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Socio-economic Profile of Equine Owner, Morphometric Characterization and Reproductive Performance of Indigenous Horses in Bangladesh

Md. Shahinur Rahman, Mohammad Mahbubul, Asma Khatun, and Md. Younus Ali

ABSTRACT

***Background*: The socio-economic importance of horses plays a decisive role in the dynamism of rural economies in remote regions of developing countries such as Bangladesh. Horses are particularly suitable for transportation and recreation in these areas.**

***Methods*: The study was conducted from January to March 2023 in 200 randomly selected horse families concentrated in Sherpur, Jamalpur, Tangail, Sirajganj, Natore, and Noagoan districts of Bangladesh. After the necessary corrections and modifications, the final questionnaire was created based on the objectives of the study. The data were collected by respondents individually through personal interviews.**

***Results*: The average number of horses per family was 1.18, with 70% of them being transported and only 11.5% participating in horse races. The average peak and the poor seasonal income of the farmers were recorded as BDT (12,920-6,717). On average, 2 kg of concentrate feed per day is supplied to each horse with forages in the morning and afternoon depending on the situation. All farmers practiced natural mating, but they did not perform vaccination (100%). The indigenous horse's face color was observed as a star of 30%, and 45% non-specific, while the coat color was chestnut 38.5%, bay 41.5%, grey 8%, pseudo-Albino 3.5%, black 3.5%, brown 1% and bay roan 4%. The chest stocking color was observed as black 48%, white 33%, black and white 19%. The average body length, chest girth, neck length, ear length, and body weight in the research region were 119.86±0.17 cm, 126.28±0.19 cm, 37.87±0.14 cm, 15.78±0.12 cm, and 160.43±0.65 kg. The body length and body weight (p=0.000) differ significantly from region to region. Age at first service, service per conception (no.), gestation length, and foaling interval were 2.34±0.07 years, 1.21±0.06 years, 10.91±0.33 months and 1.00±0.03 years, respectively.**

***Conclusions*: Horses have enormous potential for livelihoods in rural areas, so it is important to preserve and improve horse genetic resources and ensure sustainable horse rearing in Bangladesh.**

Keywords: Indigenous horse, Morphometric traits, Reproduction.

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I. Introduction

Accessible natural resources determine a significant portion of the livelihood options of the rural population in developing countries [1]. It is believed that after dogs, sheep, goats, and cattle, horses were domesticated in about 3,000 BC. Through the ownership of animal assets, the creation of employment, production, income, and the ability to fulfill moral obligations, livestock can offer one or more means to leave poverty [2]. As the capacity of the agricultural sector to ensure food and livelihoods has increased, it is now common practice to diversify means of livelihoods, such as horseback riding [3]. Currently, most horse breeding is carried out for sports and leisure purposes [4]. However, horses are still used for agriculture and transportation in several regions of the world [5]–[8]. Equines are considered symbols of strength, speed, leadership, and success, and their contributions to history have been recognized appropriately. The use of horses is important in the tourism sector, especially for pilgrims from various regions of the world. Horses can endure up to 20% dehydration and are effective consumers of a low-quality and high-fiber diet [9]. In biomedical treatment, horses are also used to produce bioactive chemicals such as hormones, vaccines, toxins, and poisons [10]. Body morphology and shape also influence horse performance [11]. Morphometric measurements are used as standards to assess breed characteristics and body configuration. The performance and documentation of current genetic resources, including the description of phenotypical characteristics, are crucial management activities [12]. Furthermore, there is a clear correlation between the size of the population, the

capacity of the population, and genetic variations. The first step towards sustainable use of indigenous animal genetic resources is morphological characterization [13]. According to a previous study, Bangladeshi horse genetic resources are of an undefined indigenous type, although they have been genetically influenced by Arabian and Persian horses that have traveled across India from the West [14]. In some rural areas of Bangladesh, horses play an important role in providing draft power but meat and milk are not consumed. However, there is limited information on the socio-economic profile of horse owners, and the characteristics and morphological parameters of horses. Therefore, this study was conducted to evaluate the socio-economic status, morphology, phenotypic, and some of the productive and reproductive parameters of Bangladesh's indigenous horse genetic resources.

II. MATERIALS AND METHODS

A. Survey Area and Duration

The survey was conducted over a three-month period from January to March 2023 in 200 randomly selected horse families concentrated in Sherpur, Jamalpur, Tangail, Sirajganj, Natore, and Noagoan districts in Bangladesh (Fig. 1).

B. Data Gathering

Prior to collecting data, a draft questionnaire was prepared. After necessary corrections and changes, the final questionnaire was created according to the objectives of the study. The questionnaire was divided into various sections: farmers socio-economic situation, horse stockpiles, feeding and management, the prevalence of diseases, and constraints. The data were collected from respondents individually through personal interviews. Using the measurement taps, data on different morphological features such as body length, chest girth body weight, neck length, head length, head width, ear length, wither height, loin height, back height, height of hip, tail length, ears length to tail, croup length and croup height have been measured [15] (Table I).

C. Weight Measurement

The live body weight was calculated from the linear measures of the thoracic girth, barrel girth, and shoulder height using the following formula [16].

$$Y = SH \times TG \times BG \times 50$$

where
Y – Estimated Body Weight in kg;
SH – Shoulder Height,
TG – Horacic Girth,
BG – Barrel Girth.

D. Analysis of Statistics

Data were double-checked after collection, and then they were entered into a Microsoft Excel sheet for editing and coding in preparation for additional analysis. The mean with standard error, coefficient of variation, and percentage were calculated using tabular approaches. The SPSS version 16 software was then used to calculate the level of significance. Tukey test was performed to see the significant difference among the mean value.

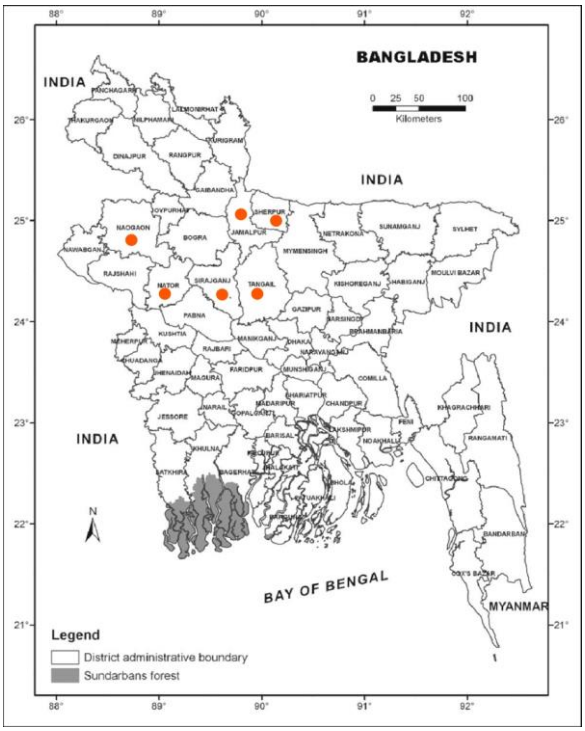

Fig. 1. Map of the study area (Sherpur, Jamalpur,Tangail, Sirajganj,Natore, Noagoan). Color in the map indicate study area.

TABLE I: DESCRIPTION OF QUANTITATIVE MEASUREMENTS

Parameters	Description
Head length	Distance from the back to the alveolar tip of the first incisor of the upper jaw
Head width	The distance between the upper sides of the eyes is measured perpendicular to the head length.
Ear length	Distance from the ear tip to the head connection point
Neck length	Distance from the ear tip to the head connection point
Body length	Distance between the pin bone's most caudal point and the shoulder joint's most cranial point
Height at wither	Distance from the highest point of the processus spinalis of the vertebra thoracic to the floor
Height at croup	Distance from the croup (rump) to the floor
Croup length	Distance between the sacral tuber (the highest point of croup) and ischiatic tuber
Height at back	Distance from the deepest point of the back to the floor
Chest girth	Distance from end of buckle to end of buckle
Loin height	Distance from the loin to the floor
Hip height	Distance from hip to the floor
Tail length	Distance from bottom of the tail bone to top of the tail
Length from ear to tail	Distance from bottom of the ear to bottom of the tail

III. RESULTS AND DISCUSSION

A. Socio-economic Status

Socio-economic profiles are the characteristics of a person or group of people by which they are known in society. Equine rearing is part and partial of the lifestyle of the farmers in the studies area. The age of the farmer ranged from 22-40 years. The main occupation of the farmers was farming (agriculture) whereas horse-rearing experience was recorded from 5-15 years in the survey area. The educational level of the farmers was illiterate 52.5% (105), literate 15.5% (31), primary 24% (48), and secondary 8% (16). The average

number of horses per family was found 1.18 and the average cultivable land was 1.87 acres. Only 11.5% (23) took part in the horse race whereas 88.5% (177) used the horse for different purposes except for race competition. Moreover, 70% (140) of farmers raised horses for transportation. The average peak and poor seasonal income of the farmer were recorded as BDT (12,920 and 6,717). For their keepers, equines provide both direct and indirect revenue. Horse is the main source of income for a poor family in Kashmir and S.S.C. (1%) was the greatest degree of literacy among horse keepers, and the majority of farmers (84.7%) could only sign their names [16]. The largest marketplace for the sale of horses is located in the Jamalpur district in Tulshipur Bazar. A mature stallion or mare price is between 30,000 and 80,000 TK. [17].

B. Feeding and Management

The horse's performance and energy supplies are greatly impacted by the feeding schedule. A semi-intensive technique is used by farmers in the study area to raise 100% (200) of the local horses, with the males being observed at 63.5% (127) and the females at 36.5% (73). However, according to the age groups of 1–5, 5–10, and 10 years and older, 60.5% (121), 19% (38), and 20.5% (41) horses were found in the study area. Two times every year, the hoof was clipped. The farmers were the ones who dewormed the horses, with 26.5% (53) of them doing it three times annually and the remaining 73.5% (147) doing it twice. Three to four hours each day were designated for grazing. On average, 2 kg concentrate feed is provided in a day to each horse that contains gram, wheat bran, rice polish, and maize crushed, etc. whereas the maize, napier, german, and roadside grass are also supplied in the morning and afternoon depending on the circumstances. Farmers (100%) practiced natural mating using horse from their own community but (100%) did not use vaccination. In terms of breeding and immunization in Bangladesh, [18] the same outcomes such as malnutrition, diarrhea, pneumonia, fever, myiasis, limb disorders, and abortion. The farmer sells their foal in the local market with the help of an agent and the selling age is 1 to 1.5 years. The major constraints were found in grazing land scarcity, feed price, and treatment facilities.

C. Phenotypic Characterization

The face color of the indigenous horse was observed as star 30% (60), strip 22% (44), patch 3% (6), and non-specific 45% (90). The ear direction was forward upward (100%). The coat color was found chestnut 38.5% (77), bay 41.5% (83), grey 8% (16), pseudo albino 3.5% (7), black 3.5% (7), chestnut roan 1% (2), and bay roan 4% (8). The KIT gene allele, which prevents the hair follicles from generating melanin, may be the cause of the variance in coat color [19]. The chest stocking color was observed as black 48% (96), white 33% (66), black and white 19% (38). The white sport on the body was noticed in 28% (56) and absent in 72% (144). In a prior study conducted on horses in Bangladesh [14], it was reported the coat color as bay, black, chestnut, bay cream, chestnut cream, pseudo albino, gray, bay roan, black roan, and chestnut roan.

D. Morphometric Measurement

For evaluating breed characteristics and body conformation, horse morphometric measurements are utilized as a benchmark. It is also essential for determining whether an animal will fulfill breed standards once it has finished growing and for keeping track of development at that time. Numerous studies [21]–[25] have examined how to evaluate the morphometric traits of different horse breeds. In this study, the majority of Bangladesh's horse-rearing regions were used to measure the horse's morphometric parameters. The means and standard errors (SE) of various morphometric measurements of male and female horses in several categories are presented in the appropriate Tables II–V.

TABLE II: OVERALL MORPHOMETRIC MEASUREMENTS OF INDIGENOUS HORSES AVAILABLE IN BANGLADESH

Parameters (cm)	Mean±S.E (200)	Max	Min	C.V (%)
Body length	119.86±0.17	126	115	2.16
Chest girth	126.28±0.19	132	120	2.16
Body weight (kg)	160.43±0.65	182	141	5.79
Neck length	37.87±0.14	44	35	5.39
Head length	40.33±0.13	45	37	4.77
Head width	21.96±0.13	26	18	8.71
Ear length	15.78±0.12	22	13	10.61
Wither height	114.0±0.16	120	110	2.09
Loin length	112.66±0.21	120	108	2.72
Back height	109.15±0.13	114	106	1.76
Hip height	99.80±0.14	105.5	95	2.11
Tail length	84.0±0.15	89	79	2.65
Length from ear to tail	153.35±0.16	159	148	1.56
Croup length	80.10±28.72	45	35	4.95
Croup height	113.37±0.17	121	109	2.13

The number in the parenthesis indicates the number of observations.

The overall morphometric measurements for indigenous horses are reported in Table II. The average body length, chest girth, neck length, head length, head width, ear length, wither height, loin length, back height, hip height, tail length, length from ear to tail, croup length, croup height, and body weight were found to be 119.86±0.17 cm, 126.28±0.19 cm, 37.87±0.14 cm, 40.33±0.13 cm, 21.96±0.13 cm, 15.78±0.12 cm, 114.0±0.16 cm, 112.66±0.21 cm, 109.15±0.13 cm, 99.80±0.14 cm, 84.0±0.15 cm, 153.35±0.16 cm, 80.10±28.72 cm, 113.37±0.17 cm and 160.43±0.65 kg, respectively in the studied area. Except for ear length, the morphometric measurements covered in this study had low coefficients of variation under 10%, indicating that the horse morphological traits were generally well-defined and these findings agreed with the previous study [26]. The minimum and maximum coefficients of variation were calculated for length from ear to tail (1.56%) and ear length (10.61%), respectively.

Table III demonstrated that all traits of male horses were greater and statistically different from those of female horses. Sex significantly affected the majority of the features of the Arab horse in Egypt [27]. Since juvenile growth is influenced by hormones, and since body size is a hereditary feature with high heritability, the relationship between sex and height is well documented [28]. However, non-genetic factors like sex, age, and horse management had an impact on body conformation measurements [29]. Males often perform better than females due to differences in anatomy, physiology, and the hormone system [30], [31]. The average body lengths of the stallion and mare were found to be 120.86±0 and 118.13±0.26 cm, respectively. Report [17] on the average body lengths of the stallion and mare in Bangladesh were 120.92±0.93 cm and 119.89±1.02 cm, which is almost similar to the present funding. In this context, [14] the average body length of adult male and female indigenous horses in

TABLE III: MORPHOMETRIC MEASUREMENTS OF INDIGENOUS HORSES ACCORDING TO SEX

Parameters (cm)	Mean±S.E Stallion (127)	Mean±S.E Mare (73)	P-value
Body length	120.86±0.20	118.13±0.26	0.00
Chest girth	126.75±0.24	125.49±0.31	0.00
Body weight (kg)	161.76±0.81	158.16±1.07	0.00
Neck length	38.44±0.17	36.86±0.22	0.00
Head length	40.99±0.15	39.22±0.20	0.00
Head width	22.41±0.16	21.17±0.21	0.00
Ear length	16.06±0.15	15.36±0.19	0.00
Wither height	114.70±0.20	112.85±0.26	0.00
Loin length	113.38±0.26	111.53±0.35	0.00
Back height	109.54±0.17	108.53±0.22	0.00
Hip height	100.61±0.16	98.45±0.21	0.00
Tail length	84.44±0.19	83.30±0.25	0.00
Length from ear to tail	153.91±0.20	152.36±0.27	0.00
Croup length	40.26±0.17	38.95±0.22	0.00
Croup height	114.13±0.20	112.11±0.26	0.00

Number in the parenthesis indicates the number of observations.

Bangladesh was 113.58±1.26 cm and 107.95±10.08 cm, which is relatively lower than the findings of the present study. The body weights of male and female horses were 161.76±0.81 kg and 158.16±1.07 kg, respectively which is comparable with the previous result [32]. The average chest girth of males and females were 126.75±0.24 cm and 125.49±0.31 cm which had a significant difference. The chest circumference of Marwari and Kathiawari in India [33] was 169.21±0.54 cm and 165.20±0.77 cm, respectively. This value is 33–40 cm greater than the findings of the present study. The neck length of the stallion and mare was found to be 38.44±0.17 cm and 36.86±0.22 cm, respectively. The average neck lengths of stallions and mares of the Abyssinian breed were reported to be 64.30±.40 cm and 62.20±0.50 cm in Ethiopia [15], which is longer than the current study. Horse average head lengths were measured at 40.99±0.15 cm for males and 39.22±0.20 cm for females, respectively. According to [34], the average head lengths of stallions and mares of the Indonesian horse breeds were 47.74±3.43 cm and 48.61±3.60 cm, respectively. This is also 7-9 cm longer than the statistics currently available. Male and female horses were measured to have head widths of 22.41±0.16 cm and 21.17±0.21 cm, respectively, whereas Marwari and Kathiawari horses were measured to have head widths of 21.07±0.09 cm and 21.41±0.08 cm, respectively [33] which is consistent with the present findings. The data were used to compute the withers' heights, which are equivalent to the other findings [14] at 114.70±0.20 cm and 112.85±0.26 cm. Hip height measurements for the stallion and mare were recorded at 100.61±0.16 cm and 98.45±0.21 cm, respectively. Estimates of [35] the average hip height of horses to be 139.33 cm, which is higher than the findings of the present study. Regarding croup height, [33] Marwari and Kathiawari had croup heights that were, 152.91±0.31 cm and 146.78±0.47 cm respectively, which is 35–38 cm greater than the current study. Genotype variability, breed differences, body conformation, and other genetic factors may be the main causes of these variations. While another study [36] reported that the average croup lengths of Konik and Hucul horses were 45 and 43.6 cm, the average value of croup length was measured at 40.26±0.17 cm and 38.95±0.22 cm, which is nearly identical to the results of the current study. The average ear length, loin length, back height, tail length, and length from ear to tail, of stallion and mare were found to be 16.06±0.15 cm; 15.36±0.19 cm; 113.38±0.26 cm; 111.53±0.35 cm, 109.54±0.17 cm; 108.53±0.22 cm; 84.44±0.19 cm; 83.30±0.25 cm; 153.91±0.20 cm; 152.36±0.27 cm; respectively those are almost similar to other results [32].

Table IV displays how the horse's morphometric data were affected by location. It was found that location had a considerable impact on the majority of the morphometric data. It may be due to the availability of grazing land, the plane of nutrition, variation in management, environmental conditions, and other factors. In comparison to the other districts, the horses from Sherpur, Jamalpur, and Sirajganj generally had a much greater morphometric value. The farmers in the Sherpur, Jamalpur, and Sirajganj districts used horses professionally for both transportation needs and agricultural needs. This was due to the fact that they offer better husbandry techniques, provide the proper amount of nutrients, and ensure good health care with a focus on horse rearing. The majority of horse owners, unlike Tangail, Natore, and Noagoan, use their animals for their personal purposes which is why they do not care for them as much. The highest and lowest recorded body lengths were found in the districts of Sherpur (121.02±0.47 cm) and Noagoan (118.66±0.41 cm), while Jamalpur & Sirajganj and Tangail & Natore had practically comparable findings. The results for body weight and chest girth were most equivalent in the districts of Sherpur, Jamalpur, and Sirajganj, while they were least similar in Tangail, Natore, and Noagoan. It was found that location significantly affected the results for the body length, chest girth, body weight, ear length, wither height, loin length, croup length, and length from ear to tail. The highest neck length (38.00±0.43 cm), head length (40.58±0.36 cm), hip height (100.16±0.35 cm), head width (22.36±0.31 cm), and tail length (84.71±0.54 cm) were recorded in Noagoan, Sherpur, Jamalpur, and Tangail districts, respectively. The districts of Sirajganj (16.51±0.28 cm) and Noagoan (15.12±0.27 cm) had the highest and lowest ear lengths, respectively, whereas Sherpur, Jamalpur, and Tangail had findings that were quite similar. In Sirajganj district (114.96±0.30 cm) & (114.08±0.42 cm) were found to have the highest results for wither height and loin length. The back height, length from ear to tail, croup length, and croup height in Sirajganj districts recorded the highest results (109.66±0.28 cm, 154.19±0.42 cm, 40.54±0.31 cm, and 114.25±0.42 cm), while Sherpur, Jamalpur, and Tangail were reported to have results that were quite similar.

Age had an impact on the morphometric measurements of indigenous horses in Bangladesh, as shown in Table V. Age has no discernible effect on any of the metrics, with the exception of neck and head length. The body length, chest girth, body weight, and head breadth varied with age group but did not differ substantially; the 5 to 10-year-old age group had the highest values for body length, chest girth, and body weight – 121.07±0.38 cm, (128.39±0.36 cm, and 166.96±1.02 kg, respectively. In Marwar horses [32] the average body weight at one, two, and three years of age in India was 173.7 kg, 294.5 kg, and 319.4 kg, and that of Kathiawari horses was 164 kg, 281.4 kg, and 301.4 kg, respectively. The main causes of these variations in body weight in horses include variances in breed, age, sex, and

TABLE IV: MORPHOMETRIC MEASUREMENT OF INDIGENOUS HORSES ACCORDING TO STUDY AREA

Parameter (cm)	Sherpur (31)	Jamalpur (40)	Tangail (24)	Sirajganj (40)	Natore (40)	Naogoan (25)	P-value
Body length	121.02^{a} ±0.47	120.8^{a} ±0.38	118.71^{c} ±0.38	120.51^{ab} ±0.44	118.82^{bc} ±0.3	118.66^{c} ±0.41	0.00
Chest girth	127.79^{a} ±0.41	127.49^{a} ±0.41	124.6^{b} ±0.44	127.66^{a} ±0.36	124.64^{b} ±0.37	124.6^{b} ±0.39	0.00
Body weight (kg)	164.87^{a} ±1.66	164.89^{a} ±1.32	155.23^{b} ±1.46	164.56^{a} ±1.06	155.39^{b} ±1.34	160.45^{b} ±1.57	0.00
Neck length	37.84 ±0.38	37.89 ±0.31	37.85 ±0.48	37.71 ±0.28	37.92 ±0.35	38.00 ±0.43	0.99
Head length	40.58 ±0.36	40.23 ±0.31	40.44 ±0.40	40.43 ±0.24	40.33 ±0.33	40.04 ±0.42	0.92
Head width	22.08 ±0.34	22.36 ±0.31	21.85 ±0.42	22.36 ±0.31	21.41 ±0.28	21.48 ±0.31	0.12
Ear length	16.24^{ab} ±0.37	15.78^{ab} ±0.22	15.65^{ab} ±0.32	16.51^{a} ±0.28	15.31^{b} ±0.24	15.12^{b} ±0.27	0.00
Wither height	114.76^{ab} ±0.44	114.36^{abc} ±0.3	112.85^{c} ±0.47	114.96^{a} ±0.30	113.28^{bc} ±0.3	113.38^{abc} ±0.4	0.00
Loin length	113.37^{ab} ±0.67	113.42^{ab} ±0.45	111.58^{b} ±0.55	114.08^{a} ±0.42	111.41^{b} ±0.43	111.66^{ab} ±0.54	0.00
Back height	109.11^{ab} ±0.34	109.49^{ab} ±0.31	109.00^{ab} ±0.38	109.66^{a} ±0.28	109.10^{ab} ±0.3	108.24^{b} ±0.39	0.07
Hip height	100.16 ±0.35	100.09 ±0.37	99.58 ±0.53	100.06 ±0.27	99.54 ±0.35	99.26 ±0.36	0.44
Tail length	84.02 ±0.41	83.89 ±0.35	84.71 ±0.54	83.58 ±0.32	84.40 ±0.34	83.70 ±0.43	0.33
Croup length	40.18^{ab} ±0.36	40.00^{ab} ±0.26	39.13^{b} ±0.44	40.54^{a} ±0.31	39.15^{b} ±0.30	39.34^{ab} ±0.37	0.00
Croup height	113.68^{ab} ±0.50	113.39^{ab} ±0.33	112.77^{ab} ±0.42	114.25^{a} ±0.42	113.22^{ab} ±0.3	112.52^{b} ±0.40	0.06
Length from ear to tail	153.52^{ab} ±0.42	153.96^{ab} ±0.37	152.85^{ab} ±0.44	154.19^{a} ±0.42	152.50^{b} ±0.34	152.60^{ab} ±0.43	0.00

TABLE V: MORPHOMETRIC MEASUREMENT OF INDIGENOUS HORSES ACCORDING TO AGE GROUPS

Parameter (cm)	1-5 years (121)	5-10 years (38)	10 years above (41)	P-value
Body length	119.24^{b}±0.23	121.07^{a}±0.38	120.57^{a}±0.38	0.00
Chest girth	124.98^{b}±0.20	128.39^{a}±0.36	128.23^{a}±0.27	0.00
Body weight (kg)	156.39^{b}±0.80	166.96^{a}±1.02	166.37^{a}±0.86	0.00
Neck length	38.07±0.19	37.51±0.29	37.57±0.29	0.20
Head length	40.29±0.18	40.11±0.27	40.73±0.26	0.30
Head width	21.43^{b}±0.15	22.88^{a}±0.30	22.66^{a}±0.30	0.00
Ear length	15.21^{c}±0.10	16.24^{b}±0.17	17.16^{a}±0.37	0.00
Wither height	112.82^{b}±0.16	115.76^{a}±0.33	115.95^{a}±0.27	0.00
Loin length	110.76^{b}±0.14	115.59^{a}±0.39	115.74^{a}±0.33	0.00
Back height	108.71^{b}±0.15	108.78^{b}±0.31	110.90^{a}±0.25	0.00
Hip height	98.91^{b}±0.14	101.38^{a}±0.35	101.06^{a}±0.27	0.00
Tail length	84.60^{a}±0.19	82.39^{b}±0.22	83.84^{a}±0.37	0.00
Croup length	152.33^{c}±0.117	155.41^{b}±0.28	154.40^{a}±0.39	0.00
Croup height	39.02^{b}±0.15	40.62^{a}±0.31	41.22^{a}±0.22	0.00
Length from ear to tail	112.95^{b}±0.19	113.16^{b}±0.34	114.89^{a}±0.46	0.00

nutritional status. Different age groups showed a considerable difference in the length of the neck and the head. The age groups 1 to 5 years and over 10 years were found to have the longest necks (38.07±0.19 cm) and heads (40.73±0.26 cm). Age-related increases in ear length, wither height, loin height, back height, hip height, croup length, and croup height were recorded, with the 5–10 years & above 10 years age groups showing nearly identical results. It was observed that the average tail length and the distance from the ear to the tail varied with age groups. The age groups of 1 to 5 and 5 to 10 years had the longest tail lengths (84.60±0.19 cm) and lengths from ear to tail (155.41±0.28 cm). Sex had a significant effect on the body measurements of horses [37]. Despite a noticeable increase from one to two years old, research [21] indicated that the different body dimensions of Thoroughbred horses were comparable at two and three years old. In comparison to the mares, stallions seem to mature later [38].

Reproductive features are important for species survival in nature as well as for the survival of the livestock sector since they have a big impact on the financial success of breeders and farms [39]. The average age at first heat in the current study was 2.34±0.07 years. Age at first heat was 12.±3 months in Lusitano native thoroughbreds, [40] which are significantly younger than the results of the current study. The age of first heat in Arabian horses was determined to be a 1301±40 day [41] which is greater than the age, found in the current study and may be influenced by the breed and other non-genetic factors. The indigenous horse foaling interval was calculated to be 1.00±0.03 years. In Brazil [42] had a foaling interval of 490 days, which is longer than the duration of the current outcome. The indigenous horses in Bangladesh [32] had an average foaling interval of 1.16±0.01 years, which is comparable to the current findings. Gestational length (GL) is a physiological trait with economic importance in the majority of domestic species [43]. While GL shorter than 320 days is commonly classified as short and has a higher chance of generating a preterm, frequently underdeveloped foal, GL more than 365 days is termed extended [44]. It was found that the typical gestation period was 10.91±0.33 months. According to previous study [33] the gestation periods of Marwari and Kathiawari horses in India were 338.3±3 days, 334±5 days (in the field), and 331±1.9

TABLE VI: REPRODUCTIVE PERFORMANCE OF HORSES AVAILABLE IN BANGLADESH

Parameters	Mean±S.E (73)
Age at first heat (year)	2.34±0.07
Service per conception (no.)	1.21±0.06
Gestation length (months)	10.91±0.33
Foaling interval (year)	1.00±0.03

Number in the parenthesis indicates the number of observations.

days (on the farm), respectively. The average gestation length was recorded at 11.44±0.09 months [32] which supported the present study. The genotype of the fetus, the mother's size, and the time of the breeding season when conception takes place all affect a mare's gestation period [45]. The length of the pregnancy may be influenced by a variety of maternal characteristics, including maternal age, the number of births, and maternal nutrition, as well as fetal and environmental factors, including location, birth year, birth month, and weather [46]. In a foal, the average service per conception was 1.21±0.06 whereas in Indian Kathiawari mare, a far higher service per conception (1.97±0.13) was reported [33].

E. Prospect of Horse Rearing

Horse manure has reportedly aided the agricultural and forestry land in the Indian states of Kasmir and Jammu. A mature horse produces approximately 10 t of farm waste annually [47]. Simple management, adaptability, cost-effectiveness, disease tolerance, and a respectable income are signs that horse rearing may be feasible [18]. Fuel prices are rising drastically on the global market right now as a result of the crisis between Russia and Ukraine. As a result, the usage of horses is growing in several parts of the world. Long-term fuel costs can be decreased, nevertheless, if the usage of horses is maintained. A large rise in the number of urban employees migrating from motorized vehicles to equine power carts is also being observed in various nations, including Pakistan and India [48].

IV. CONCLUSIONS

A greater understanding of the socioeconomic circumstances of horse owners, horse management, morphometric characterization, and reproductive efficiency of indigenous horses was made possible by this study. Horses are a significant source of income for horse owners in various geographic regions of Bangladesh. Therefore, to preserve and improve the indigenous horse genetic resources, the government, academic and research institutions, several national and international NGOs and private companies must step forward.

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CONFLICT OF INTEREST

The authors declare no conflict of interest.

APPENDIX

Fig. 2. Uses of horse in the rural area for transportation.

Fig. 3. Phenotypic variation of indigenous horse.

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