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Assessment of Hoof Disease Prevalence, Risk Factors, and Management Practices in Indigenous Horses of Bangladesh

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Abstract

FOOT diseases have a significant impact on the health and productivity of horses, particularly in regions where they are integral to the livelihoods of rural communities. This study aimed to assess the prevalence of hoof diseases, identify associated risk factors, and evaluate management practices in indigenous horses in the greater Mymensingh region of Bangladesh. Over a 12-month period, data were collected from 140 horse owners through structured interviews, and their horses were examined in the field for signs of lameness. The overall prevalence of lameness was found to be 8.57%, with significant differences across age groups, housing systems, and body height ($P<0.05$). Older horses (>5 years) and those taller than 145 cm were significantly more prone to lameness. Among the housing systems, enclosed tie-stall housing showed a higher lameness rate (5.71%) than open-front stables (2.86%). Poor management practices, including inadequate housing, irregular grooming, limited dietary supplementation, and lack of access to veterinary care, were identified as major contributors to foot health problems. The findings highlight the important role of proper husbandry and healthcare in mitigating the burden of hoof diseases. Improving housing design, ensuring balanced nutrition, and increasing access to trained veterinary services are essential strategies to enhance the productivity and welfare of indigenous horses in Bangladesh.

Keywords: Indigenous horses, hoof disease, lameness, risk factors, management practices, Bangladesh.

Introduction

Horses have been an integral part of rural livelihoods in several areas of Bangladesh, serving as draught animals [1]. They are known as the beasts of burden and work as the only means for low-income people [2]. In Bangladesh, horse dungs are the most important manure source and transport for agricultural products in urban and rural areas [3, 4]. As a whole, the horse is regarded as a non-ruminant livestock species and is widely used for drought purposes like pulling carts, transportation of people and goods, tillage, racing, and finally, the horse is also being used as an amusement tool for rural people. It is said that horses have been raised in Bangladesh since time immemorial as draught animals and for amusement [5]. Despite scientific and technological advancements, horses continue to play an important role in areas with rugged terrain and river erosion-prone lands, particularly in the alluvial zones of Bangladesh [3, 6].

Internationally, the equine industry contributes significantly to rural economies. For instance, in Brazil, over 6 million people are directly employed in the equine sector, which generates approximately 2.91 billion USD annually [7, 8]. The equine population is decreasing worldwide, and also in Bangladesh. As a result, horse utility is very limited these days. Recent household-level surveys

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conducted in several horse-rearing areas of Bangladesh revealed an average of 1.18 horses per household, underscoring the sparse and geographically limited distribution of working horses in the country [3, 9]. Today, horses are sparsely distributed across the country, with relatively higher concentrations in the Sylhet, Mymensingh, and Dhaka regions. A limited number of exotic horses are also maintained by elite institutions such as the President's Guard Regiment, Police Headquarters, and Bangladesh Military Academy for defense or ceremonial purposes [9]. Despite their historical and socio-economic importance, indigenous horses in Bangladesh remain largely under-researched, especially regarding their health and management practices. According to Bhuiyan et al. [9], these horses are descendants of Southeast Asian ponies, adapted to local environmental conditions, but still vulnerable to various health challenges. Among these, hoof diseases, particularly lameness, pose a major threat, affecting the mobility, productivity, and overall welfare of the animals [3].

Globally, lameness is one of the most frequently reported health issues in horses and has been associated with substantial economic losses [10]. Despite their historical and socio-economic importance, indigenous horses in Bangladesh remain largely under-researched, particularly regarding their health and management practices. Hoof diseases, especially lameness, pose a significant challenge as they impair mobility, reduce work efficiency, and compromise animal welfare [3, 9]. The development of hoof disorders is often multifactorial, influenced by poor housing conditions, prolonged exposure to wet or muddy environments, inadequate nutrition, lack of hoof trimming, and continuous workload without rest [10]. Previous studies in other countries have reported lameness prevalence rates ranging from 14% to 26% [11, 12], with risk factors such as age, body height, flooring type, and poor hoof management practices playing important roles [13, 14]. However, such data are scarce for indigenous horses in Bangladesh.

Therefore, this study aimed to assess the prevalence of hoof diseases, identify associated risk factors, and evaluate the management practices of horse owners in the greater Mymensingh region of Bangladesh. By addressing these gaps, the research intends to offer practical insights that can inform better health management, improve equine welfare, and support the sustainability of horse-based rural livelihoods.

Material and Methods

Study Area, Duration, and Experimental Animals

The study was conducted in three horse-prone districts of Bangladesh: Mymensingh, Jamalpur, and Tangail. Specifically, the research focused on Sadar Upazila of Mymensingh district, Jamalpur Sadar Upazila of Jamalpur district, and Madhupur Upazila of Tangail district. These areas were selected purposively due to their prominence in horse farming and trade, often referred to as the "horse farming belt" of the Mymensingh region. The Jamuna basin, one of the three major agro-economic zones for livestock farming in Bangladesh, comprises vast plains and riverine char lands. The chars of Mymensingh district fall within this agro-economic zone. Notably, the Porangonj union of Mymensingh Sadar Upazila is located on the bank of the Brahmaputra River. The selected study sites included Ambikagonj, Chalkshamrampur, Fodiar Char, Char Hasadia, and Bartipara of Mymensingh Sadar Upazila; Nandina of Jamalpur Sadar Upazila; and Madhupur Upazila of Tangail district (Fig. 1).

These areas are also renowned for equine trade hubs such as 'Tulsipur Hat' in Nandina and Madhupur, where local communities regularly buy and sell horses, horse carts, and related accessories. This cross-sectional study was conducted over a 12-month period. A total of 140 horse owners, actively engaged in horse-rearing, were selected based on their willingness to participate.

Study Design

The study was carried out in three sequential phases: Phase I involved planning, including topic selection, literature review, and development of methodology. Phase II focused on field-level data collection through owner interviews and clinical examination of horses. In Phase III, the collected data were statistically analyzed, interpreted, and discussed. The study design summarized in Fig. 2.

Data Collection and Examination for Lameness

Data were collected using a pre-structured questionnaire and field examinations. The questionnaire included sections on owner demographics, housing systems, feeding practices, grooming frequency, disease history, and veterinary care. According to the frequency of recorded outcomes, the management system of horses was categorized as A (Good) = Standard Housing + Weekly grooming + Feeding forage, concentrate and supplement + Veterinary care for diseases, B (Average) = Good housing + Quarterly grooming + Feeding forage and concentrate + Local treatment for diseases, and C (Poor) = Mixed housing + Monthly grooming + Feeding only forage + Self-treatment for diseases. Field examinations assessed horse height, age, housing conditions, and signs of lameness, including gait irregularities, swelling, and hoof abnormalities (Fig. 3).

Horses were examined for lameness while grazing in the pasture. Individual horses reported for lame were placed in sitting positions and closely examined for lesions in interdigital structures, including skin, soft horn, hard horn, and skin horn.

Positive cases were determined by the presence of abnormal conformation in the fore limb and hind limb (Figure 3). Abnormal gait was also considered a positive indication of lameness. Physical examination and hoof testing were done to diagnose swelling, pain, enlargement, fracture, atrophy, joint effusion, flexion, luxation, displacement, and UPF. Lameness was graded using the American Association of Equine Practitioners (AAEP) lameness scale, ranging from 0 (no lameness) to 5 (non-weight bearing lameness or unable to move).

Data Analysis

Data were entered in a Microsoft Excel Worksheet and further analysis was done using Statistical Package for Social Sciences (SPSS) statistics version 26.0. Descriptive statistics were used to summarize the prevalence of lameness, while t-tests and chi-square tests determined the significance of relationships between management practices and lameness ($P<0.05$).

Results

Overall prevalence

Horse lameness is a common and significant issue in the rural economy. Among the seven study areas, lameness was observed in four. Out of 140 horses, 12 (8.57%) were identified as lame. The highest prevalence was noted in Bartipara (28.57%) and Chalkshamrampur (18.18%), while no cases were reported in Ambikagonj, Nandina, and Madhupur. The prevalence in Char Hasadia and Fodiar Char was 11.11% and 12.50%, respectively (Table 1).

Animal-Level and General Housing Factors

Among all the horses, 68.57% were housed in enclosed tie systems and 31.42% in open-front stables (Table 2). Lameness prevalence was significantly higher in enclosed housing systems (5.71%) compared to open-front stables (2.86%) ($P<0.05$). A total of 96 horses were housed in enclosed systems and 44 in open-front stables. Age also significantly affected lameness prevalence ($P<0.05$). Among the horses, 41.43% were under 5 years old, and 58.57% were over 5 years. Lameness prevalence was higher in horses older than 5 years (7.14%) than in younger horses (1.43%).

According to height, horses were grouped into: Group A (pony <145 cm) and Group B (horse >145 cm). Lameness prevalence was significantly higher in Group B (7.14%) compared to Group A (1.43%) ($P<0.05$). The purpose of horse use also influenced prevalence, though not significantly. Most horses (97.14%) were used for carriage and load-bearing purposes, with 12 lame cases (8.57%). None of the four horses used for riding or show were lame.

Sex did not significantly affect prevalence ($P>0.05$), though 5.71% of males and 2.86% of females were affected. Management quality also influenced prevalence. Of the 140 horses, 16 (11.43%) were under good management, 38 (27.14%) under fair, and 86 (61.43%) under poor systems. All 12 lame horses came from poor management systems, indicating an 8.57% prevalence under poor conditions ($P>0.05$) (Table 2).

Housing and Management Practice Factors

Rearing systems varied slightly across areas. Of the 140 horses, 46 were reared in single housing, 62 in group housing, and 32 in mixed systems. Lameness was most prevalent in mixed housing (5.71%), followed by group (2.14%) and single housing systems (0.71%), with a statistically significant association ($P<0.05$) (Table 3). Floor type also showed a significant influence ($P<0.05$). Of the 140 horses, 106 were housed on earth floors and 34 on brick floors. Lameness prevalence was higher in brick floor housing (8.00%) than in earth flooring (3.57%).

Some other non-significant factors were taking no veterinary care and feeding practices. In the study area, horses were fed forage, concentrate, and supplements. Grass, straw, and hay were supplied as forage. Grains such as corn, barley, and wheat bran were supplied as concentrate, and soybean meal, linseed meal, and mustard cake were used as supplements. Among the total 140 horses, all were supplied with forage, 74.29% received concentrate, and only 17.14% received supplements. Veterinary care was mostly provided by quacks (80.00%), with very few horses treated by veterinarians (4.29%) or self-treated (15.71%) (Table 3).

Discussion

In Bangladesh's agro-based economy, livestock play a crucial role in supporting rural livelihoods, and horses have historically been a part of this system [16, 17]. In particular, indigenous horses continue to serve low-income communities by providing transportation and load-carrying services, especially in the riverine and char areas [5]. Despite their importance, there is limited scientific literature addressing the health management and welfare challenges of indigenous horses in Bangladesh. Among the health issues faced by these animals, lameness represents a significant concern due to its impact on productivity, animal welfare, and household economies.

In the context of developing countries, recent report of lameness among working equids ranges from ~30% prevalence, with factors such as advanced age, poor body condition, and heavy workloads strongly linked to increased risk [13]. In our study, the lower prevalence of 8.57% may reflect local differences in workload intensity, owner awareness, or seasonal use patterns of indigenous horses. In addition, our findings align with Lykkjen

et al. [18], who reported an 8.4% period prevalence of laminitis in Norwegian ponies. This similarity suggests that, despite differences in geography, management systems, and breed, foot-related disorders remain a persistent welfare concern across both developed and developing regions.

Another significant observation in this study is the influence of housing and management systems on lameness prevalence. Horses kept in enclosed tie systems showed a higher risk of developing lameness compared to those housed in open-front stables. Poor ventilation, restricted movement, and hard flooring are well-documented contributors to hoof problems and musculoskeletal strain [19]. These findings are consistent with earlier research showing that restrictive housing compromises equine welfare and increases susceptibility to foot diseases [20, 21].

Floor type also played a notable role. Horses housed on brick floors had a higher prevalence of lameness (8.00%) compared to those on earth floors (3.57%). This aligns with the findings of Wattanapornpilom et al. [22] and Ruet et al. [23], who reported that hard flooring materials increase the risk of hoof wear, joint stress, and reduced locomotion comfort. Soft flooring, such as sand or earth, better mimics natural conditions, reducing the biomechanical strain on the hoof and joints.

The effect of age and height on lameness prevalence was significant in our study. Older horses (>5 years) and taller horses (>145 cm) had higher rates of lameness. This may be due to age-related degenerative changes and the increased biomechanical load placed on the limbs of larger animals. Similar patterns were observed by McGowan [24] and supported by recent studies in working equids, where joint health deterioration correlated with both age and body size [5, 25]. In a similar vein, body size was another influential factor. Horses taller than 145 cm had a significantly higher prevalence of lameness (7.14%) compared to shorter horses (1.43%). Larger body size increases the mechanical load on limbs and hooves, which may predispose taller horses to lameness, particularly when management conditions are suboptimal. This observation is supported by Adams [26], who described the correlation between body mass and increased musculoskeletal stress in horses.

Additionally, horses kept under mixed housing systems, where animals shift between individual and group management, showed a higher prevalence of lameness (5.71%). This could be due to inconsistent care routines, higher risk of trauma from group interactions, or increased stress levels leading to abnormal movement patterns, as discussed in welfare studies by Lesimple [19] and Reix et al. [27].

Another contributing factor is the lack of proper veterinary care. In the present study, only 4.29% of horses received treatment from licensed veterinarians, while the majority relied on quacks or self-treatment. This highlights a critical gap in rural animal healthcare services, mirroring findings from other low-income regions [28, 29]. Furthermore, feeding practices may indirectly influence hoof health. Although all horses received forage, only 17.14% were provided with supplements. Nutritional deficiencies, particularly in minerals like zinc, copper, and biotin, are known to compromise hoof integrity and increase susceptibility to lameness [30, 31]. Therefore, nutritional intervention should be prioritized alongside structural management improvements.

This study was limited to three districts and relied on clinical diagnosis without etiological confirmation or dietary nutrient profiling, and did not analyze seasonal variations. Future nationwide studies incorporating seasonal effects, advanced diagnostics (radiography, culture, histopathology), and feed/serum analysis are needed to provide stronger evidence for targeted hoof health interventions in Bangladesh.

Conclusion

This study provides valuable insights into the prevalence of lameness and the management practices that influence foot health in indigenous horses of the greater Mymensingh region of Bangladesh. An overall lameness prevalence of 8.57% was recorded, with significant associations observed with housing type, age, height, flooring, and overall management quality. Horses kept in enclosed tie housing systems, housed on brick floors, and those under mixed or group housing systems exhibited a higher risk of developing lameness. Additionally, older and taller horses were more susceptible to foot diseases, likely due to increased musculoskeletal strain and cumulative wear over time. The study also highlights critical gaps in nutritional management and veterinary care. Inadequate supplementation and the predominance of informal healthcare providers contribute to the persistence of preventable conditions such as lameness, which negatively affects horse welfare and the livelihoods of owners who depend on them for transportation and income generation. Addressing these management-related factors is essential to improve the welfare, productivity, and longevity of indigenous horses in Bangladesh. Improving housing, feeding, and veterinary services can substantially reduce the burden of foot diseases and support the sustainable use of horses in rural communities.

Recommendations

Based on the findings, the following recommendations are proposed:

- Promote improved housing systems, particularly open-front stable designs, to enhance airflow,

reduce hoof diseases, and minimize the risks associated with confined spaces.

- Discourage the use of hard brick flooring for horse housing and instead encourage the adoption of earth or sand-based floors that provide better shock absorption and hoof comfort.
- Provide training programs for horse owners focusing on balanced nutrition, including the importance of mineral and vitamin supplementation to maintain hoof health and prevent lameness.
- Expand access to veterinary care services, including the training of local paraprofessionals and establishment of mobile veterinary clinics, to reduce reliance on unqualified treatment providers.
- Implement public awareness campaigns on proper hoof care, regular grooming, and early detection of lameness to empower owners with preventive knowledge.
- Encourage community-based initiatives for improving horse management practices, including cooperative housing improvements, feed supplementation programs, and the establishment of local equine welfare committees.

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Declaration of Conflict of Interest

The authors declare that there is no conflict of interest.

Ethical of approval

The experimental procedures and the accession of the study were carried out according to the principles of the Ethics Committee of Bangladesh Agricultural University, Mymensingh -2202. Local laws and regulations were also followed.

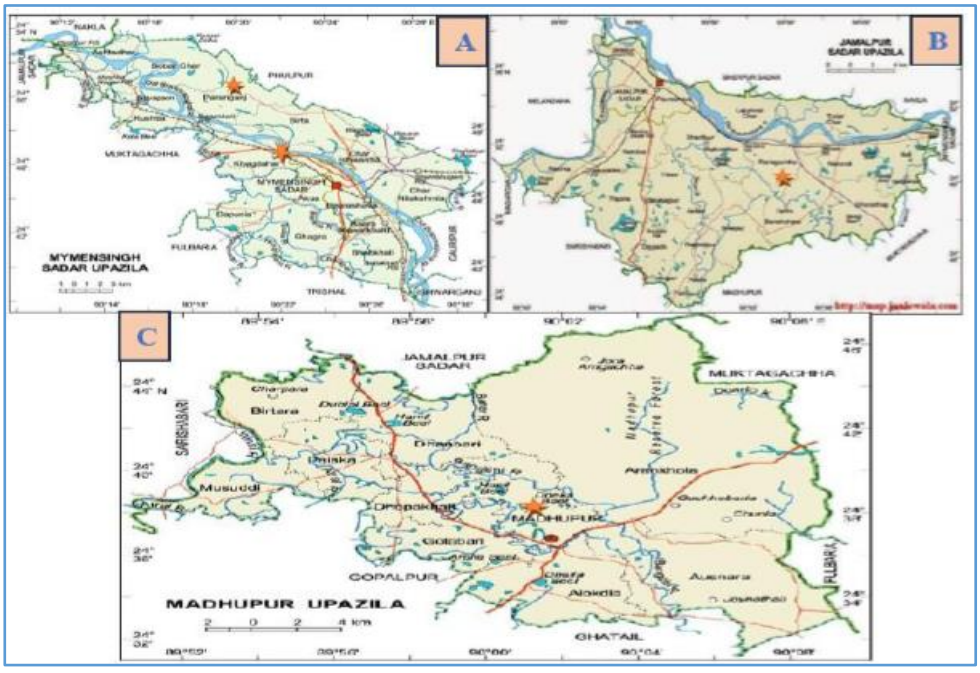

Fig. 1. Map of study areas: Paranganj in Mymensingh Sadar (A), Nandina in Jamalpur Sadar (B), and Madhupur in Tangail district

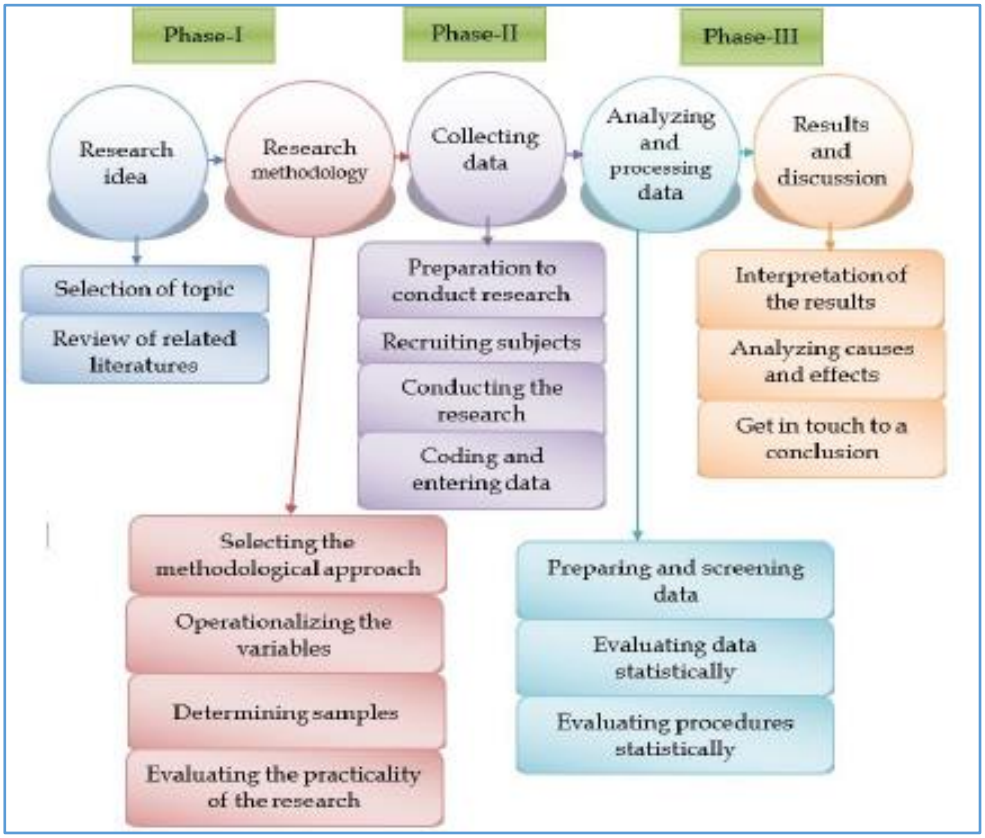

Fig. 2. Schematic representation of the study design outlining key steps from methodology development to data collection and analysis.

Fig. 3. Traditional horse housing (A), measurement of height (B), hoof examination for lameness (C), and a local horse market (D)

TABLE 1. Overall and area-wise prevalence of lameness in horses

Area	Horse Population	Lame Horses	Prevalence (%)
Chalkshamrampur	22	4	18.18
Bartipara	14	4	28.57
Char Hasadia	18	2	11.11
Fodiar Char	16	2	12.50
Ambikagonj	24	0	0
Nandina	22	0	0
Modhupur	24	0	0
Total	140	12	8.57

TABLE 2. Association of animal and management-related factors with lameness prevalence in indigenous/local horses

Factors	Categories	Horse population (%)	Lame horse (%)	Prevalence (%)
Type of horse used	Carriage & Load bearing	97.14 (136)	8.57 (12)	8.57
	Race/show & Riding	2.86 (04)	-	-
Housing	Enclosed tie housing*	68.57 (96)	5.71 (8)	5.71
	Open front stables*	31.42 (44)	2.86 (4)	2.86
Management practice	Good	11.43 (16)	-	-
	Fair	27.14 (38)	-	-
	Poor	61.43 (86)	8.57 (12)	8.57
Age	<5 years*	41.43 (58)	1.43 (02)	1.43
	> 5 years*	58.57 (82)	7.14 (10)	7.14
Sex	Male	51.43 (72)	5.71 (08)	5.71
	Female	48.57 (68)	2.85 (04)	2.86
Height	Group A <145 cm *	38.57 (54)	1.43 (2)	1.43
	Group B >145 cm *	68.43 (86)	7.14 (10)	7.14

*Significant relationship according to the t-test (P<0.05)

TABLE 3. Influence of housing and management practices on lameness prevalence in indigenous/local horses

Management factors	Frequencies	Number of Horses (%)	Prevalence of lameness (%)
Grouping	Single*	32.86 (46)	1 (0.71%)
	Group*	44.29 (62)	3 (2.14%)
	Mixed *	22.86 (32)	8 (5.71%)
Floor type	Earth*	75.71 (106)	5 (3.57%)
	Concrete	-	-
	Brick*	24.29 (34)	7 (8.00%)
Bedding	Present	72.86 (102)	8 (5.71%)
	Absent	21.14 (38)	4 (2.86%)
Feed supply	Forage	100 (140)	12 (8.57%)
	Concentrate	74.29 (104)	10 (7.14%)
	Supplement	17.14 (24)	2 (1.43%)
Regular grooming	Present	97.14 (136)	11 (7.86%)
	Absent	2.86 (04)	1 (0.71%)
Veterinary care	Veterinarian	4.29 (06)	0
	Quack	80.00 (112)	10 (7.14%)
	Self	15.71 (22)	2 (1.43%)

*Significant relationships according to the t-test (P<0.05)

References

1. Mota-Rojas, D., Braghieri, A., Álvarez-Macías, A., Serrapica, F., Ramírez-Bribiesca, E., Cruz-Monterrosa, R., Masucci, F, Mora-Medina, P. and Napolitano, F. The use of draught animals in rural labour. *Animals*, **11**(9),2683(2021). https://doi.org/10.3390/ani11092683.

2. Bonsi, M., Anderson, N. E. and Carder, G. The socioeconomic impact of diseases of working equids in low and middle-income countries: A critical review. *Animals*,**13**(24),3865(2023). https://doi.org/10.3390/ani13243865.

3. Alam, M. P., Bhuiyan, M. S. A. and Bhuiyan, A. K. F. H. The socio-economic status of horse owners in rural areas of Bangladesh. *The Agriculturists*, **13**(1), 46-52 (2015).. https://doi.org/10.3329/agric.v13i1.26547.

4. Pearson, R. A., Lhoste, P., Saatamoinen, M. and Martin-Rosset, W. (Eds.). (2023). Working animals in agriculture and transport: a collection of some current research and development observations.

5. Rahman, M. S., Mahbubul, M., Khatun, A. and Ali, M. Y. Socio-economic Profile of Equine Owner, Morphometric Characterization and Reproductive Performance of Indigenous Horses in Bangladesh. *European Journal of Veterinary Medicine*, **3**(5), 19-25 (2023).. https://doi.org/10.24018/ejvetmed.2023.3.5.108.

6. Bakaloudis, D. E., Thoma, C. T., Makridou, K. N., Kotsonas, E. G., Arsenos, G., Theodoridis, A. and Kontsiotis, V. Home Range and Habitat Selection of Feral Horses (Equus ferus f. caballus) in a Mountainous Environment: A Case Study from Northern Greece. *Land*, **13**(8), 1165(2024). https://doi.org/10.3390/land13081165.

7. Brasil. (2016). Revisão do Estudo do Complexo do Agronegócio do Cavalo. Ministério da Agricultura, Pecuária e Abastecimento. Retrieved from http://www.agricultura.gov.br/.../revisao-do-estudo-do-complexo-do-agronegocio-do-cavalo

8. Cabral, G.C., de Carvalho Peres, A.A., Dias, A.C., de Souza Tassinari, W., de Almeida, M.I. and de Almeida, F.Q. Horse Agribusiness in Rio de Janeiro, Brazil: trade and economic aspects of Mangalarga Marchador farm production. *Research, Society and Development*. **9**(11):e4319119938(2020).

9. Bhuiyan, A. F. H. (2013). Farm animal genetic diversity country report-Bangladesh. Farm animal genetic resources in SAARC countries: diversity, conservation and management, 1474.

10. Mustefa, K. A review on lameness in equine. *International Journal of Advanced Research in Biological Sciences*, **6**(10), 101-109(2019).. http://dx.doi.org/10.22192/ijarbs.2019.06.10.010.

11. Watson, W. L., MacKay, J. R. and Dwyer, C. M. Healthy as a Horse? Characterising the UK and Ireland's Horse Owners, Their Horses, and Owner-Reported Health and Behavioural Issues. Animals: *an Open Access Journal from MDPI*, **15**(3), 397(2025). https://doi.org/10.3390/ani15030397.

12. Herbst, A. C., Coleman, M. C., Macon, E. L., Harris, P. A. and Adams, A. A. Owner-reported health and disease in US senior horses. *Equine Veterinary Journal*,**57**(3),684-702(2025).. https://doi.org/10.1111/evj.14200.

13. Merridale-Punter, M. S., Wiethoelter, A. K., El-Hage, C. M. and Hitchens, P. L. Prevalence and factors associated with working equid lameness in low-and middle-income countries: A systematic review and meta-analysis. *Animals*, **12**(22), 3100(2022).. https://doi.org/10.3390/ani12223100.

14. Visser, E. K., Neijenhuis, F., de Graaf-Roelfsema, E., Wesselink, H. G. M., De Boer, J., van Wijhe-Kiezebrink, M. C., Engel, B. and Van Reenen, C. G. Risk factors associated with health disorders in sport and leisure horses in the Netherlands. *Journal Of Animal Science*, **92**(2), 844-855(2014).. https://doi.org/10.2527/jas.2013-6692.

15. Ferdous, M. R., Wesselink, A., Brandimarte, L., Slager, K., Zwarteveen, M. and Di Baldassarre, G. Socio-hydrological spaces in the Jamuna River floodplain in Bangladesh. *Hydrology and Earth System Sciences*, **22**(10), 5159-5173(2018).. https://doi.org/10.5194/hess-22-5159-2018.

16. Rahman, M. H., Ahmed, E., Haque, M. N., Hassan, M. Z. and Ali, M. Z. Major respiratory diseases of goat and their epidemiology, prevention and control. *Bangladesh Journal of Livestock Research*, 1-20 (2022). https://doi.org/10.3329/bjlr.v29i1.72031.

17. Deb, G. K., Miraz, M. F. H., Hossain, S. M. J., Akter, S., Kabir, M. A., Amin, M. R., Choudhury, M. P. and Desha, N. H. Characterization of phenotypic traits and socioeconomic importance of native horses in Bangladesh: Current status and way forward. *Adv. Anim. Vet. Sci.*, **12**(8), 1483-1491(2024). https://dx.doi.org/10.17582/journal.aavs/2024/12.8.1483.1491.

18. Lykkjen, S., Stenbakk, L. K. and Holmøy, I. H. Prevalence and risk factors for laminitis within the Norwegian pony breed Nordlandshest/Lyngshest. *Acta Veterinaria Scandinavica*, **65**(1), 22(2023).. https://doi.org/10.1186/s13028-023-00687-w.

19. Lesimple, C. Indicators of Horse Welfare: State-of-the-Art. *Animals*, **10**(2),294(2020). https://doi.org/10.3390/ani10020294.

20. Rushen, J. and Passillé, A. M. de. Effects of Roughness and Compressibility of Flooring on Cow Locomotion. *Journal of Dairy Science*, **89**, 2965-2972(2006).. https://doi.org/10.3168/jds.S0022-0302(06)72568-1.

21. Johnson, S. A., Donnell, J. R., Donnell, A. D. and Frisbie, D. D. Retrospective analysis of lameness localisation in Western Performance Horses: A ten-year review. *Equine Veterinary Journal*, **53**(6), 1150-1158 (2021).. https://doi.org/10.1111/evj.13397.

22. Wattanapornpilom, T., Pornprasitroj, P., Thongsri, K., Iamprapai, S., Suan-Aoy, P. and Chanda, M. The Use of Confined Housing in Sand Bedding and Trimming to Manage Phalangeal Rotation and Hoof Malconfo rmation Over a 20-Week Period in Two Laminitic Stallions. *Journal of Equine Veterinary Science*, **116**,

104062(2022). https://doi.org/10.1016/j.jevs.2022.104062.

23. Ruet, A., Lemarchand, J., Parias, C., Mach, N., Moisan, M.P., Foury, A., Briant, C. and Lansade, L. Housing horses in individual boxes is a challenge with regard to welfare. *Animals*, **9**(9), 621(2019).. https://doi.org/10.3390/ani9090621.
24. McGowan, C. Welfare of aged horses. *Animals*, **1**(4), 366-376(2011). https://doi.org/10.3390/ani1040366.
25. van Weeren, P. R. and Back, W. Musculoskeletal disease in aged horses and its management. Veterinary Clinics: *Equine Practice*, **32**(2), 229-247 (2016).. https://doi.org/10.1016/j.cveq.2016.04.003.
26. Adams, S. 2014: "Lameness in Horses". The Merck Veterinary Manual Online. Merck Publishing Group. Retrieved 21 December 2014.
27. Reix, C. E., Dikshit, A. K., Hockenhull, J., Parker, R. M., Banerjee, A., Burn, C. C., Pritchard, J.C. and Whay, H. R. A two-year participatory intervention project with owners to reduce lameness and limb abnormalities in working horses in Jaipur, India. *PLoS One*, **10**(4), e0124342(2015).. https://doi.org/10.1371/journal.pone.0124342.
28. Alam, M. P., Bhuiyan, M. S. A. and Bhuiyan, A. K. F. H. Management, constraints and prospects of indigenous horse development in Bangladesh. *Veterinary Science Research Journal*, **8**, (1&2), 13-19 (2017).. http://dx.doi.org/10.15740/HAS/VSRJ/8.1and2/13-19.
29. Rahman, M. S., Bhattacharjee, P. K., Sarker, R. R., Parvin, M. S., Tasnin, S., Sarker, M. A. S., Neubauer, H., Khatun, F., Wares, M.A., Nishidate, I. and Elschner, M. C. Glanders in horses in some selected areas of Bangladesh and comparison between CFT and Immunoblot used for the screening of glanders. *Indian Journal of Animal Research*, **54**(5), 631-634 (2020).. http://dx.doi.org/10.18805/ijar.B-976.
30. Witherow, B. Advances in the understanding of laminitis and the role of nutrition in its management. *UK-Vet Equine*, **6**(1), 32-39(2022).. https://doi.org/10.12968/ukve.2022.6.1.32.
31. Etemadi, F., Tabatabaei Naeini, A. And Aminlari, M. Assessment of calcium, phosphorus, magnesium, vitamin D, and PTH levels in sera of lame horses. *Veterinary Medicine and Science*, **9**(5), 2070-2077 (2023).https://doi.org/10.1002/vms3.1198.