

# SPECIAL INTEREST SECTION

## Assessing the welfare of horses in Lesotho using health and behaviour parameters

MOLEBOHENG BOLIBE and SETSUMI MOLAPO

Department of Animal Science, Faculty of Agriculture, National University of Lesotho, Maseru, Lesotho

Correspondence: mbolibe0@gmail.com

### Abstract

Horses play an important role in the livelihood of people living in the rural areas in Lesotho; however, their health and behaviour remains a concern. A cross-sectional study on the assessment of health and behaviour of horses was carried out from September to December 2020. The aim of the study was to determine the problems of horses in Lesotho using health and behavioural parameters. Assessment of health condition was based on direct observation of horses.

Horse behaviour was assessed through reaction that relied on the observer's approach and contact. A total of 455 horses participated in the study and data was statistically analysed in Statistical Package for Social Sciences version 20. None of the assessed horses had abnormal mucous membranes, diarrhoea or lower limb swelling. The incidence of ticks was higher. Approximately, 42.2%, 45.2% and 35.1% of horses respectively in the rural, semi-urban and urban areas had good body condition scores. Open lesions occurred mainly in horses in the rural region (11.6%). Few horses demonstrated hoof abnormalities (4.8% in rural region and 3.1% in semi-urban region) and gait deformities (2%, 0.6% and 0.7%) respectively for urban, semi-urban and rural regions. Horses in urban regions (35.1%) demonstrated a negative reactive behaviour towards an observer, while in rural region; most horses (43.5%) reacted positively when approached. The indicators of good health and behaviour of horses were observed across the three regions. Therefore, there is a need for horse owners to be trained on issues aimed at improving the human-horse relationship, control of parasites and wound care of horses in Lesotho.

**Keywords:** equine, horse, owners, welfare, assessment

### Introduction

Most common livestock in Lesotho are cattle, sheep, goats, pigs, poultry, mules, donkeys, and horses.<sup>1</sup> Horses are among the most common livestock in Lesotho hence they are regarded as the source of pride. In some areas of the country, the horse is the only alternative to travelling on foot, hence, horses are used mainly as a mode of transport over the rugged topography of Lesotho.<sup>2</sup> They are also used for ploughing, planting, carding\* and cultivating the fields.<sup>3</sup> With 80% of the country more than a mile high and few paved roads, horses are life-saving couriers, shuttling vital medical supplies, anti-retroviral medicine (ARVs), mother-to-baby pregnancy kits and laboratory samples to remote clinics that serve villages inaccessible by vehicles.<sup>4</sup>

The environment in which domestic horses are kept differs and is often designed for human convenience instead of what is 'good' for the horse. Behavioural and physiological measures are used to determine health and wellbeing and the response of an animal to its environment. Good health is indicated by condition, freedom from pain and behavioural signs of positive emotion.<sup>5</sup> In the case of working equids there is increasing evidence of their socio-economic contribution to human livelihood through their direct and indirect impact in generating income for thousands of households worldwide. It has been reported that the welfare state of these equids is usually poor and impacts directly on their health, mental state and working capacity.<sup>6</sup> Often, horses are neglected and exploitation cases originate from lack of economic resources needed to effectively sustain the horse wellbeing.<sup>6</sup>

Injuries and diseases are regarded as important welfare indicators because they are both generally associated with negative experiences such as pain, discomfort and

\* **EDITORS NOTE:** Carding is a mechanical process in the preparation of fibres for further processes such as weaving etc.

distress.<sup>7</sup> Animal health measurements provide specific and practical information which aids the observer in determining how the animal is managed. Animal health measures can be indicative of current and potential welfare concerns, as well as providing information regarding the management and husbandry practices employed by the animals' owner or primary carer and the response of the owner or primary carer to animal health challenges.<sup>7</sup>

The animal's reactions to human interaction can be measured experimentally by using behavioural tests.<sup>8</sup> Tests measuring an animal's reactions to humans are generally grouped into reactions to stationary human, moving human and actual handling. The physical and social environment can strongly influence the outcome of the test.<sup>9</sup> Behavioural tests such as avoidance, approach and startle tests, measure an animal's level of fear towards humans which provides a reflection of the nature of the human-animal relationship.<sup>10</sup> Fear is a negative emotion and as such is often included in assessments and recommendations of animal welfare.<sup>11</sup> Taking this into account, the aim of this study was to assess the welfare of horses in Lesotho, using health and behaviour as parameters.

## Materials and methods

### Study area

The study was carried out in Mafeteng and Maseru districts, covering the three regions: urban, semi-urban and rural. Four resource centres represented each region. The urban region was composed of Masianokeng, Morija, Semonkong and Ramokoatsi. The semi-urban region was made up of Ramabanta, Ntsi, Tsâkholo and Thabana Morena while Matelile, Mosala, Ribaneng and Marakabei represented the rural region. Data collection took place between September and December 2020.

### Study design

A cross sectional survey was conducted using a simple random sampling procedure. With the help of extension staff from the Ministry of Agriculture and Food Security, the horse owners were identified in their respective resource centres. Owners were included in the study if they owned at least one horse and were willing to participate. The data was collected using the individual questionnaires and assessment forms.

Four hundred and fifty five horses were randomly selected composed of 148, 160 and 147 horses in the urban, semi-urban and rural regions respectively. The horses were composed of 281 stallions and 174 mares. The horses were further categorised into foals (39), yearlings (44) and adults (372). Horse age was estimated according to dentition and the farmer's information. Each horse used in this study was uniquely identified. The Standardised Equine Based Welfare Assessment Tool (SEBWAT) was used to evaluate

horses.<sup>12</sup> The assessment form included descriptors of a horse (sex and age group), health parameters (eyes, mucous membranes, nasal discharge, respiratory noise, diarrhoea, external parasites, body condition score (BCS), severity and size of body lesions, gait, limbs, and hooves) and behaviour (observer approach, chin contact, general attitude and spinal contact).

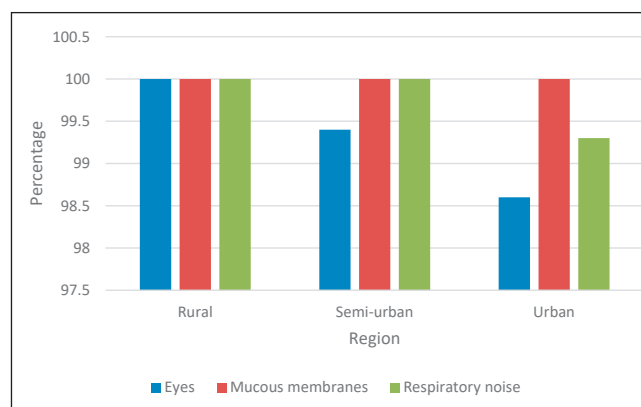
The assessment took five to ten minutes per horse. Horses were assessed by observation and also touched by the assessor or owner. The BCS was assessed using a standard scoring scale from zero to five (emaciated to obese).<sup>13</sup> Lesions were numbered and scored according to their severity and the surface area covered (0-3). Hooves were considered neglected if they were overgrown, cracked or deformed with the score ranging from 0-2. General attitude was evaluated by considering the behaviour of the horse throughout the whole assessment (the handler, the assessor and being handled) and was scored from zero to two (zero = positive general attitude: bright, alert, responsive, one = negative non-reactive general attitude: dull, obtund, lethargic and two = negative reactive general attitude: fearful, aggressive, signs of anxiety).

The data was statistically analysed by Statistical Package for Social Sciences version 20. Descriptive Statistics were employed to describe data with the use of percentages and frequency distributions. The Chi-square test was utilised to determine if the differences were due to chance or owing to a relationship between the variables under study 95% confidence level was set.

## Results

### Eyes, mucous membranes and respiratory noise

Few horses in the semi-urban (0.6%) and urban (1.4%) regions showed a moderate eye abnormality (excessive tears, red conjunctiva or abnormal eyelid being visible in one or both eyes). The mucous membranes of all horses (100%) in the three regions were within normal range, meaning they were neither pale nor darker in colour (Figure 1). The respiratory noise of most assessed

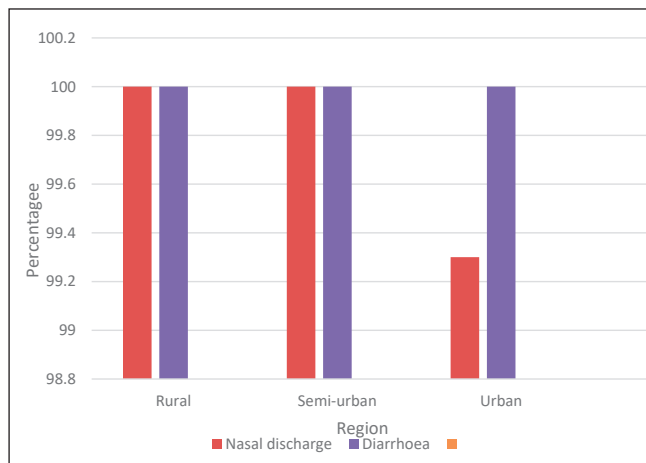


**Figure 1.** The status of eyes, mucous membranes and respiratory noise of horses in different regions.

horses was not audible. The Chi-square tests indicated that there was no significant association ( $P>0.05$ ) between the respiratory noise and the region in which a horse was kept.

**Nasal discharge and diarrhoea**

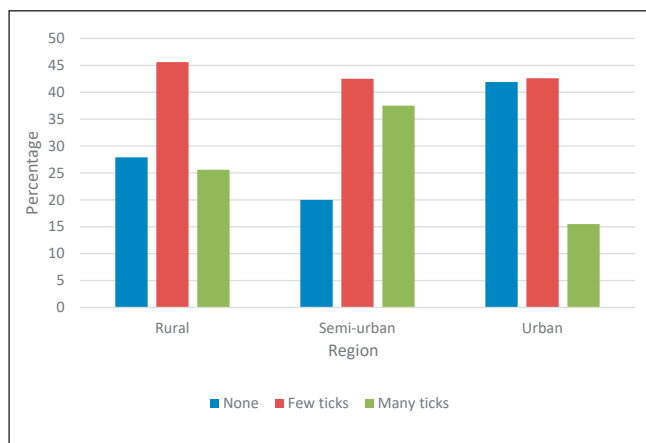
In rural and semi-urban regions, None of the horses (100%) showed nasal discharge, whereas 0.7% of horses in the urban region had some nasal discharge which in most cases signifies the presence of a disease. The results as illustrated in Figure 2 also demonstrated that all horses (100%) that were assessed in the three regions had no diarrhoea.



**Figure 2.** The occurrence of nasal discharge and diarrhoea in horses in different regions.

**External parasites**

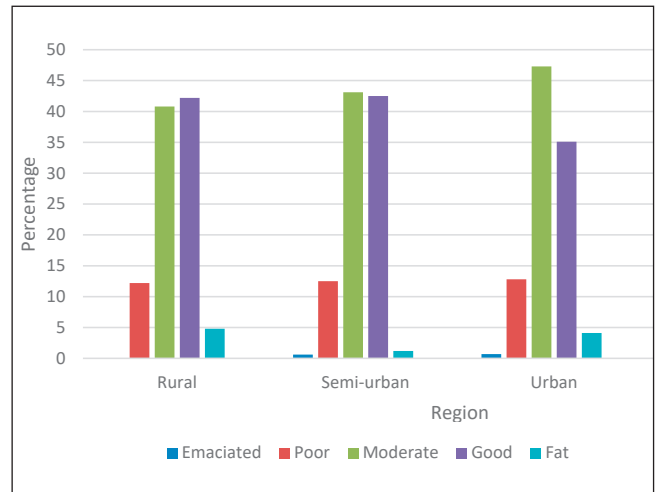
The majority of horses had low numbers of ticks since the proportion of horses that were without external parasites in rural, semi-urban and urban regions was 27.9%, 20.0% and 41.9% respectively. The severity of ticks ranged from one to five. The Chi-square tests indicated that there was a significant relationship ( $P<0.05$ ) between external parasites and the region.



**Figure 3.** The prevalence of ticks in horses found in different regions.

**Body condition score**

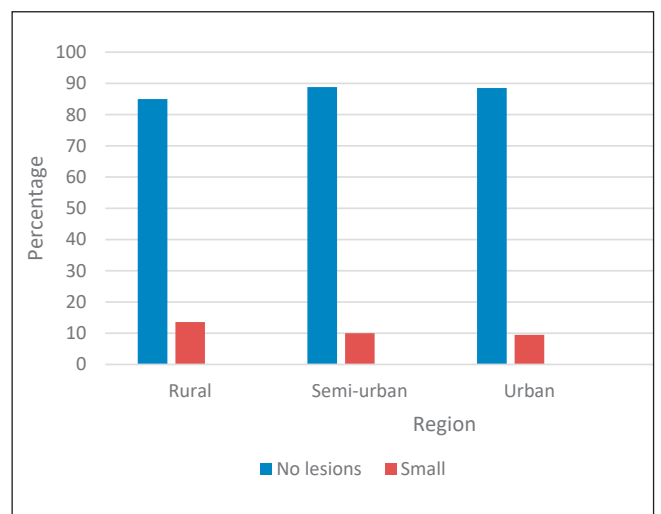
Majority of horses that were assessed had a moderate to good body condition as presented in Figure 4. Only 0.6% and 0.7% of horses in semi-urban and urban regions respectively were found to be emaciated. The horses with poor body condition were found in rural (12.2%), semi-urban (12.5%) and urban (12.8%) areas. The results indicated that only a few horses were found to be fat in all the regions though the number was higher in the rural (4.8%) and urban (4.1%) regions than in the semi-urban region (1.2%).



**Figure 4.** Body conditions of horses in different regions.

**Body lesions**

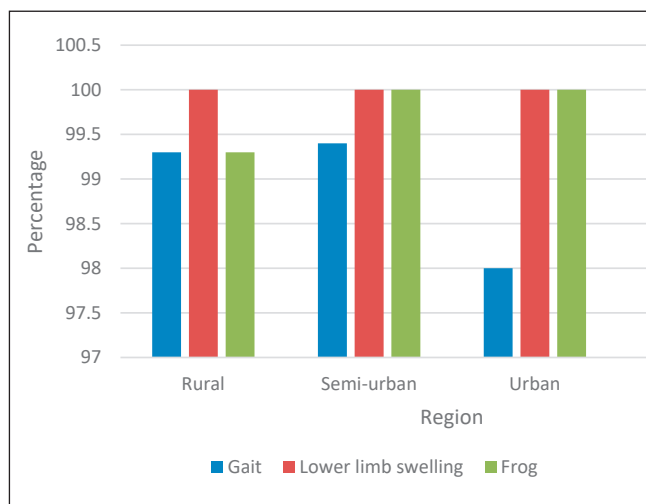
The results of the current study as shown in Figure 5 revealed that the majority of horses had no body lesions in the rural (85%), semi-urban (88.8%) and urban (88.5%) regions. The numbers of horses in the rural, semi-urban and urban with open lesions was 11.6%, 6.2% and 4.7% respectively. Most assessed horses had small lesions comprised of 13.6%, 10% and 9.5% for rural, semi-urban and urban regions respectively.



**Figure 5.** The severity and size of body lesions of horses assessed in difference regions.

### Gait, limbs and frog

The majority of assessed horses in the rural, semi-urban and urban areas showed uncompromised gait. Moderately abnormal gaits were disclosed in semi-urban (0.6%) and urban (2%) regions while a small percentage of highly compromised gaits were only found in horses in the rural region (0.7%). The results of the present study showed that all horses assessed had no swelling in the lower limbs. As illustrated in Figure 6, only 0.7% of horses in the rural region did not have healthy frogs.

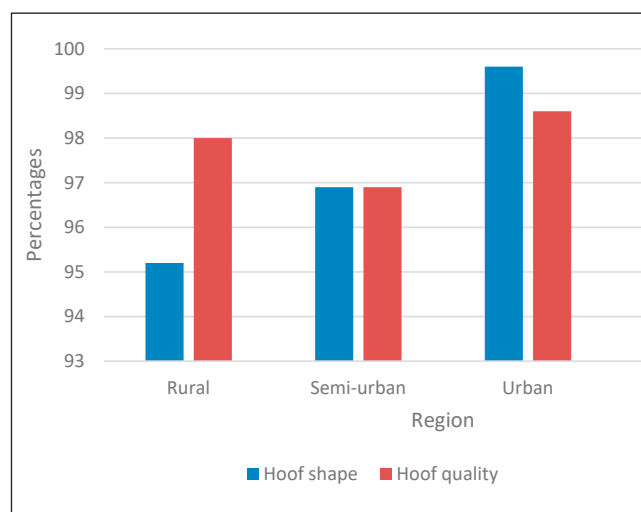


**Figure 6.** The state of gait, limbs and frog of assessed horses in different regions.

### Condition of hooves

The findings of this study showed that the majority of the horses hooves that were assessed had normal shape

and quality. In terms of shape the two fore hooves of a few horses in rural region (4.8%) were abnormal. In the case of hoof quality, 3.1% of horses in semi-urban region had abnormal hooves on the two fore feet assessed.



**Figure 7.** The shape and quality of hooves for horses in different regions.

### Observer's approach

Generally a higher percentage of assessed horses were positive (not afraid, alert, friendly or relaxed, not nervous or apathetic) towards the observer's approach. A negative reaction was mostly noticed with horses in the urban region (35.1%) than in the rural (22.4%) and semi-urban (27.5%) regions. The Chi-square tests ( $P > 0.05$ ) between the observer's approach and the region in which a horse is kept (Table 1).

| Parameter                  | Rural (%) | Semi-urban (%) | Urban (%) | SE    | X <sup>2</sup> | Sig   |
|----------------------------|-----------|----------------|-----------|-------|----------------|-------|
| <b>Observer's approach</b> |           |                |           |       |                |       |
| Positive                   | 43.5      | 39.4           | 39.9      | 0.060 | 7.022          | 0.155 |
| Neg. non-reactive          | 34.0      | 33.1           | 25.0      | 0.066 |                |       |
| Negative reactive          | 22.4      | 27.5           | 35.1      | 0.071 |                |       |
| <b>Chin contact</b>        |           |                |           |       |                |       |
| Accepts contact            | 43.5      | 39.4           | 41.2      | 0.060 | 0.548          | 0.760 |
| Avoids contact             | 56.5      | 60.6           | 58.8      | 0.049 |                |       |
| <b>General attitude</b>    |           |                |           |       |                |       |
| Positive                   | 43.5      | 39.4           | 40.5      | 0.060 | 7.371          | 0.118 |
| Neg. non-reactive          | 33.3      | 32.5           | 23.6      | 0.067 |                |       |
| Negative reactive          | 23.1      | 28.1           | 35.8      | 0.070 |                |       |
| <b>Spinal contact</b>      |           |                |           |       |                |       |
| No reaction                | 45.5      | 40.0           | 40.5      | 0.059 | 0.450          | 0.798 |
| Reaction                   | 56.5      | 60.0           | 59.5      | 0.049 |                |       |

SE: Standard Error      X<sup>2</sup>: Pearson Chi-Square Value      Sig: Significant Value

**Table 1.** Behaviour of horses in different regions.



### Chin and spinal contacts

Regarding chin contact, more horses in the rural (56.5%), semi-urban (60.6%) and urban (58.8%) regions avoided contact than those that accepted contact as stipulated in Table 1. It was also revealed that 56.5%, 60% and 59.5% of horses in the rural, semi-urban and urban areas respectively reacted upon spinal contact.

### General attitude

The majority of assessed horses exhibited a positive general attitude followed by a higher percentage of horses that displayed a negative non-reactive attitude (apathetic, dull or non-responsive throughout the assessment) with 33.3% in the rural, 32.5% in semi-urban and 23.6% in urban regions. However, majority of horses reacted upon spinal contact encompassed of 56.5%, 60% and 59.5% for rural, semi-urban and urban regions respectively.

## Discussion

The results in Figure 1, which indicated that horses assessed were not having any eye problems, are in disparity with Upjohn *et al.* (2011) who reported that 48.4% of assessed horses had ocular discharge.<sup>14</sup> This might be due to the fact that the referred assessment was made during winter months (between April and June, 2007) when it was cold and horses were prone to diseases such as equine influenza (flu). Pritchard *et al.* (2005) also demonstrated a high prevalence of abnormalities of eyes ranging from mild discharge to signs of ocular pain, keratitis, uveitis and blindness.<sup>15</sup>

The outcomes which revealed that the mucous membranes of all horses (100%) studied in the three regions were within normal range (Figure 1) concur with those of Pritchard *et al.* (2005) who observed that fewer than 8% of working equines had abnormal mucous membranes.<sup>15</sup> In addition, Upjohn *et al.* (2011) reported that 6.2% of assessed horses had pale mucous membranes.<sup>14</sup>

As shown in Figure 1, the respiration of most horses was not affected because the following signs were also not observed; flaring of the nostrils, heaving abdomen, asynchrony between movements of the chest and abdomen and audible respiratory noise as stated by the European Animal Welfare Indicators Project (AWIN) (2015).<sup>16</sup> Nevertheless, the results of the present study disagree with the study of Upjohn *et al.* (2011) who reported that 11.5% of horses in Lesotho had audible respiratory noise.<sup>14</sup>

The results about the nasal discharge as presented in Figure 2 differs with the findings of Upjohn *et al.* (2011) who stated that 48.4% of assessed horses had nasal discharge.<sup>14</sup> The reason for the variations could be traced to the fact that the study in contrast was

conducted in winter, when it was cold and horses were prone to diseases such as flu.

The results in Figure 2, which demonstrated that all horses (100%) in the three regions had no diarrhoea suggest that maybe the horses investigated did not have problems related to feeds or gastrointestinal parasites. AWIN (2015) designated that a bad manure consistency could indicate a gastrointestinal problem but also a poor value of food.<sup>16</sup>

The findings of the current study concur with the results of Upjohn *et al.* (2011) who found that 59% of assessed horses had ticks.<sup>14</sup> On the other hand, the results of the present study disagree with the findings of Pritchard *et al.* (2005) who reported that fewer than 8% of working equines had external parasites.<sup>15</sup> The fact that majority of assessed horses were found with parasites suggests that the housing management practices by horse owners are not good.

The results in Figure 4 that revealed that majority of assessed horses had a moderate to good body condition suggest that the evaluated horses are correctly fed and or the internal parasites are sufficiently controlled because most horses were in good body condition. Supporting these results, Upjohn *et al.* (2011) also reported that the body condition score of assessed horses was moderately good.<sup>14</sup> Contrary to the results of the current study, Fröhlich *et al.* (2020) indicated that 90.4% of animals were moderately thin.<sup>17</sup> Pritchard *et al.* (2005) also reported a much higher prevalence of thin horses.<sup>15</sup> The study of Horseman *et al.* (2016) also revealed that in relation to health, horses being underweight was the most commonly discussed issue.<sup>18</sup> Leckie (2001) found that the cases most frequently encountered by field officers were situations involving undernourished horses.<sup>19</sup> In addition, Pearson (2003) found that the problem most frequently encountered by inspectors from the RSPCA was poor body condition and that most cases were classed as moderately severe.<sup>20</sup>

The findings of the current study on body lesions concur with the results of Fröhlich *et al.* (2020) who indicated that wounds were found in less than a quarter of the assessed population of horses, and explained that those horses that were doing more work were found to have more wounds.<sup>17</sup> However, Upjohn *et al.* (2011) reported that 62% of assessed horses had lesions.<sup>14</sup> The study conducted by Luna *et al.* (2017) also revealed that 47% of the assessed horse population had skin lesions.<sup>6</sup>

As shown in Figure 6, majority of assessed horses in the rural, semi-urban and urban areas showed uncompromised gait. Based on a limited lameness assessment, the lower lameness prevalence in Lesotho was also witnessed by Pritchard *et al.* (2005) and Broster *et al.* (2009).<sup>15,21</sup> Conversely, the findings of Scott *et al.* (2003) revealed that the majority of working equines

showed a gait abnormality of over twelve paces at walk; these varied from uneven gait in animals with poor limb conformation, through mild to severe lameness.<sup>22</sup>

The results of the current study as illustrated in Figure 6 agree with the study of Fröhlich *et al.* (2020) who found that few horses (4.1%) had swollen joints.<sup>17</sup>

The fact that SEBWAT was used means the frog assessment may have been underrated since Brooke (2013) indicated that when using this tool, only the fore hooves are assessed for practical reasons; therefore, prevalence of frog disease found in this study is likely to be underestimated (Figure 6).<sup>23</sup> The possible reason for a diseased frog is that, sometimes service providers or farriers who are not well trained and do not understand the hoof structure and the function of the frog may do excessive trimming or even remove or cut the frog.

The findings of this study which showed that the majority of the hooves of the horses assessed were normal in shape and quality (Figure 7) contradict with the results of Horseman *et al.* (2016) who stated a higher number of horses with foot abscesses and over grown hooves.<sup>18</sup> The study of Fröhlich *et al.* (2020) also indicated that 71.5% of horses showed signs that their hooves were neglected.<sup>17</sup> Furthermore, Pritchard *et al.* (2005) reported 55.5% of examined horses to have overgrown hooves.<sup>15</sup> Upjohn *et al.* (2011) also reported 39.8% to 44.6% of horses to have overgrown hooves while 9.8% to 21.3% had foot injuries.<sup>14</sup> In addition, Tadich *et al.* (2008) pointed hoof management to be the most prominent concern in horses, which could be attributed to lack of education and perception of health and husbandry issues.<sup>24</sup>

The results illustrated in Table 1 showing a higher percentage of assessed horses being positive to the observer are in accordance with the findings of Burn *et al.* (2009) who reported that only 21% of the animals were avoiding the observer.<sup>25</sup> Furthermore, Hausberger *et al.* (2020) reported that 8% of horses showed aggressiveness in human-horse relationship test both towards the assessor and the owner.<sup>26</sup> Nonetheless, Popescu and Diugan (2013) found that most horses (64%) showed avoidance/fear when the assessor walked along their side.<sup>27</sup> These results strongly suggest that the daily human-horse contact has a great influence on the way horses perceive humans and the resulting relation.

The results illustrated in Table 1 indicating that most horses avoided contact are in agreement with those of Pritchard *et al.* (2005) who reported that the proportion of horses avoiding chin contact by the observer's cupped hand was significantly higher.<sup>15</sup> Popescu and Diugan (2013) also reported that 48% of the horses assessed showed avoidance/fear when the assessor touched their chin (48%).<sup>27</sup> In support of the results of this study Fröhlich *et al.* (2020) also found that 89.2% of horses had a positive general attitude.<sup>17</sup>

## Acknowledgements

World Horse Welfare is greatly recognised; the project financially supported this work during data collection.

## References

- Botreau, R., Veissier, I., Butterworth, A., Bracke M.B.M. and Keeling, L.J.** (2007). Definition of criteria for overall assessment of animal welfare. *Animal Welfare*, Vol 16, 225-228.
- Lekota, T.A.** (2001). The State of the Basotho Pony in Lesotho.
- Rwelamira, J.K.** (1998). Economic aspects of draught animal power. *Animal Production Officer. Ministry of Agriculture, Quthing, Lesotho.*
- McLean, A.N. and McGreevy, P.D.** (2010). Ethical equitation: Capping the price horses pay for human glory. *Journal of Veterinary Behaviour: Clinical Applications and Research*, Vol 5, 203-209.
- Botreau, R., Veissier, I., Butterworth, A., Bracke M.B.M. and Keeling, L.J.** (2007). Definition of criteria for overall assessment of animal welfare. *Animal Welfare*, Vol 16, 225-228.
- Luna, D., Vásquez, R.A., Rojas, M. and Tadich, T.A.** (2017). Welfare Status of Working Horses and Owners Perceptions of Their Animals. *Animal*, Vol 7, 4-12.
- Rousing, T., Bonde, M. and Sorensen, J.T.** (2001). Aggregating welfare indicators into an operational welfare assessment system: a bottom-up approach. *Animal Supplement*, Vol 30, 53-57.
- Hemsworth, P.H., Coleman, G.J., Barnet, T.J.L. and Borg, S.** (2000). Relationships between human-animal interactions and productivity of commercial dairy cows. *Journal of Animal Science*, Vol 78, 2821-2831.
- Rushen, J., Taylor, A.A. and De Passille, A.M.B.** (1999). Domestic animals' fear of humans and its effect on their welfare. *Applied Animal Behaviour Science*, Vol 65, 285-303.
- Waiblinger, S., Boivin, X., Pedersen, V. et al.** (2006). Assessing the human-animal relationship in farmed species: A critical review. *Applied Animal Behaviour Science*, Vol 101, 185-242.
- Bonde, M.K.** (2004). Welfare assessment in a commercial sow herd. Royal Veterinary and Agricultural University, Denmark.
- Sommerville, R., Brown, A.F. and Upjohn, M.A.** (2018). Standardised equine-based welfare assessment tool used for six years in low and middle income countries. *PLoS ONE*, Vol 13, No 2, 5-8.
- Carroll, C.L. and Huntington, P.J.** (1988). Body condition scoring and weight estimation of horses. *Equine Veterinary Journal*, Vol 20, 41-45.
- Upjohn, M.M., Shipton, K., Pfeiffer, K. et al.** (2011). Cross-sectional survey of owner knowledge and husbandry practices, tack and health issues affecting working horses in Lesotho. *Equine Veterinary Journal*, Vol 44, 310-318.

- 15 **Pritchard, J.C., Lindberg, A.C., Main, D.C.J. and Whay, H.R.** (2005). Assessment of the welfare of working horses, mules and donkeys, using health and behaviour parameters. *Preventive Veterinary Medicine*, Vol 69, 265-283.
- 16 **European Animal Welfare Indicators Project (AWIN)** (2015). Animal welfare indicators assessment protocol for horses. DOI: 10.13130/AWIN\_HORSES.
- 17 **Fröhlich, N., Patrick, D.S., Sommerville, R. et al.** (2020). Welfare Assessment and Husbandry Practices of Working Horses in Fiji. *Animals*, Vol 10, 392.
- 18 **Horseman, S.V., Buller, H., Mullan, S. and Whay, H.R.** (2016). Current Welfare Problems Facing Horses in Great Britain as Identified by Equine Stakeholders. *PLoS ONE*, Vol 11, No.8.
- 19 **Leckie, E.J.** (2001). Equine Population of the UK: A Report for the International League for the Protection of Horses (ILPH). United Kingdom.
- 20 **Pearson, N.Y.Â.** (2003). *A study of horse ownership and management in Victoria, Australia*. Masters thesis, University of Melbourne, Australia.
- 21 **Broster, C.E., Burn, C.B., Barr, A.R.S. and Whay, H.R.** (2009). The range and prevalence of pathological abnormalities associated with lameness in working horses from developing countries. *Equine Veterinary Journal*, Vol 41, 474-481.
- 22 **Scott, E.M., Fitzpatrick, J.L., Nolan, A.L., Reid, J. and Wiseman, M.L.** (2003). Evaluation of welfare state based on interpretation of multiple indices. *Animal Welfare*, Vol 12, 457-468.
- 23 **Brooke.** (2013). Understanding Equid Welfare Issues. *The Working Equid Veterinary Manual*. First edition. Essex: Whittet Books.
- 24 **Tadich, T., Escobar, A., Pearson, R.A.** (2008). Husbandry and welfare aspects of urban draught horses in the South of Chile. *Archives of Veterinary Science and Medicine*, Vol 40, 267-273.
- 25 **Burn, C., Pritchard, J. and Whay, H.** (2009). Observer reliability for working equine welfare assessment: problems with high prevalence of certain results. *Animal Welfare*, Vol 18, 177-187.
- 26 **Hausberger, M., Lerch, N., Guilbaud, E., et al.** (2020). On-Farm Welfare Assessment of Horses: The Risks of Putting the Cart before the Horse. *Animals*, Vol 10, No. 371, 2-16.
- 27 **Popescu, S. and Diugan, E.A.** (2013). The relationship between behavioural and other welfare indicators of working horses. *Journal of Equine Veterinary Science*, Vol 33, 1-12.