of these animals was described in terms of occupation of ground or elevated areas, followed by observation of the cats' behavior in each of these locations.

MATERIAL AND METHODS

Fifty-one mix-breed domestic cats, 25 males and 26 females, were the subjects of this study. Cats were identified by numbers according to the main color and length of their coat. The animals belonged to an animal shelter located in the city of Ribeirão Preto, state of São Paulo, Brazil, where they were kept in confinement throughout the study.

Cats were kept as a group inside a total area of 151m², with 2.96m² /animal (above the value recommended by (Rochlitz, 2005ab). The available ground area was 125m² (2.45 m²/animal), to which 26m² of elevated area (0.51m²/animal) were added by means

of plastic tables, wooden boards, bins, plastic boxes, and shelves (places between: 50-100 cm to ground).

The area was cleaned once a day by a staff member, and sanitary control (vaccines, deworming and ectoparasite control) was regularly carried out by a veterinarian. Feeding areas were evenly distributed inside the enclosure, and dry food and water were available ad libitum.

Behavior was registered by means of closed-circuit television camera. The images were simultaneously viewed on a television set and recorded on DVD set.

Animals were observed for 8 days during 24 hours each day, at 10-minute intervals, which accounted for 6 observations per hour. Information was entered in previously designed tables.

The behaviors displayed by the cats on ground and elevated areas were simultaneously registered. We registered only the most frequently behaviors executed: walking, resting, and auto/self-grooming):

Walking: was recorded whenever the animal moved using alternate movements of the limbs.

Resting: the animal should be lying in prone or supine position, with open or closed eyes. Grooming: only self-grooming was considered.

Data analysis

Wilcoxon and Mann-Whitney tests were employed for determination of statistical differences ($P < 0.05$ were considered for significance) in behavior when the two spatial occupation conditions were compared.

RESULTS

The data were grouped within a 24-hour analysis period, followed by an hourly description of the behaviors recorded, which enabled a longitudinal presentation of the results.

The data revealed the preferential occupation of elevated areas ($x = 2.32 \pm 0.05$ animals/m², day; $x = 2.23 \pm 0.03$ animals/m², night) compared with ground areas ($x = 0.15 \pm 0.01$, day; $x = 0.10 \pm 0.01$, night), with statistical difference ($P < 0.05$) (Figure 1). Moreover, the mean values indicated higher spatial occupation of elevated areas ($x = 2.27 \pm 0.03$) compared with ground areas ($x = 0.13 \pm 0.01$), with statistical difference ($P < 0.05$), when the whole 24-hour period was considered (day + night periods).

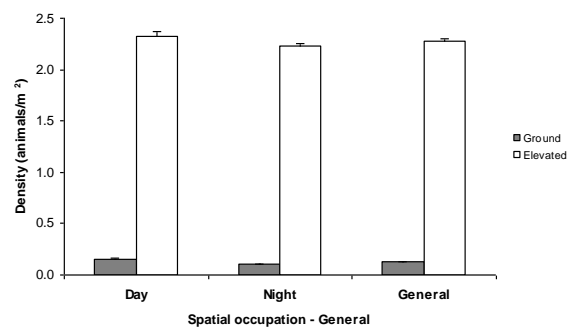


Figure 1 - Mean (\pm SE) of spatial occupation (animals/m²) of ground and elevated areas by domestic cats during the day (0800h-1900h), night (2000h-0700h), and day + night (General: 0800h-0700h) periods.

Results showed an equivalent number of walking events on the ground ($x = 0.03 \pm 0.002$ and $x = 0.02 \pm 0.001$ animals/m² walking) and on elevated areas ($x = 0.03 \pm 0.003$ and $x = 0.02 \pm 0.002$ animals/m² walking) both during the day and night periods, respectively, with no significant differences. As for the mean day + night values, the values were also the same, with no statistical difference ($x = 0.02 \pm 0.002$ and $x = 0.02 \pm 0.001$ for elevated and ground areas, respectively).

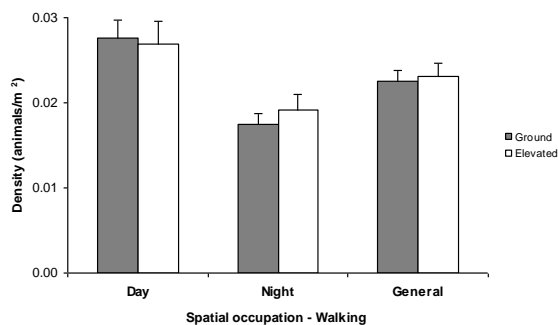


Figure 2 - Mean (\pm SE) of the walking (animals/m²) on ground and elevated areas by domestic cats during the day (0800h-1900h), night (2000h-0700h), and day + night (General: 0800h-0700h) periods.

Regarding resting, this behavior was recorded with higher frequency (20 times more frequent) in elevated areas ($x = 2.14 \pm 0.05$ animals/m²) compared with ground areas ($x = 0.11 \pm 0.05$ animals/m²) during the day. During the night, resting on elevated areas had a value of $x = 2.09 \pm 0.03$ against $x = 0.07 \pm 0.004$ recorded on ground areas. All the aforementioned values were statistically significant ($P < 0.05$). The mean value of the day + night period was $x = 2.12 \pm 0.03$ on elevated areas against $x = 0.09 \pm 0.004$ on ground areas, so the difference between these two areas within a 24-hour period was also statistically significant ($P < 0.05$) (Figure 3).

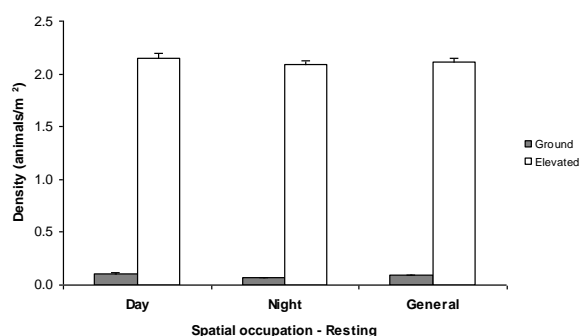


Figure 3 - Mean (\pm SE) of resting on ground and elevated areas by domestic cats (animals/m²) during the day (0800h-1900h), night (2000h-0700h),

and day + night (General: 0800h-0700h) periods, during the 8 days of observation.

Results recorded for grooming were $x = 0.10 \pm 0.006$ (animals/m²) for elevated areas and $x = 0.01 \pm 0.001$ (animals/m²) for ground areas during the day, with statistical significance ($P < 0.05$). During the night, the mean values were lower, namely $x = 0.06 \pm 0.004$ for elevated areas and $x = 0.03 \pm 0.0006$ for ground areas, with statistical difference ($P < 0.05$). The mean values for the day + night periods revealed higher frequency of grooming on elevated areas ($x = 0.08 \pm 0.004$) compared with ground areas ($x = 0.006 \pm 0.0006$), which was statistically significant ($P < 0.05$) (Figure 4).

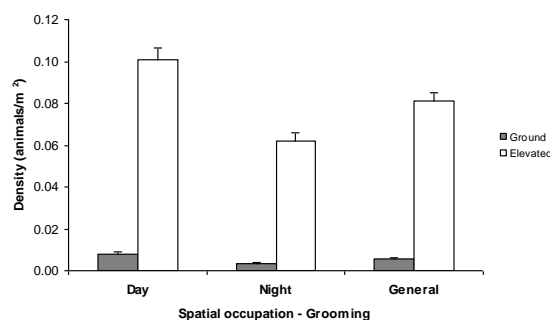


Figure 4 - Mean (\pm SE) of grooming on ground and elevated areas by domestic cats (animals/m²) during the day (0800h-1900h), night (2000h-0700h), and day + night (General: 0800h-0700h) periods.

The data recorded hourly during the 8-day observation period, day and night (24 hours daily, 0800h-0700h), demonstrated a statistically significant difference ($P < 0.05$) between the occupation of elevated ($x = 2.27 \pm 0.03$ animals/m²) and ground ($x = 0.13 \pm 0.005$ animals/m²) areas, with the largest difference being recorded at 1200h $x = 2.94 \pm 0.16$ elevated areas versus only $x = 0.11 \pm 0.02$ ground areas (Figure 5).

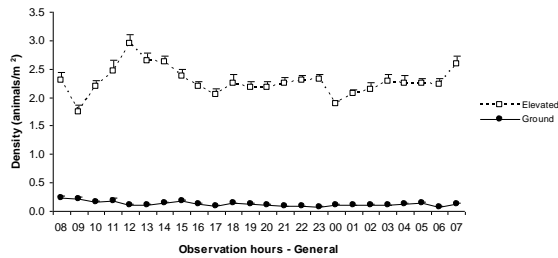


Figure 5 - Linear 24-hour presentation of the study (means \pm SE) of the general spatial occupation of ground and elevated areas by domestic cats (animals/m²) during the day + night period (0800h-0700h), during the 8-day observation period.

Regarding the behaviors recorded hourly during the 8-day observation period, there was significant difference ($P < 0.05$) in the mean values of resting in elevated and ground areas, with values of $x = 2.79 \pm 0.15$ (animals/m²) and $x = 0.06 \pm 0.01$ (animals/m²) being registered at 1200h, respectively (Figure 6).

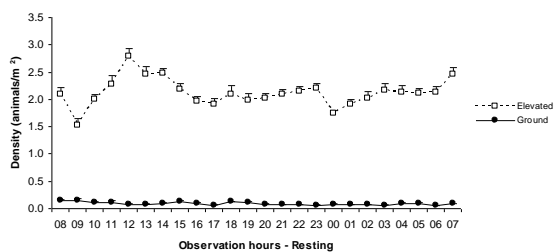


Figure 6 - Linear 24-hour presentation of the behavioral study on domestic cats (animals/m²) resting behavior comparing ground and elevated areas during the day + night period (0800h-0700h), during the 8-day observation period.

Regarding walking, there were no statistical differences between ground and elevated areas along 24 hours of recording. The exception was observed at 2100h, for which the mean values on ground and elevated areas were $x = 0.008 \pm 0.004$ (animals/m²) and $x = 0.03 \pm 0.005$ (animals/m²), respectively ($P < 0.05$).

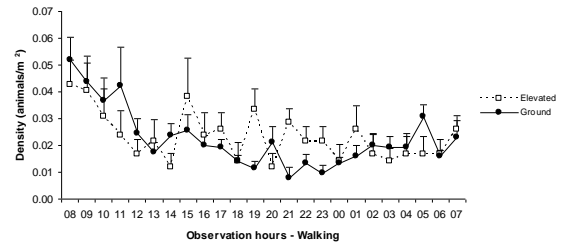


Figure 7 - Linear 24-hour presentation of the behavioral study on domestic cats (animals/m²) walking behavior comparing ground and elevated areas during the day + night period (0800h-0700h), during the 8-day observation period.

The final results allowed us to conclude that auto-grooming was consistently more frequent on elevated areas compared with ground areas ($P < 0.05$), during all the 24-hour observation period (Figure 8).

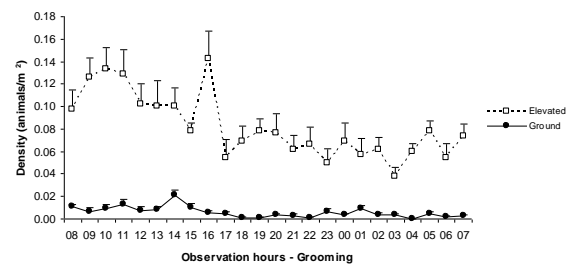


Figure 8 - Linear 24-hour presentation of the behavioral study on grooming on domestic cats (animals/m²) comparing ground and elevated areas during the day + night period (0800h-0700h).

DISCUSSION

The results of the present study indicate a significant preferential occupation of elevated areas $x = 2.27 \pm 0.03$ (animals/m²) compared with ground areas $x = 0.13 \pm 0.005$ (animals/m²) ($P < 0.05$). This preference might be due to the fact that elevated spaces might give more control over the environment (Bradshaw, 2000, Turner and Bateson, 2000). Studies on felines kept in captivity have revealed that the structure of housing premises can influence their

behavior (Lyons *et al.*, 1997). In this context, research analyzing the effects of environmental enrichment on the behavior of other confined species has suggested that elevated areas should be increased (Hebert and Bard, 2000, Mallapur *et al.*, 2002).

Animal welfare is generally assessed by measuring behavioral response to surroundings and to interventions in the environment (Nicol *et al.*, 2009). Preference tests are particularly useful to establish environmental preferences. The number of choices made by an animal with respect to a certain option, or the amount of time spent by the animal on each option can indicate the adequacy of the environment (Nicol *et al.*, 2009).

Although confinement might be considered to be advantageous to animal welfare to some aspects, such as controlling infectious diseases, avoiding accidents and for population control purposes (Jongman, 2007), it is necessary to ensure easy access to water and food, and that suitable areas for elimination and resting are available.

How space is utilized deserves even more attention than dimensions of an enclosure (Jongman, 2007). Improving the welfare of animals under veterinary responsibility demands careful examination of how the animals interact with their environment, so that a balance can be reached (Odendall, 1998). According to Morgan & Tromborg (2007), the quality of the environment, and not only the available space, is essential for animals to exhibit what is considered their normal behavior.

The results of the present work showed that resting was statistically more frequent in elevated areas, compared with ground areas, indicating a preference for elevated areas. In the same way, grooming was more frequently carried out in elevated areas compared with ground areas, with oscillations being detected along the 24-

hour observation period and in events recorded in the morning.

It is noteworthy that walking on elevated and ground areas was similar along all the 24-hour period, with no statistical differences. This results can also suggest a preference for elevated areas, since it had a smaller total area (26m²) compared with ground area (125m²).

Broom & Fraser (2007) stated that besides good management practices, cats kept in confinement for long periods require a sufficiently complex setting, so that behavioral needs, such as exercise, play and social interactions can be met. The lack of suitable resources for performing exploratory behavior may lead to behavioral problems (Scott *et al.*, 2009), such as stereotypies and compulsive behaviors, leading to a decrease in welfare (Manson *et al.*, 2007).

Environment complexity can be maximized by increasing the number of shelves or elevated platforms, creating different functional areas and providing more opportunities to explore the premises, to avoid social conflict, to choose social partners and to provide hiding and observational sites, increasing environmental control (Newberry, 1995).

The inadequate features of an artificial environment can be a source of discomfort and stress, with physiological and behavioral consequences, all of which impact animal welfare negatively (Ross *et al.*, 2009). Confinement causes several behavioral restrictions due to space use limitations. Variations in group size and high animal density are social factors that can aggravate these negative effects. In this sense, elevated areas seem to be an important environmental feature to promote domestic cats' welfare.

The results of the present work may contribute to a more appropriate housing design for domestic cats, so that

their biological and behavioral needs can be met.

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CONCLUSION

In conclusion, the occupation of elevated areas by domestic cats in this study was significantly higher when compared to ground areas. These results point out the relevance of proper housing design for the welfare of confined cats. Elevated areas can be provided by using tables, shelves, benches, etc., which not only provide shelter in adverse situations but also increase cats' environmental control.

Additionally, some of cats' basic behaviors, such as walking, resting and grooming, which animals carry out significantly more frequently compared with other activities, were fundamentally accomplished in elevated areas, making the relevance of such areas evident. A better understanding of the spatial occupation by confined domestic cats may allow more appropriate housing in order to meet the specific biological and behavioral needs of this species, positively affecting their welfare. Concerns about animal welfare are leading to an attempt to improve the physical and social conditions of confined cats which is extremely important in the case of animals kept in animal control centers, shelters and sanctuaries, laboratories, and even in veterinary clinics to a better comprehension of their behavior and for the provision of a suitable environment for these populations.

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INFORMATIVE NOTES

This study was approved by the Ethics Committee on Animal Use of the Centro Universitário Barão de Mauá (Ribeirão Preto), Brazil, and it complied with the ethical principles of animal experimentation (protocol number: 126/2009).

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