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RESEARCH ARTICLE

PHENOTYPIC AND MORPHOMETRIC CHARACTERIZATION OF CAMELS UNDER FARM CONDITION IN BANGLADESH

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ABSTRACT

Camels are considered as a component in arid as well as semi-arid regions where they contribute to combat desertification and attaining food security. To evaluate the phenotypic and morphometric characteristics of camels in Bangladesh, a one-week survey was carried out at Babe Madina camel farm in Dhaka. A well-defined questionnaire focused on survey goals was used to gather data through direct interviews. Brown coat color (41.67%) with medium hair length (50%) and flat face (83.33%) was prominent. The average body weight, body length, hump length, and width, length of fore limb, and length of hind limb were 431.69±20.51 kg, 159.09±2.61 cm, 55.5±1.5 cm, 29.23±0.82 cm, 145.36±1.44 cm and 151.05±1.29 cm, respectively. Morphometric parameters were higher in males compared to females though the sex effect was statistically non-significant except length of fore limb (p=0.18). To sum up, this data will provide important context and information for the breeding and selection processes designed to ensure the long-term viability of camel farming in Bangladesh.

KEYWORDS

Camel, Phenotype, Morphometry, Bangladesh

1. INTRODUCTION

Camel is a widely recognized animal throughout the world and is the most capable animal in utilizing marginal areas because they can survive under harsh environmental conditions (Yosef et al., 2014). Camel has some special attributes; utilizing poor quality roughages with better efficiency (Rollefson, 2005), reutilization of urea in kidneys for microbial protein synthesis (Schwartz et al., 1992), fluctuate body temperature to reduce sweating can digest dry matter and crude fiber better (Faraz, 2020). Compared to "conventional" domestic livestock species, camels are better suited to survive in regions with adverse climates (Wilson, 2017). The one humped camel (Camelus dromedarius) is uniquely adapted domestic animal in arid and semiarid environment (Fazal et al., 2017). Though Bangladesh is not native to camels, there is some one-humped camel in this country. In Bangladesh, the temperature has been gradually rising over the past few years due to the effects of global warming, and has recently recorded temperatures of exceeding 42°C. The average temperature is 0.5°C rise in Bangladesh from 1976 to 2019. In general, summers are getting longer, winters are getting warmer, and the monsoon is becoming more unpredictable than usual (World Bank, 2021). As a result, the productivity of local animals will decreased as temperatures rise, but camel farming will become viable because they are animals in hot and humid climates. In the face of climate change, camels are expected to become the most important domestic livestock in terms of food security in many countries. On the other hand, day by day, the demand for camel milk is increasing among people as well as the price of milk is high. The milk price varies from 400-500 tk per liter. As a Muslim majority country, there is no ethical dilemma with consuming camel meat. Particularly during Eid-ul-Azha, camel is in high demand in the Bangladeshi market. In recent years, people have been more interested in eating camel meat, and prices are rising steadily. The current retail price per kilogram ranges from 900 to 1200 tk. However, camel has a lot of potential and in the upcoming year camel farming will be very promising in Bangladesh. Assessing the extent and structure of phenotypic variation in camel populations is important to document available gene pools to initiate rigorous breeding programs to generate best-suited stock for various tasks (Alhajeri et al., 2021). There is no information concerning the morphological and phenotypic traits of camel in Bangladesh. Therefore, the study was carried out to evaluate the phenotypic and morphometric characteristics of camel in Bangladesh.

2. MATERIALS AND METHODS

2.1 Location and Duration of The Study

The study was carried out in Babe Madina camel farm at North Kamalapur, Kamalapur (latitude and longitude, 23°44'1.29"N, 90°25'33.85"E) in Dhaka, capital city of Bangladesh. The experiment lasted a week from 20th to 26th June, 2023.

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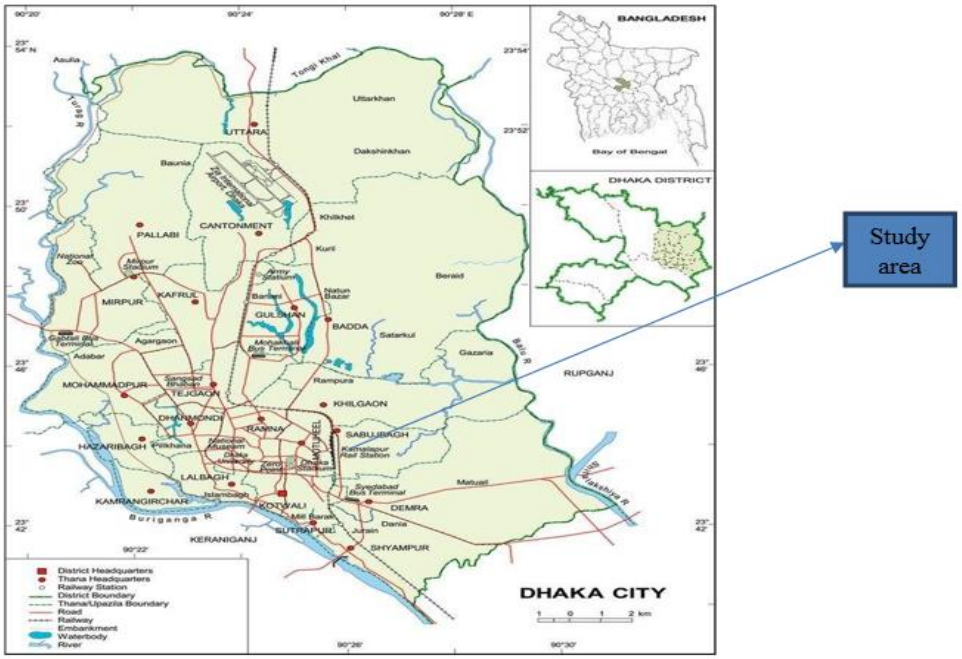

Figure: Kamalapur, Dhaka, Bangladesh

2.2 Data Collection

Before the collection of data, a draft questionnaire was prepared to focus on the study objectives. After, all the required corrections, the final questionnaire was prepared. The questionnaire was divided into two sections including phenotypic and morphometric parameters. Data were gathered from 12 camels, six of which were male and six female. The phenotypic characteristics including body color, color pattern, hair length, face profile, rump profile, hump size, hump orientation, hump location, ear size, ear orientation, udder size, teat size, tail length and tail base were listed with closer eye vision. Different morphometric characteristics such as head length, body length, height at shoulder, chest girth, barrel girth, neck length, hump length, hump width, ear length, ear width, distance between eyes, distance between ears, length of forelimb, length of hind limb and tail length were taken using measuring tape (Legesse et al, 2018; Ehsaninia et al, 2020).

Table 1: Details of collected different morphometric characteristics

Parameters	Description
Head length	Horizontal distance from point of shoulder to pin bone
Body length	Distance between the occipital and the line between the forehead and the nose
Shoulder height	The height (vertical) from the bottom of the front foot to the tip of the scapula
Chest girth	Around the body just behind the sternal pad
Barrel girth	Around the abdomen over the midpoint of the hump
Neck length	Distance from lower part of mandible to sternum
Neck girth	Perimeter of the middle of the neck
Hump length	The distance from the bottom to the tip of the hump
Hump width	The distance between the sides of the hump in the middle of the hump
Ear length	The distance between the beginning or the lower ear to the tip of the ear
Ear width	The distance between the inner edge and the outer edge of the ear from the back (back) of the ear
Distance between eyes	Distance between the most medial part of each eye
Distance between ears	Distance between upper part of each ear
Length of fore limb	Distance from surface of the ground level to front of sternum
Length of hind limb	Distance from bottom of leg to pin hip bone
Tail length	Maximum distance from tail base to tip of tail

Figure 2: One hump camel in Bangladesh

2.3 Weight measurement

The following formula, as described was used to estimate the live body weight from linear measurements of the thoracic girth, barrel girth, and shoulder height by (Younan et al., 2012).

Y= SH × TG × BG × 50

Where:

Y: estimated body weight in kg.

SH: shoulder height in meters.

TG: thoracic girth in meters.

BG: barrel girth in meters.

2.4 Statistical analysis

Data were checked again after collection, and then put into a Microsoft Excel sheet where editing and coding were done in preparation for additional analysis. The mean as well as the standard error were calculated using tabular methods. The SPSS version 16 computer application was then used to calculate the level of significance.

3. Results and Discussion

3.1 Phenotypic characterization

Skin color has a detectable influence on the zootechnical performance of camels (Amine et al, 2013). The body color was found to be brown 41.67%, brown and white 25%, brown and red 8.33%, dark & white 16.67%, and dark & brown 8.33%. The coat color of Steppe camels was dark brown 83.64%, brown 1.82%, red 14.55% and Shaharan camels were dark brown 1.67%, brown 98.33% reported by (Meghelli et al., 2020). The body color was 41.67% (5) uniformly and 58.33% (7) un-uniformly distributed. The hair length was medium 50% (6), short 33.33% (4) and long 15.67% (2). The face was observed flat 83.33% (10) and convex 16.67% (2). The rump was found roomy 8.33% (1), flat 16.67% (2) and slopping 75% (9). The reported hump size was large 50% (6), medium 25% (3) and small 25% (3). The hump orientation was seen erect 66.67% (8) and bent sideways 33.33% (4). The hump was located middle 50% (6) and middle to the back 50% (6). The ear size was reported to be large 16.67% (20), medium 75% (9) and 8.33% (1). The ear orientation was observed erect 58.33% (7) and erect & forward 41.67% (5). Similar results were found for udder and teat size which were medium 33.33% (2) and rudimentary 66.67% (4). The length of the tail was noted long 41.5% (5), medium 50% (6) and short 8.33%. In the populations under study, the tail base was 41.67% (5) thin and 58.33% (7) thick. The described various phenotypic characteristics of Sudanese camels that are comparable to the current findings (Ishag et al., 2011). The present study was also in accordance with experiment in Nigeria (Tandoh et al., 2018).

3.2 Morphometric characterization

Descriptive statistics for morphological characterization and body measurement of one hump camel are summarized in Table 2. The body weight of Issa-Somali camels found by Abebe et al. (2002) was 425.9 kg, which is equivalent to the current data. The body length was found 159.09±2.61 cm. reported that the body length of an adult (5-10 years) bactrian (Camelus Bactrian) camel was 62.5±1.60 inch which is identical to the current experiment (Lamo et al., 2020). The average head length was 49.14±1.33 cm. According to a study, the average head length of 12 ecotypes of camels in Saudi Arabia ranges from 39.3 to 48.1 cm (Abdallah and Faye, 2012) which supports the present findings. The ear length and width were 14.59±0.44 cm and 9.18±0.61cm which are almost similar to the results of Iranian native camels reported by (Ehsaninia et al., 2020). Distance between eyes and distance between ears of our study was similar with Meghelli et al (2020) report on Algerian camel where these traits were 22.23±0.63 cm, and 19.73±0.54 cm respectively. In contrary, measured distance between eyes in four Arabian camel breed and observed 26.10±0.40 cm, 24.70±0.15 cm, 24.50±0.21 cm and 24.40±0.23 cm in Meghem, Sawahli, Gamra and Awadi breed respectively (Al-Hazmi et al., 1994). Overall mean neck length (94.05±1.23 cm) of this experiment was supported by Al-Hazmi et al. (1994) who stated 97.80±2.56 cm and 97.80±1.93 cm in Awadi and Gamra breed of Arabian camel. According, measurement on neck girth was much lower (60.98±0.858 cm) compared to present study (Meghelli et al., 2020). The present study measured hump length and hump width was close to result of Ehsaninia et al. (2020) who reported 58.48±2.29 cm and 26.07±2.19 cm, respectively in Pakistani camels. Mean chest girth was almost similar (186.33±1.60 cm) with Pakistani camels (Ehsaninia et al., 2020). Average barrel girth of Sudanese camel (245.00± 0.02) reported by Ishag et al. (2011) was in agreement with current study findings. The average height at shoulder was comparatively lower (190.00±0.01 cm) than Sudanese camels (Ishag et al., 2011). The average length of fore limb and length of hind limb of camels were measured 145.36±1.44 cm and 151.05±1.29 cm respectively. It has reported that the length of hind limb of Ethiopian camels was 155.88 cm which supports present result (Yoseph and Legesse, 2018). In case of Sindhi camel, Prakash et al. (2022) found average tail length 57.85±0.47 cm which a bit higher than this study findings. The morphometric measurements were achieved in both male and female camels and reported separately (Table 3). All morphometric characteristics of male camels were found to be higher than females. It also demonstrated that male and female camels did not differ greatly from one another. The male camel is frequently taller and heavier than the female, according to (Mehari et al., 2007), which is a highly obvious sexual dimorphism in camels. The greater values of the traits that were measured in male camels may be due to physiological causes and activities that differ between the sexes. Also reported the existence of sexual dimorphism in Jigjiga camels (Yohannes et al., 2007). The body weight was calculated 444.96±33.73 vs 420.64±27.02 kg which was higher compared to Algerian camel (267.69±5.732 vs 248.35±3.787 kg) and Ibtissam et al. (2023) (330.12 vs 261.41 kg) reported by (Meghelli et al., 2020). Body length in present study was similar with dromedary camel in Algeria (163.83 cm vs 153.31 cm) reported by Ibtissam et al. (2023).

Table 2: Overall morphometric characteristics of camels in Bangladesh

Parameters (cm)	Mean±SE
Body weight (kg)	431.69±20.51
Body length	159.09±2.61
Head length	49.14±1.33
Ear length	14.59±0.44
Ear width	9.18±0.61
Distance between eyes	22.23±0.63
Distance between ears	19.73±0.54
Neck length	94.05±1.23
Neck girth	63.01±1.42
Hump length	55.5±1.5
Hump width	29.23±0.82
Chest girth	188.18±2.65
Barrel girth	254.72±6.21
Height at shoulder	178.77±2.26
Length of fore limb	145.36±1.44
Length of hind limb	151.05±1.29
Tail length	51.55±0.97

Much lower body length was observed in male (152.4±3.1 cm) and female (129.5±2.0 cm) in adult double humped Ladekh camel (Makhdoomi et al., 2013). Almost similar head length in both sexes (52.66 cm vs 51.29 cm) was stated by Ibtissam et al. (2023) in Algerian camel. The current study result was in arrangement with Legesse et al. (2018) who reported 13.38 cm ear length in male and 13.36 cm in female for Ethiopian camel. Similar Neck length of 94.0±4.02 cm in male and 91.4±4.07 cm in female double hump camel was reported by Makhdoomi et al (2013). Another study conducted by Elbashir et al. (2011) in Sudan, demonstrated higher (116.7±1.2 cm vs 120.3±1.1 cm) neck length compared to present study. Our study findings were in accordance with the result of Elbashir et al. (2011) who found 182.4±1.0 cm height at wither in male and 178.9±0.9 cm in female camel. Similar observation (182.52 cm vs 173.12 cm) was also stated by (Ibtissam et al., 2023). The current study findings of height of shoulder are supported by Tandoh et al. (2018) who stated 172.8±2.12 to 179.3 ± 3.50 in male and 162.33±12.14 cm to 172.87±2.74 cm in female camel. Chest girth varied significantly and result from Ibtissam et al. (2013) study showed 183.10 cm in male and 165.73 cm in female which are inferior to present findings. In an experiment with Sudanese camel, findings was in consistence with our study where they found 245±0.02 cm and 245±0.02 cm barrel girth in male and female, respectively (Ishag et al., 2011). Almost similar result for this trait was also reported by (Legesse et al., 2018). Comparatively higher distance between eyes of camel than ours was stated who found 27.25 cm in male and 27.21 cm in female by

(Legesse et al., 2018). A much lower (15.2±2.0 cm vs 12.7±0.1cm) distance between ears was observed in double humped camel at Ladakh, India by (Makhdoomi et al., 2013). Has a found length of fore limb 153.34±1.22 cm in male and 145.32±.54 cm in female that was close to our findings (Bekele et al., 2018). Present study length of hind limb was comparable with Makhdoomi et al. (2013) who stated 152.4±3.1 cm in male and 175.3±2.3 cm in female double hump camel. Ibtissam et al. (2023) found much higher (67.46 cm vs 62.57 cm) tail length than present study. In contrary, observed 51.65±1.683 cm in male and 55.06±1.113 cm in female camel (Meghelli et al., 2020).

Table 3: Sexual difference of morphometric characteristics of camels

Parameters (cm)	Male (Mean±SE)	Female (Mean±SE)	P-value
Body weight (kg)	444.96±33.73	420.64±27.02	0.582
Body length	161±3.05	157.5±4.21	0.534
Head length	51.2±1.43	47.41±1.95	0.168
Ear length	15.3±0.66	14±0.52	0.151
Ear width	9.6±0.51	8.83±1.07	0.561
Hump length	58±1.92	53.42±1.97	0.134
Hump width	30.5±1.02	28.17±1.14	0.169
Neck length	94.2±2.39	93.93±1.32	0.916
Neck girth	64±1.82	62.33±2.22	0.586
Height at shoulder	180.1±3.93	177.67±2.82	0.618
Chest girth	190.2±4.62	186.5±3.20	0.516
Barrel girth	257.6±9.48	252.33±8.76	0.695
Distance between eyes	22.8±1.07	21.75±0.78	0.436
Distance between ears	20.2±0.86	19.33±0.72	0.454
Length of fore limb	148.8±1.24	142.5±1.71	0.018
Length of hind limb	151.7±1.22	150.5±2.23	0.668
Tail length	52.8±0.8	50.5±1.59	0.257

4. Conclusion

For the improvement of genetic makeup, proper identification and characterization of morphometric character is of paramount importance. The current morphometric study description could be the first step in establishing a standard of one hump camel in Bangladesh. At the same time, the basic phenotypic and morphometric information generated from this study may be used for breeding and selection purposes to achieve sustainable camel farming in Bangladesh.

Conflict of Interest

The authors declare that there is no conflict of interests.

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