Colombian Creole Horse: Frequency of oral and motor stereotypies

Jhonny Alberto Buitrago Mejía1, Jairo Alejandro Navarro Jaramillo2 and Natalia Uribe Corrales3

1. Department of Agricultural Sciences, Faculty of Veterinary Medicine, Lasallian University Corporation (Unilasallista), GIVET Research Group, Caldas, Antioquia, Colombia; 2. Department of Agricultural Sciences, Faculty of Veterinary Medicine, Remington University Corporation (UniReimington), Medellin, Antioquia, Colombia.

Corresponding author: Natalia Uribe Corrales, e-mail: nuribe@unilasallista.edu.co
Co-authors: JABM: jbuitrago@unilasallista.edu.co, JAN: alejandro-jjllo@hotmail.com

Received: 07-12-2021, Accepted: 25-03-2022, Published online: 27-04-2022

doi: www.doi.org/10.14202/vetworld.2022.1113-1120 How to cite this article: Mejía JAB, Jaramillo JAN, Corrales NU (2022) Colombian creole horse: Frequency of oral and motor stereotypies, Veterinary World, 15(4): 1113-1120.

Abstract

Background and Aim: The current stable housing of Colombian Creole Horses severely restricts the animals’ locomotion and natural behaviors. In addition, their feed consists of a combination of high-energy concentrates with considerably little forage which potentially leads to locomotor or oral stereotypies. This study aimed to report the frequency of locomotor and oral stereotypies in Colombian Creole Horses in Girardota (Antioquia, Colombia) and associated risk factors.

Materials and Methods: A prospective cross-sectional study was conducted from 2019 to 2020, in which 102 stable horses aged 28 months and older participated. A questionnaire was developed to collect information on the horses’ daily barn routines. The horses were observed twice a day for 2 h for 3 consecutive days to record information related to stereotypy behaviors. The Fisher’s exact test and the Mann–Whitney U test were utilized for data analyses. Associations were considered statistically significant at p<0.05.

Results: Among the horses evaluated, 32.35% presented at least one stereotyped behavior. The most common was crib-biting (i.e., cribbing), with 17.65% exhibiting this behavior. Age, weight, gender, type of feeding, visual contact between horses, and natural lighting were all associated with oral stereotypies. Crib-biting was most common in young horses (U=1.36, p≤0.05), wind-sucking was more common in lighter weight animals (U=1.45, p=0.01), and lip-smacking was more common in stallions (χ²=9.10, p≤0.01). It is noteworthy that their feeding diet included bran, molasses, and gopher. Horses that did not have visual contact with other horses and those that did not have natural lighting were associated with pica (χ²=9.52, p≤0.02; χ²=3.72, p≤0.05; and χ²=3.72, p≤0.05, respectively). Of locomotor stereotypies, kicking the wall was significant in young animals (U=1.54, p=0.03) and walking in circles in lactating mares (χ²=13.20, p≤0.02).

Conclusion: Housing conditions in this study were found to have several risk factors affecting horses that exhibit stereotypic behaviors, and all these factors resulted in a higher frequency of stereotypies. Establishing risk factors for the presentation of abnormal behaviors allows for the implementation of better management practices in the production systems of the Creole Colombian Horse and will help improve their overall welfare.

Keywords: behaviours disorders, equines, stereotypies, welfare.

Introduction

Current housing conditions of domestic horses compared with a natural situation are very different. This is especially true of Colombian Creole Horses, which are frequently housed in environments that often severely restrict their locomotion. They are also often fed a combination of high-energy concentrates with relatively little forage, usually only twice daily. This results in the horses being food deprived for relatively long periods and having inadequate stall infrastructure and bedding material [1-7].

Therefore, even if current housing environments are better at facilitating the handling of horses by owners and veterinarians, they often limit the social interactions of horses with their peers [6,8]. In addition, they can result in alterations in their feeding and physical exercise schedule [9]. Due to these conditions, stabled horses may display forms of locomotor or oral stereotypies more frequently than horses managed under other conditions.

The most accepted definition of stereotypy is a behavior pattern that is repetitive and invariant with no apparent goal or function [10,11]. However, Mason [12] defined stereotypy as repetitive behavior induced by frustration, repeated coping attempts, or central nervous system dysfunction. These stereotypies can reduce the conception rate in mares and contribute to other health problems [13,14]. In addition, stereotypies can reduce the economic value of horses and are one of the most important indicators of long-term welfare problems in these animals [15].

According to some studies, there is a genetic predisposition toward stereotypic display that could be associated with temperament [1,16]. However, there are other risk factors, including age [17,18], gender [19], type of bedding [20], feeding frequency [21], usage of concentrate feed [22], lack of access to pasture [5,23], and restriction of free movement [24]; all

Copyright: Mejía, et al. Open Access. This article is distributed under the terms of the Creative Commons Attribution 4.0 International License (http://creativecommons.org/licenses/by/4.0/), which permits unrestricted use, distribution, and reproduction in any medium, provided you give appropriate credit to the original author(s) and the source, provide a link to the Creative Commons license, and indicate if changes were made. The Creative Commons Public Domain Dedication waiver (http://creativecommons.org/publicdomain/zero/1.0/) applies to the data made available in this article, unless otherwise stated.
of which can increase the risk of manifesting locomotor or oral stereotypies.

Behavioral problems in horses can be categorized into three groups [25]:
- Oral stereotypies, such as crib-biting, wind-sucking, wood chewing, teeth grinding, self-mutilation, coprophagy, lip-smacking, and pica (the abnormal desire to eat substances not customarily eaten, i.e., non-food items).
- Locomotor stereotypies include weaving, stall circling, head nodding, and wall kicking.
- Social problems, including training problems and phobic responses.

One of Colombia’s most popular breeds of horses is the Colombian Creole Horse, used for recreational riding and exhibitions. These horses are characterized by having a nervous and energetic temperament and are usually kept in barns differentiated by specific training regimes. All these factors are predispose to developing stereotypies [26]. Despite this, few studies in Colombia have provided information on stereotypes, especially in this type of horse [26,27].

Therefore, the objective of this study was to report the frequency of locomotor and oral stereotypies in Colombian Creole Horses in Girardota (Antioquia, Colombia) and associated risk factors.

**Materials and Methods**

**Ethical approval and Informed consent**

This study was framed under Colombian law 8430 of 1993, law 84 of 1989 and law 1774 of 2016. It was considered a study without risk, and the animal's rights were respected. Likewise, the project had the ethics endorsement (No. 04) of the Uniremington University Corporation as stated in act 005/2018. All the owners signed the informed consent before starting the observation of the animals.

**Study type, period, and location**

A prospective cross-sectional study was carried out in 2019-2020. A non-probabilistic sampling was carried out with 102 equines distributed to 13 barns in Girardota (Antioquia, Colombia). Girardota is a town in Colombia, located in Antioquia. It borders the towns of San Pedro de los Milagros, Donmatías, Barbosa, San Vicente, Guarne and Copacabana. Its geographical coordinates are 6° 22'37" N 75 ° 26'46" W. This town has an area of 82.56 km², of which 3.07 km² are urban land, and 79.49 km² are rural land. Its average temperature is 22°C and an average height of 1.425 m above sea level [28] (Figure-1), [29].

**Population**

This study included Colombian Creole Horses aged more than 28 months and which were managed in barns full time. Horses that presented pre-existing pathologies were undergoing environmental enrichment or were undergoing medical treatment were excluded from the study.

**Data collection**

The owners signed informed consent forms, and then veterinarians performed a general physical examination to check the health status of each horse. The same veterinarian always performed this activity. Subsequently, a questionnaire related to the characteristics and handling of the horse was conducted, and finally, the animal was observed over a time period as described in this section.

**Questionnaire**

A questionnaire was created to record the horses’ daily barn routine. Various data, including feeding programs, training regimen, and stall size, were collected during an interview with the horse’s owner or barn manager.

**Observation**

The horses were observed twice a day for 2 h for 3 consecutive days. The observation of the horses was conducted 45 min before feeding, 30 min during their feeding time, and 45 min after they had finished feeding. An ethogram suggested by Tadich et al. [19] was completed. Information related to stereotypies manifested by the animals and the time dedicated to each behavior was recorded.

**Statistical analysis**

The data were analyzed with the Stata® program version 15 (https://www.stata.com/stata15/), license number: 301506348331. A frequency analysis was conducted in which proportions were determined for qualitative variables, and the means and their
Results

One hundred two horses were evaluated in 13 barns in Girardota. The horses had an average age of 5.80±3.58 years, a mean weight of 325.77±50.18 kg, and 59.80% of horses were mares. Among the males, 22% were geldings. It was found that the average assessed body condition on a scale from 1 to 9 was 7.00±1. The other analyzed characteristics of the animals are shown in Table-1.

The horses’ feed was found to consist of 49.02% concentrate, 27.45% cut grass, 17.65% molasses and corn cob, and 5.88% bran. Regarding the handling of the horses, there was no evidence of shouting or harsh treatment from the stable workers toward the horses. In addition, it was found that the workers changed the water an average of 2 times a day, and the horses performed an average of 36.96±13.48 min of physical activity daily.

The drinker and feeder boxes were observed to be made of plastic of 77.0% of the time and were made of cement 23.0% of the time. On average, the total area of each box was 4.91±1.47 m² (Table-1).

Of the stereotypies observed, 32.35% of the horses presented at least one, with the most common being crib-biting (17.65%); Figure-2). Similarly, it can be seen that wind-sucking was the behavior that had the longest duration (Table-2).

Oral stereotypies

Age, weight, gender, type of feeding, visual contact between horses, natural lighting, distribution of feeder and drinker boxes, and tactile contact between horses were associated with oral stereotypies. Crib-biting was more common in young horses (U=1.36, p≤0.05); wind-sucking was more common in lighter animals when feeders and drinkers were close together, and when the animals did not have tactile contact (U=1.45, p=0.01; χ²=15.94, p≤0.00; χ²=5.20, and p≤0.02, respectively); lip-smacking was more usual in stallions (χ²=9.10, p<0.01). Finally, horses fed with bran, molasses, and gopher, which did not have visual contact with other horses, and which did not have natural lighting, were associated with

Table-1: Horses and barns characteristics.

| Variable      | Category       | Absolutely Frequency (n=102) | Percentage |
|---------------|----------------|-----------------------------|------------|
| Mares         | Empty          | 45                          | 44.12      |
|               | Pregnant       | 11                          | 10.78      |
|               | Lactation      | 4                           | 3.92       |
|               | Weaned         | 1                           | 0.98       |
| Males         | Stallion       | 32                          | 29.41      |
|               | Gelding        | 9                           | 22.00      |
| Gaits         | Canter         | 35                          | 38.24      |
|               | Trot and gallop| 37                          | 36.27      |
|               | Smooth steeper | 10                          | 9.80       |
| Age           | From 2 to 5-years-old | 61                      | 59.80      |
|               | From 6 to 10-years-old | 31                     | 30.39      |
|               | From 11 to 15-years-old | 8                       | 7.84       |
|               | More than 15-years-old | 2                       | 1.97       |
| Incisor wear  | Yes            | 24                          | 23.13      |
|               | No             | 78                          | 76.57      |
| Spicules      | Yes            | 19                          | 18.63      |
|               | No             | 83                          | 81.37      |
| Barn location | Parallel       | 52                          | 50.98      |
|               | Linear        | 42                          | 41.17      |
| layout        | Horseshoe      | 6                           | 5.88       |
|               | Internal       | 2                           | 1.96       |
| Feeder/ drinker distribution | Side to side | 64                      | 62.74      |
|               | Opposite       | 36                          | 35.29      |
|               | Together       | 2                           | 1.96       |
| Contact between horses | Yes        | 92                          | 90.20      |
|               | No            | 10                          | 9.80       |
| Bedding       | Wood chip      | 96                          | 94.12      |
|               | Sawdust        | 6                           | 5.88       |
| Natural lighting | Yes           | 92                          | 90.20      |
|               | No            | 10                          | 9.80       |

Figure-2: Motor and oral stereotypies manifested by the Colombian Creole Horses.

Table-2: Duration time of different behavioral alterations.

| Alteration   | Behavioral alterations | The average duration in minutes (Standard deviation) |
|--------------|------------------------|-----------------------------------------------------|
| Oral         | Supported wind sucking | 19.33 (10.96)                                       |
|              | Unsupported wind sucking| 6.51 (2.22)                                        |
|              | Crib-biting            | 4.79 (4.59)                                        |
|              | Lip-smacking           | 0.81 (0.44)                                        |
| Motor        | Weaving                | 9.71 (8.38)                                        |
|              | Kick walls             | 3.59 (3.71)                                        |
|              | Walking in circles     | 2.78 (3.14)                                        |
|              | Digging                | 2.5 (2.12)                                         |
Locomotor stereotypies

The behavior of wall kicking was found to be common in young animals (U=1.54, p=0.03), and walking in circles was common in lactating mares (χ²=13.20, p≤0.02) (Tables-3 and 5).

Discussion

In the current study, oral and locomotor stereotypies had the same percentage of presentation, with both being observed in 24.51% of the animals. Some studies have reported that horses kept in barns have a higher frequency of locomotor stereotypies, whereas those that do not have ad libitum access to forage will manifest oral stereotypies. Both conditions were found to be present in the population evaluated [11,24,27].

The most common observed stereotypy was crib-biting. This behavior has been reported as highly prevalent in horses from Europe, Canada, and the United States, although their frequencies are lower than seen in this study [30].

The results show a higher frequency of stereotypy among Creole Horses from Chile and English Thoroughbreds. Studies of these breeds found stereotypies observed in 4-11% of Chilean Creole Horses [10,18] and 6-12% of English Thoroughbred horses [19,31,32]. Nonetheless, the frequency of abnormal behaviors found here was lower than reported previously in Colombia, Costa Rica, and Chile, where authors found 65%, 48.4%, and 56.9% of horses exhibiting these behaviors, respectively [26,33,34].

Some risk factors, such as the breed type, have been reported. In Chile, differences were found in the distribution of stereotypies, and in Chilean Creole Horses, a higher frequency of walking in circles was reported, followed by crib-biting [18,35]. In English Thoroughbred horses, the stereotypy most frequently seen was wind-sucking, followed by stall circling and weaving [31,32]. In Fino Chilote, the most frequent stereotype observed was weaving, followed by wind-sucking [34].

It has been reported that crib-biting has been associated with social isolation and lack of grazing [36,37] and is seen as a more common postprandial behavior in horses with little fiber in their diet [38,39]. A higher incidence of crib-biting behavior has also been reported in foals fed concentrates after weaning than foals that did not receive concentrates [39]. One possible explanation for crib-biting, the most frequent stereotypy, is that in horses that are kept permanently housed, their ability to express natural grazing behaviors has been limited, thus resulting in stereotypes [40].

Some previous studies have not found associations between stereotypes and gender or age [31,35], yet in this study, different associations were found between gender, age, and oral or locomotor stereotypes. These differences could be the result of differences...
| Variable                | Category | Crib bit OR (95% CI) | F (p-value) | Supported wind sucking OR (95% CI) | F (p-value) | Unsupported wind sucking OR (95% CI) | F (p-value) | Lip-smacking OR (95% CI) | F (p-value) | Pica OR (95% CI) | F (p-value) |
|-------------------------|----------|----------------------|-------------|-----------------------------------|-------------|-------------------------------------|-------------|--------------------------|-------------|---------------------|-------------|
| Gender                  | Mare     | 1.06 (0.89-0.95)     | 1.47 (0.68) | 1.08 (0.82-1.15)                  | 0.96 (0.90) | 1.04 (1.00-1.09)                    | 4.76 (0.18) | 1.07 (0.98-1.09)          | 6.21 (0.10) | 1.08 (0.82-1.15)        | 0.56         |
|                         | Stallion | 1.10 (0.75-1.23)     | 1.18        | 1.21                               | 1.39        | 1.21                                | 0.80       | 1.18                     | 1.18        | 1.18                |              |
|                         | Gelding  | 1                    | 1           |                                    | 1           | 1                                   |            |                          |             |                    |              |
| Reproductive status     | Empty    | 0.91 (0.84-1.10)     | 2.29 (0.80) | 1.00 (0.95-1.06)                  | 0.85 (0.97) | 0.94 (0.86-1.06)                    | 4.76 (0.44) | 0.98 (0.91-1.10)          | 6.21 (0.28) | 1.09 (0.98-1.12)        | 0.85         |
|                         | Pregnant | 1.06 (0.89-0.95)     | 1.03        | 1.06                               | 0.91        | 1.03                                | 0.84       | 1.03                     | 0.98        | 0.98                |              |
|                         | Lactation| 1.03                 | 1.01        | 1.03                               | 0.98        | 0.98                                | 0.84       | 1.03                     | 0.92        | 0.98                |              |
|                         | Weaned   | 0.91 (0.84-1.10)     | 1.08        | 1.08                               | 0.82       | 1.08                                | 0.84       | 1.08                     | 0.95        | 0.91                |              |
|                         | Stallion | 1.13                 | 1.15        | 1.32                               | 1.02        | 1.32                                | 0.84       | 1.03                     | 1.03        | 1.03                |              |
|                         | Concentrate | 1.81 (0.18-18.14)   | 1.55 (0.67) | 0.2 (0.016-2.42)                  | 1.89 (0.99) | 0.58 (0.03-9.67)                    | 0.80       | 1.81 (0.18-18.14)        | 0.89        | 0.80                | 9.52         |
|                         | Bran     | 1.04 (1.00-1.09)     | 1.04        | 1.03                               | 0.86       | 1.03                                | 0.84       | 1.03                     | 0.91        | 1.01                |               |
|                         | Cut grass | 1.06 (0.89-0.95)   | 1.04        | 1.23                               | 1.06        | 1.23                                | 0.86       | 1.06                     | 0.78        | 0.78                |               |
|                         | Bran. molasses and gopher | 1           | 1           |                                    |            | 1                                   |            |                          |             |                    |              |
| Barn location           | Internal | 0.58 (0.03-9.67)     | 6.56 (0.08) | 1.03 (0.98-1.07)                  | 0.19 (0.97) | 0.91 (0.84-1.10)                    | 0.43 (0.93) | 2.34 (0.24-17.20)       | 13.70 (0.22) | 1.03 (0.98-1.07)        | 0.19         |
| layout                  | Horseshoe| 1.03                 | 1.04        | 1.03                               | 1.03        | 1.03                                | 0.84       | 1.03                     | 0.91        | 1.01                |               |
|                         | Linear   | 1.01                 | 1.05        | 1.05                               | 1.23        | 1.23                                | 0.86       | 1.23                     | 0.98        | 1.07                |               |
|                         | Parallel | 1.02 (0.89-1.12)     | 1.47 (0.47) | 0.2 (0.016-2.42)                  | 1.21 (0.27) | 1.08 (0.82-1.15)                    | 15.94 (0.00*) | 1.05 (0.016-2.42)       | 0.44 (0.54) | 0.2 (0.05)*            |               |
| Feeder/drinker          | Opposite corners | 0.98 (0.84-1.17) | 0.58       |                                    |            | 2.11                                |              |                          |            |                    |              |
| distribution             | Together | 0.98                 | 0.58        |                                    |            |                                    |              |                          |            |                    |              |
|                         | Side to side | 1                    | 1           |                                    |            |                                    |              |                          |            |                    |              |
| Visual contact          | No       | 2.04 (0.24-17.20)    | 0.44 (0.50) | 1.02 (0.99-1.05)                  | 0.22 (0.63) | 0.2 (0.016-2.42)                    | 1.91 (0.16) | 1.04 (1.00-1.09)        | 0.44 (0.50) | 1.18 (0.102-1.29)       | 3.72         |
| among horses            | Yes      | 1                    | 1           |                                    |            | 1                                   |              |                          |            |                    |              |
| Tactile contact         | No       | 2.38 (0.72-7.85)     | 2.11 (0.14) | 1.03 (0.98-1.07)                  | 1.21 (0.27) | 7.89 (1.01-16.04)                   | 5.20 (0.02*) | 1.81 (0.18-18.14)       | 0.26 (0.60) | 0.58 (0.03-9.67)        | 0.14         |
| among horses            | Yes      | 1                    | 1           |                                    |            | 1                                   |              |                          |            |                    |              |
| Natural lighting        | No       | 2.04 (0.24-17.20)    | 0.44 (0.50) | 1.02 (0.99-1.05)                  | 0.22 (0.63) | 0.2 (0.016-2.42)                    | 1.91 (0.16) | 1.04 (1.00-1.09)        | 0.44 (0.50) | 1.18 (1.02-1.29)        | 3.72         |
|                         | Yes      | 1                    | 1           |                                    |            | 1                                   |              |                          |            |                    |              |

F=The Fisher’s test. *Associations statistically significant, OR=Odds ratio, CI=Confidence interval, bold values=Category of the variable that is different
in the sample populations of these studies compared to the population involved in this study, confounding the data. Specifically, most of the [1,6,19] were conducted on young racehorses with the same handling regardless of animal gender. Related to gender, this study found an association with the presentation of lip-smacking mainly in stallions to be similar to other reports, which have also shown that the risk is more significant in male horses working in competitions [18,19].

The characteristics of feeding type, level of visual contact between horses, and access to natural lighting were all found to be factors related to the presentation of pica. This behavior was present in the animals fed with bran, molasses, and gopher and with among horses that do not have visual contact with other horses. This finding corresponds to other studies in which it has been reported that isolation can increase the risk of developing abnormal behaviors due to lack of socialization [18]. Locomotor stereotypies observed were similar to findings of other reports and included young animals that kicked the walls more frequently and lactating mares that were found to more frequently walk in circles [32].

![Table 5: Association between motor stereotypies with animal and environment variables.](image-url)

F=The Fisher’s test. *Associations statistically significant, OR=Odds ratio, CI=Confidence interval, bold values=Category of the variable that is different
provides information that allows for the estimation of the behavioral alterations manifested by horses related to mealtime, as well as to the time invested in those behavioral alterations.

**Conclusion**

This study found that horses’ housing conditions were related to several risk factors in the study area of Girardota, Colombia. These included no access to pasture, no ad libitum feeding, and the use of feed concentrates. All these factors resulted in a higher frequency of oral stereotypies. In addition, prolonged confinement in individual horse stalls was found to be positively correlated with stereotypies. Establishing risk factors for the presentation of stereotypies will allow the implementation of good management practices in the production systems of the Colombian Creole Horse and will thereby improve their welfare.

**Authors’ Contributions**

JABM: Conceptualization. JANJ: Data collection. NUC: Formal analysis. JABM, JANJ, and NUC: Investigation. NUC: Methodology. JABM, JANJ, and NUC: Writing original draft. NUC: Writing – review and editing. All authors have read and approved the final manuscript.

**Acknowledgments**

We would like to thank Lasallian University Corporation, Colombia. The university supported this study sharing their computers, and also helping us with transportation. The authors did not receive any funds for this study.

**Competing Interests**

The authors declare that they have no competing interests.

**Publisher’s Note**

Veterinary World remains neutral with regard to jurisdictional claims in published map and institutional affiliation.

**References**

1. Muñoz, L., Donaire, C., Salazar, T., Ortiz, R., Cruces, J. and Briones, M. (2021) Heritability of locomotor stereotypies in Chilean horses. *J. Equine Vet. Sci.*, 105(1): 103702.
2. Wickens, C.L. and Heleski, C.R. (2010) Crib-biting behavior in horses: A review. *Appl. Anim. Behav. Sci.*, 128(1): 1-9.
3. Henderson, A. (2007) Don’t fence me in: Managing psychological well-being for elite performance horses. *J. Appl. Anim. Welf. Sci.*, 10(4): 309-329.
4. Sarrafi, A. and Blokhuis, H.J. (2013) Equine stereotypic behaviors: Causation, occurrence, and prevention. *J. Vet. Behav.*, 8(5): 386-394.
5. Sneddon, J.C. and Argenzio, R.A. (1998) Feeding strategy and water homeostasis in equids: The role of the hindgut. *J. Arid Environ.*, 38(3): 493-509.
6. Roberts, K., Hemmings, A.J., McBride, S.D. and Parker, M.O. (2017) Causal factors of oral versus locomotor stereotypy in the horse. *J. Vet. Behav.*, 20(1): 37-43.
7. Lesimple, C., Gautier, E., Benhajali, H., Rochais, C., Luncel, C., Bensaid, S., Khalloufi, A., Henry, S. and Hausberger, M. (2019) Stall architecture influences horses’ behaviour and the prevalence and type of stereotypies. *Appl. Anim. Behav. Sci.*, 219(1): 104833.
8. da Silva, G.C., da Carvalho, C.C.S., de Maranhão, C.M.A., da Costa, M.D., Brito, S.N.S., de Castro, A.L.O., Pereira, K.C.B. and Diniz, T.A. (2018) Thermal comfort of horses housed in different types of stalls. *Rev. Ciênc. Agrotec.*, 17(3): 402-407.
9. Lökken, S., Reese, S., Erhard, M. and Wöhr, A.C. (2016) Pasturing in herds after housing in horseboxes induces a positive cognitive bias in horses. *J. Vet. Behav.*, 11(1): 50-55.
10. Alonzo, L.M., González, V.T. and Luengo, M.B. (2018) Prevalence of crib-biting and weaning in stalled horses tie stalls. *Rev. Med. Vet.*, 37(8): 65-72.
11. Seabra, J.C., Dittrich, J.R. and de Vale, M.M. (2021) Factors associated with the development and prevalence of abnormal behaviors in horses: Systematic review with meta-analysis. *J. Equine Vet. Sci.*, 106(3): 103750.
12. Mason, G.J. (1991) Stereotypies: A critical review. *Anim. Behav.*, 41(6): 1015-1037.
13. Benhajali, H., Ezzaooui, M., Luncel, C., Charfi, F. and Hausberger, M. (2014) Stereotypic behaviours and mating success: In domestic mares. *Appl. Anim. Behav. Sci.*, 153 (5): 36-42.
14. Grenner, N., Divers, T., Mohammed, H., Johnson, A., Albright, J. and Reuss, S. (2010) Epidemiological features and association with crib-biting in horses with neurological disease associated with temporohypophyseal osteoarthropathy (1991-2008). *Equine Vet. Educ.*, 22(9): 467-472.
15. McBride, S. and Long, L. (2001) Management of horses showing stereotypic behaviour, owner perception and the implications for welfare. *Vet. Rec.*, 148(26): 799-802.
16. Hemmann, K., Rackallo, M., Vainio, O. and Juga, J. (2014) Crib-biting and its heritability in Finnhorses. *Appl. Anim. Behav. Sci.*, 156(4): 37-43.
17. Ijichi, C.L., Collins, L.M. and Elwood, R.W. (2013) Evidence for the role of personality in stereotypy predisposition. *Anim. Behav.*, 85(6): 1145-1151.
18. Tadich, T., Smulders, J.P., Araya, O. and Nicol, C.J. (2012) Husbandry practices associated with the presentation of abnormal behaviours in Chilean Creole horses. *Arch. Med. Vet.*, 44(3): 279-284.
19. Tadich, T., Weber, C. and Nicol, C.J. (2013) Prevalence and factors associated with abnormal behaviors in Chilean racehorses: A direct observational study. *J. Equine Vet. Sci.*, 33(2): 95-100.
20. Hockenhull, J. and Creighton, E. (2014) Management practices associated with owner-reported stable-related and handling behaviour problems in UK leisure horses. *Appl. Anim. Behav. Sci.*, 155(2): 49-55.
21. Nagy, K., Schrott, A. and Kabai, P. (2008) Possible influence of neighbours on stereotypic behaviour in horses. *Appl. Anim. Behav. Sci.*, 111(3): 321-328.
22. Hothersall, B. and Nicol, C. (2009) Role of diet and feeding in normal and stereotypic behaviors in horses. *Vet. Clin. North Am. Equine Pract.*, 25(1): 167-181, 8.
23. Christie, J.L., Hewson, C.J., Riley, C.B., McNiven, M.A., Dohoo, I.R. and Bate, L.A. (2006) Management factors affecting stereotypies and body condition score in non-racing horses in Prince Edward Island. *Can. Vet. J.*, 47(2): 136-143.
24. Normando, S., Meers, L., Samuels, W.E., Faustini, M. and Ödberg, F.O. (2011) Variables affecting the prevalence of behavioural problems in horses. Can riding style and other management factors be significant? *Appl. Anim. Behav. Sci.*, 133(3): 186-199.
25. McDonnell, S., Lexington, K.Y. and Lanham, M.D. (2003) The Equid Ethogram: A Practical Field Guide to Horse Behavior. Eclipse Press, Washington, DC.
26. Zuluaga, A.M., Mira, A., Sánchez, J.L. and Martinez, J.R. (2018) Frequency of abnormal and stereotypic behaviors in urban police patrolling horses: A continuous 48-hour study.
Rev. Colomb. Cienc. Pecuarias, 31(1): 17-25.

27. Patiño, J.J., Vélez, S.A. and Martínez, J.R. (2020) Ethological, endocrinological, and gastroscopic evaluation of crib-biting Colombian creole horses. J. Vet. Behav., 40(5): 92-97.

28. Alcaldía de Girardota, Municipio de Girardota. Available from: https://www.girardota.gov.co/Paginas/default.aspx. Retrieved on 16-11-2021.

29. Sajo, R. (2007) Mapa del área rural de Girardota, Colombia. Available from: https://commons.wikimedia.org/wiki/File:Veredas_de_Girardota-Colombia.png Retrieved on 22-11-2021.

30. Albright, J.D., Mohammed, H.O., Heleski, C.R., Wickens, C.L. and Houpt, K.A. (2009) Crib-biting in US horses: Breed predispositions and owner perceptions of aetiology. Equine Vet. J., 41(5): 455-458.

31. Alonzo, L.M., Leal, J.C. and Luengo, M.B. (2017) Prevalencia de estereotipias clásicas en caballos fina sangre de carrera del Hipódromo Chile, Chile. Rev. Med. Vet., 33(6): 51-57.

32. Navarrete, D., Hamilton-West, C., Stephens, N., Weber, C. and Tadich, T. (2015) Risk factors for the presentation of undesired behaviours in sport horses in Chile. Arch. Med. Vet., 47(1): 77-84.

33. Arias-Esquivel, A.M. and Wickens, C.L. (2020) Owner perceptions and management of stereotypic behaviors in four horse breeds in Costa Rica. Agron. Mesoam., 31(1): 237-249.

34. Tuemmers, C., Saldivia, A., Mora, C. and Pinto, J. (2017) Prevalencia de conductas estereotipadas y no deseadas en el caballo fino chilote en la región de la Araucanía, Chile. Sustain. Agric. Food Environ. Res., 5(2): 1-11.

35. Muñoz, L., León, C., Crucés, J., Ortiz, R. and Briones, M. (2018) Locomotor stereotypies and racing performance in thoroughbred horses. J. Vet. Behav., 25(2): 24-27.

36. Hemmann, K., Koho, N., Vainio, O. and Raekallio, M. (2013) Effects of feed on plasma leptin and ghrelin concentrations in crib-biting horses. Vet. J., 198(1): 122-126.

37. Freymond, S., Beuret, S., Alice, R., Zuberbühler, K., Bachmann, I. and Briefer, E. (2020) Stereotypic behaviour in horses lowers stress but not spatial learning performance. Appl. Anim. Behav. Sci., 232(1): 105099.

38. Sarrafchi, A. (2012) Equine Stereotypic Behavior as Related to Horse Welfare: A Review. Available from: https://www.semanticscholar.org/paper/equine-stereotypic-behavior-as-related-to-horse-a-Sarrafchi/432f1e9ef46e8db8d2f3e21bb396c611218243d7. Retrieved on 16-11-2021.

39. Sarrafchi, A. and Blokhuis, H.J. (2013) Equine stereotypic behaviors: Causation, occurrence, and prevention. J. Vet. Behav., 8(5): 386-394.

40. Casey, R. (2012) Undesired behaviour in horses: A review of their development, prevention, management and association with welfare. Equine Vet. Educ., 24(9): 479-485.

**********