Morphological identification of buffaloes in the coastal region of Bangladesh

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Abstract

Context: In morphological study, three forms of buffaloes in the coastal region of Bangladesh like Surti type, Nili-Ravi type and Crossed/Mixed type were determined.

Materials and Methods: The study was conducted to identify the buffaloes in the coastal region of Bangladesh. The questionnaire was prepared and data/information was collected within December/2017 to March/2018 in door to door interviewing method by randomly selected of 100 households' buffalo farmers from each of Barishal, Patuakhali and Bhola districts. After completion of collecting data/information was tabulated, processed and recorded in computer Microsoft Excel sheet and finally it was analyzed for results.

Results: In study areas observed 78, 14, 6 and 2% farmers were occupied in agriculture, business, service and labor, respectively. Maximum farmers were uneducated (73%), and 12, 10 and 5% having the primary, high school and SSC or more level of education, respectively. Moreover 56, 28 and 16% farmers' families were small, medium and large, respectively, and on the basis of land size 37, 35 and 28% of them were large (>1.0 acres), marginal (<0.2 acres) and medium (0.2-1.0 acres), respectively. It was revealed that the buffaloes at study areas having similarities in some of the phenotypic characteristics of typical Surti and Nili-Ravi breeds of Indian water buffaloes and believed to be bred themselves with indigenous ones forming three different types like Surti type, Nili-Ravi type and Crossed/Mixed type were of 40, 18 and 42%, respectively. The mean weight of matured male observed 347.9±2.70 kg in Bhola was distinctly ($p<0.01$)heavierto 339.4±3.58 and 312.70±3.64 kg in Patuakhali and Barishal, respectively. Similarly, the mean matured weight of female found to be 260.7±2.46 kg in Bhola was also significantly ($p<0.01$) differed over 243.4±2.30 and 238.20±2.24 kg in Patuakhali and Barishal, respectively. The buffalo cows in Bhola produced averaging 2.42±0.062 litters of milk per day was distinctly ($p<0.05$) higher than those produced 2.27±0.060 and 2.21±0.059 litters milk daily in Patuakhali and Barishal district, respectively. The heaviest weight for male and female along with higher milk producing abilities of buffaloes in Bhola district was for favorable environment in Bhola than other two districts in respect of both management and feeding aspects.

Conclusion: Three forms of buffaloes found in coastal region were Surti type, Nili-Ravi type and Crossed/Mixed type thought to be derived from Surti and Nili-Ravi breed mixing with indigenous buffaloes in these areas.

Key words: Breed, Buffalo, Coastal, Family, Farmer, Household, Milk, and Type.

Introduction

Buffaloes are members of bovine animals classified into two main species (Chantalakhana and Bunyavejchewin, 1994). These are African wild buffaloes (*Syncerus*) and Asian buffaloes (*Bubalusbubalis*), which is the most domesticated (Abd El-Salam and El-Shibiny, 2011). Asian buffaloes are further classified in to river and swamp buffalo sub species (Perera, 2008). River buffaloes are often called water buffaloes and have high lactation yields than swamp buffaloes. The domestic or water buffalo (*Bubalusbubalis*) is descended from the *arni*or wild Indian buffalo, and is widely dispersed throughout the southern Asia.It has been suggested that buffaloes were in the service of man as early as 2,500 to 2,100 B.C. Presently, there are 72 buffalo breeds in the world, where as 57 are in Asia (Hamid *et al*., 2016). In India, there are 20 buffalo breeds, most popular of which are the Murrah and Nili-Ravi, noted for their high milk production performance (Singh, 2013). The buffalo populations of all the member states of South Asian Association of Regional Cooperation (SAARC) combined together with approximately of 1.61 billion (SAARC, 2012). India is the highest buffalo populated country in the world comprising 112.91 million buffalo (58.11% of the world). India is the world's top most milk producing country in the world where buffalo forms the backbone of India's dairy industry which share 67.99% of world's buffalo milk production (Chakravarty, 2013). It is the largest exporter of dairy and dairy products globally. Pakistan is the second most buffalo populated country in the world, contributes 16.83% of world buffalo population (FAO, 2012). Pakistan is the 2nd largest buffalo milk producing country in the world, contributes 23.96% of total buffalo milk production (Hamid *et al*., 2016). Buffaloes are financially and culturally very important livestock species especially in developing countries (Arefaine and Kashwa, 2015). It plays a significant role through contributions in social and cultural aspects (Desta, 2012). They possess the highest potential for meat and milk production with a promising gene pool, which is not yet fully used. Buffalo milk can be converted into many kinds of cheese, primarily mozzarella (Aspilcueta-Borquis *et al.,* 2012). Furthermore, buffaloes are valuable work animals and commonly used as draught animals in crop fields (Perera, 2008). Due to these reasons, water buffalo is often called the living tractor of the East since it is relied upon for draught and transportation in many parts of Asia (Chantalakhana and Bunyavejchewin, 1994). Leather is another major contribution of buffalo in the world market (FAOSTAT, 2014). Dung is used as organic fertilizer. Buffalo racing and plowing contests and fighting are among traditional festivities after rice harvest in Thailand (Chantalakhana and Bunyavejchewin, 1994). The water buffalo is the second most important species in the world in terms of milk production after dairy cows (Coroian *et al*., 2013) and good source of milk and meat in SAARC region. Comparing to cow,

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buffalo milk is higher in protein, fat, lactose and energy (Hamid *et al*., 2016). The population of global buffalo is 194.29 million; Asian buffalo dominate the world population, representing 92.52% (179.75 million) of the total buffalo population (FAO, 2012 and Chakravarty, 2013). Within the Asian region, about 74.80% of buffaloes in the South Asia, 12.80% in East Asia and only 8.40% found in South-East Asia (Hamid *et al*., 2016). The Asian countries represent 91.89% of world's buffalo meat and with volume of 3.08 Mt in 2008 (Wanapat and Chanthakhoun, 2015). About 78.5% of Asian buffalo meat was produced in South and South-West Asia with the greater bulk contributed by India and followed by Pakistan (Wanapat and Chanthakhoun, 2015). India is the world's 4th meat producing country and largest buffalo meat exporting country globally (Hamid *et al*., 2016).

Bangladesh is a South Asian country where the economy is based primarily on agriculture and livestock is an essential component of the rural economy. In Bangladesh, buffalo used primarily for draught purpose, otherwise the dairy and meat production is a secondary option (Hamid *et al*., 2016). There is no recognized breed of water buffaloes in Bangladesh and are mainly indigenous non descriptive types (Hamid *et al*., 2016). Though total milk production of Bangladesh is about 6.09 Mt in 2014 out of which about 3-4% is produced by the buffalo in spite of the number of buffalo growth rate are increasing during last 10 years (DLS, 2015). The consumption of milk and meat was increased by at 4.0 and 12.7%, respectively during 2005-2010, and accordingly it is increasing the number of consumer of buffalo milk because of its white color, high fat content and flavor (Hamid *et al*., 2016). As a result there is a high demand for buffalo milk in the country but milk yield per dairy buffalo is very low which is 600-1000/ lactation periods of 250-270 days and however, this indicates that Bangladesh have great opportunity to produce buffalo milk because of its high consumer preference and demand (Huque and Borghese, 2012). Unfortunately the sector is not utilized yet due to many constraints. In Bangladesh, buffalo has never been addressed but always neglected species despite of their important role in the national economy (Huque and Borghese, 2012). According to the national health strategy an adult people need 250 ml milk and 120g of meat every day. However, presently the availability is only 43.44 and 67.17%, respectively (DLS, 2015). Recently, the demand for animal derived products such as milk, meat, butter, cheese, ice-cream, baby foods, locally made sweets are increasing which are heavily dependent on milk plus sugar (Hamid *et al*., 2016). Thus, the buffalo is an important component of livestock species and has a great opportunities of taking part in milk production during this time when a huge deficiency in both of milk and its products in Bangladesh.

The total buffalo population of the country is 1.457 million (DLS, 2015) of which coastal regions posses about 40% (Faruque*et al*., 1990). Buffaloes are found in the Bramhaputra-Jamuna flood plain of central Bangladesh and Ganges-Meghna flood–plain of southern Bangladesh (Osmani, 2012). Buffaloes are mainly raised under an extensive system in the coastal and hilly areas where large scale pasture land and enough green forage are available. Other than those, rests are mostly raised under a semi-intensive system on plane and marshy land where there is limited pasture land. The buffalo farming has now got popularity because of their outstanding productivity performance in comparison to that of cows in Bangladesh. It is reported that farmers' yearly net income per lactating buffalo (US$ 361±147) is about eight times more than that from an indigenous lactating cow (US$ 47±25) under smallholder dairy farming system at Kanihari union of Mymensingh district in Bangladesh (Talukder et al., 2008). During the last 10 years, the world buffalo population increased by approximately 1.49% annually. Worldwide interest has been developed on this species not only as a source of animal protein as meat and milk for human consumption, but also their adaptability to harsh environment (FAO, 2005). Though the buffalo is an important part of livestock in Bangladesh, there is no documented research studies so far that investigated the scenario of buffalo and their production status in coastal regions of the country. It is emerging for Bangladesh to develop buffalo breed, their production and reproduction performances through various scientific programs. In order to develop buffalo production in Bangladesh, it would be worthy to know details about the scenario of buffalo production in this region, such as buffalo types, their population, their inheritance characteristics, production and reproduction performances, contribution of buffalo to milk and meat production, contribution of buffalo to national economy etc. Thus, the study on this valuable species about its type with population and performances is undeniable, especially in the coastal reasons of Bangladesh where in very difficult to rear cattle as well as other livestock due to its agro-climatic condition and topography of the land, is thought to be more suitable and advantageous for buffalo production. Therefore, the aim of this study was to study the scenario of buffalo farmers and to identify the types of buffaloes with population size and performance in the coastal region of Bangladesh.

Methods and Materials

The present experiment was conducted to identify the types of buffaloes in coastal region of Bangladesh on the basis of their phenotypic appearance. Moreover, milk production performance was also estimated with this study. The questionnaire was prepared and pre-tested within October to November/2017 and it was cautiously designed in maintaining the basis of the study in view, and it was pre-tested for judging the suitability of the questionnaire to the respondents. The questionnaire had both open and closed form of questions, but prepared in accordance with the objectives of the study and designed in a simple manner in which it was possible to obtain all information from the farmers as much as accurate and authentic. It was comprised of major items- a) General information about the livestock owner i.e. occupation, income, income from buffaloes and family size etc. b) Live weight; d) Phenotypic and morphologic assessments i.e. coat color, horn pattern, feature, configuration etc. c) Feeding management; and f) Milk yield. Thereafter the questionnaire was finalized upon making necessary modifications. For executing the objectives, data/information was collected from a period of December/2017 to March/2018 with randomly selected of 100 households from each of Barishal, Patuakhali and Bhola districts in Bangladesh. To know the origin with other information of a particular buffalo, it was accumulated in a door to door or rearing place survey by filling up the structured questionnaire through interviewing with

the farmers of the aforesaid districts. When the interview was over, the information was checked carefully before leaving the farmers' house/place at study areas, and any confusion was rationalized and corrected by comparing these with local standards to keep consistency of the data/information.

Study Areas

The study was covered the different households of Barisal, Patuakhali and Bhola districts.

Data collection, record keeping and statistical analysis

Door to door interviewing method was used to collect the data/information from buffalo owners. Information given by them was recorded in a record book and kept for further analysis.

Estimation of Live weight live weight (LWT):

The live weight (LWT) of each buffalo was estimated at the time of survey. For being difficulties in bearing weigh balance to study areas (either farmers' house or fields), Shaeffer's formula was applied for estimating the LWT of the buffaloes as follows:

$$\text{LWT} = \frac{\text{L} \times \text{G}^2}{300} \text{ Pounds}$$

Here, L= length (inches); G= heart girth (inches)

For calculating the weight in kilogram (kg), simply the estimated result was divided by 2.2 (as 1kg= 2.2 pounds).

After the completion of collecting of data/information was tabulated, processed and recorded in computer Microsoft Excel sheet and finally it was analyzed by using Statistical Program for Social Science (SPSS, Version 22.0) computer program.

Results and Discussion

Socio-economic status of buffalo farmers

The socio-economic status of the farmers is directly related to livestock production. Their education, land size, family type etc. is greatly influenced on management and rearing patterns of animals. Different position and characteristics of the buffalo farmers at study areas were documented.

Farmers' occupation

The nature of the occupation of farmers is given in Table 1 and shown in Figure 1. The buffalo farmers at study areas were occupied in various professions like agriculture, business, service and labor, and of 78, 14, 6 and 2%, respectively (Table 1 & Figure 1). It was found that highest numbers (78%) of the farmers were employed as agriculture followed by business (14%), service (6%) and labor (2%).

The present study revealed maximum farmers (78%) employed in agriculture (Table 1 & Figure 1) was comparable to the value of 70% by Hashem *et al.* (1999), but the finding was highly disagreed with Rashid *et al.* (2007), who observed 50% were occupied in agriculture and dairying in Jessore district.

Table 1. Different occupation of the farmers at study areas

Farmers' occupation	No. of farmers' family	Percentage
Labor	7	2
Agriculture	233	78
Service	17	6
Business	43	14
Total	300	100

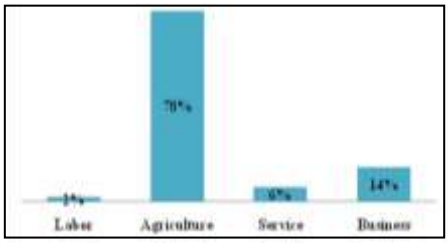

Figure 1: Different occupation of the farmers at study areas

The present experiment revealed that the huge number of buffalo farmers engaging in crop-animal agriculture might be due to easier and comfortable profession to their sense than any other business in these areas.

Family types

Farmers' family types are represented in Table 2 and shown in Figure 2. It was observed that 30, 38 and 32% farmers' families were small (<4 members), medium (4-6 members) and large (>6 members), respectively (Table 2 & Figure 2).

Table 2. The different types of farmers' family at the study areas

Family types	Farmers' family	Percentage
Small (<4 members)	90	30
Medium (4-6 members)	114	38
Large (>6 members)	96	32
Total	300	100

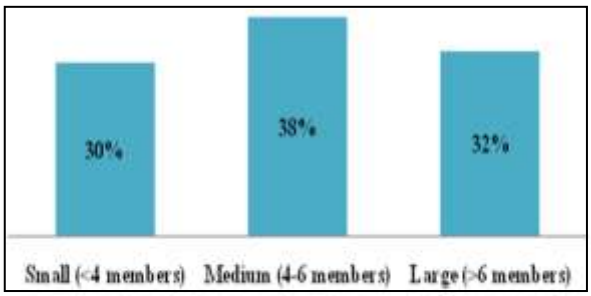

Figure 2: Different types of farmers' family at study areas

Mogesse (2007) observed maximum families were medium in size that agreed with present value showed that maximum farmers' families were medium (38%) in size (Table 2 & Figure 2). Moreover, the present finding represented 30% of small families were distinctly differed and 3 times higher to the value only of 10% for small family was found by Ahmed *et al.* (2010), and moreover they also observed 25% of large family was greatly varied to the present finding of 32% of large family (Table 2 & Figure 2). The maximum farmers' families observed medium in size (38%) at study areas might have been the quick fragmentation of the families due to socio-economic imbalance and inter conflict among the joined family members.

Education level

The education level of farmers is summarized in Table 3 and shown in Figure 3. It was observed 73% farmers were uneducated and 12, 10 and 5% had primary, high school and SSC level or more education, respectively. A very small number (5%) of buffalo farmers having SSC or more education which was very less and about to half of both primary (12%) and high school (10%) level of education (Table 3 & Figure 3).

Table 3. The different level of education of the farmers at the study areas

Education level	Farmers' family	Percentage
Uneducated	218	73
Primary	37	12
High school	29	10
SSC or more	16	5
Total	300	10

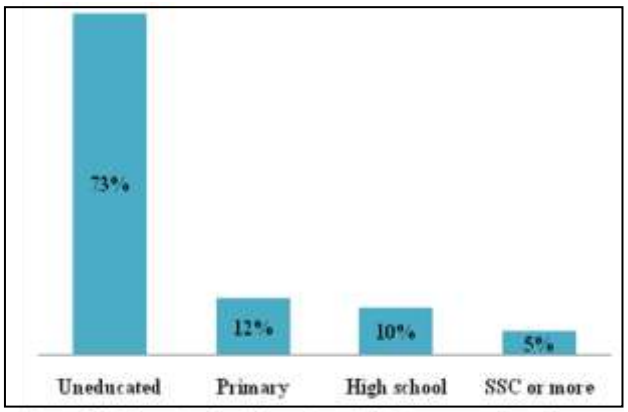

Figure 3: Different level of education of the farmers at the study areas

However, it was very unfortunate that maximum farmers (73%) were still now uneducated at the experimental areas and this huge number of uneducated population having lack in modern knowledge and ideas about various technologies for scientific methods of animal production. However, the commercial animal production is fully technology based and in fact one's education is undeniable. The study was confidently exposed that farmers at study areas raised a lot of buffaloes, but illiteracy of huge number (73%) (Table 3 & Figure 3) made them unable to keep proper health and production performance of their animals and consequently their production was far bellow than expectation and evidently proved that uneducated farmers were not able to rear their buffaloes properly. The similar statement was also established by Okoye *et al*. (2007) and Hashem *et al.* (1999) who found that less educated farmers have not enough knowledge in case of cattle rearing and fattening aspects.

Categories of farmers based on land size

The categories of farmers based on land size are represented in Table 4 and shown in Figure 4. Mazumder (2011) categorized farmers based on land size was marginal (<0.2 acres), medium (0.2-1.0 acres) and large (>1.0 acres) farmers. According to categorization, the present experiment revealed that 35, 28 and 37% of buffalo farmers were marginal, medium and large, respectively.

Table 4. Different categories of farmers based on land size at study areas

Farmers' categories	Farmers' family	Percentage
Marginal (<0.2 acres)	106	35
Medium (0.2-1.0 acres)	84	28
Large (>1.0 acres)	110	37
Total	300	100

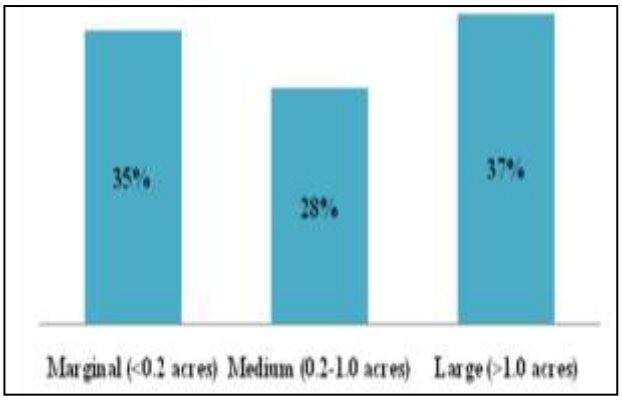

Figure 4: Different categories of farmers based on land size at study areas

The present study observed fairly parallel values of marginal and large farmers, and these were 35 and 37%, respectively (Table 4 & Figure 4). However, these values were comparable to the values obtained by Mogesse (2007) and Hashem *et al*. (1999).

Farmers' groups based on income from buffaloes

Different groups of farmers based on their income buffaloes are summarized in Table 5 and shown in Figure 5 and were grouped as group 1 (<600000 Tk./year), group 2 (60000-120000 Tk./year) and group 3 (>120000 Tk./year).

Table 5. Farmers' groups based on income from buffaloes

Farmers' groups (on income basis)	Farmers' family	Percentage
Group 1 (<600000 Tk./year)	90	30
Group 2 (60000-120000 Tk./year)	95	32
Group 3 (>120000 Tk./year)	115	38
Total	300	100

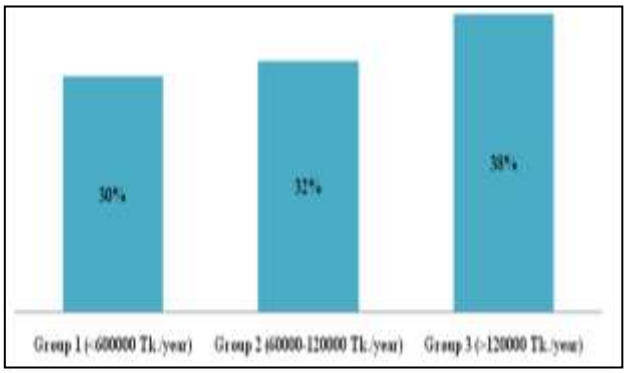

Figure 5: Farmers' groups based on income from buffaloes

The farmers group 3 (38%) was higher in position in respect of income than group 2 (32%) followed by group 1 (30%). The highest (38%) income group 3 (>120000 Tk./year) seemed to be rear large number of buffaloes successfully.

Types of existing buffaloes at study areas

The coastal region is thought to be more suitable and advantageous for buffalo production. The introduction of new genetics or genetic up-gradation of buffalo, it is crucial to identify and to know the present scenario of existing buffaloes in these areas. Until now, there is no authentic report on types of

buffaloes, their population size and production performance etc. All these information need to further improvement of the existing buffaloes and buffalo raisers in these regions. So, the study was to identify the types of buffaloes, population size and milk production performances in coastal region of Bangladesh.

Buffalo population

Buffalo population and number of buffaloes per household at study areas are shown in Table 6. Total number of buffaloes/100 households at study areas observed 514, 2371 and 943 heads in Barishal, Patuakhali and Bhola district, respectively. However, the concentration of buffaloes per household in Patuakhali district (23.71 heads) was very high than other two districts as Barishal (5.14) and Bhola (9.43) (Table 6).

Table 6. Buffalo population and number of buffaloes per household at study areas

Variable	Study areas		
	Barishal	Patuakhali	Bhola
No. of households	100	100	100
Total no. of buffaloes/100 households	514	2371	943
No. of buffaloes/household	5.14	23.71	9.43

This high concentration of buffaloes in Patuakhali than other two districts like Barishal and Bhola was probably due to its vast Char areas where there was a great opportunities free grazing of buffaloes.

Live weight and milk yield

The live weight and milk yield of buffaloes at study areas are summarized in Table 7. The average milk yield at study areas was 2.30±0.060 litters/day. However, the average yield observed 2.42±0.062 litters in Bhola district was significantly (*p<0.05*) higher than those produced 2.27±0.060 and 2.21±0.059 litters daily in Patuakhali and Barishal districts, respectively. The same (2.30 litters/day) yield of milk was obtained by Hussen (1990). Amin *et al*. (2015) and Huque and Shahjahan (2016) observed the daily average milk yield of 2.7 and 2.8 litters/day, respectively and both of them were slightly higher than present observation as 2.30 litters/day (Table 7). Siddiki *et al*. (2015) stated that average milk yields of buffaloes were 3.32litters/day was heavier to present production of 2.30litters/day. Karim *et al*. (2013) reported average milk yield of indigenous buffaloes were 3.43±0.744 and 3.33±0.68 litters/day under Barguna and Pirojpur district, respectively and these figures were also larger to present findings (Table 7).

Table 7. Average live weight and milk yield of buffaloes at study areas

Parameters		Average	Barishal	Patuakhali	Bhola	Level of sig.
Live weight (kg)	M	334.33±3.42	312.7^{c}±3.64	339.4^{b}±3.58	347.9^{a}±2.70	***
	F	247.43±2.34	238.2^{b}±2.24	243.4^{b}±2.30	260.7^{a}±2.46	***
Milk yield (litters/day)		±0.060	2.21^{b}±0.059	2.27^{b}±0.060	2.42^{a}±0.062	**

*M, Male; F, Female; Means with different superscripts in the same row differed significantly (**, p<0.05; ***p<0.01)*

Faruque *et al*. (1990) found that average daily milk yield per buffalo cow in the central region were 2.32±0.63 litters was almost nearest to the present value of 2.30±0.060 litters/day. Gupta *et al*. (2014) observed that daily milk yield of non-descript buffalo cows in the Eastern region of India varied from 1.56-4.12 litters/day and Hamid *et al.* (2017) reported the milk production of indigenous Bangladeshi buffaloes varies from 2.1-2.7 litters/day, and the present production of milk (2.30 litters/day) agreed within the range of their values. Khan *et al*. (2014) reported that Azikheli crossbreed type buffalo in Pakistan produced daily 7.19±0.18 litters of milk was extremely higher than that found in present study (Table 7).

Identifying characteristics and number of buffaloes examined at study areas

Characteristics and number of buffaloes examined at study areas are summarized in Table 8. Grand total of 3828 heads of buffaloes at study areas were examined. Among the buffaloes, total of 735 heads (Bsl., 137, Pkl., 384 and Bhl., 214) observed black with white markings on forehead, legs and tail; total of 1349 heads (Bsl., 182, Pkl., 962 and Bhl., 205) observed Reddish brown, Rusty brown and Silver-grey; and total of 1744 heads (Bsl., 195, Pkl., 1025 and Bhl., 524) observed Black, Rusty brown and Silver-grey with white markings on forehead, legs and tail.

Table 8. Characteristics of buffaloes examined in different districts at study areas

Variable	Characteristics	No. of buffalo			
		Bsl.	Pkl.	Bhl.	Total
Colour type	Black with white markings on forehead, face, legs and tail	137	384	214	735
	Reddish brown, Rusty brown or Silver-grey	182	962	205	1349
	Black, Rusty brown or Silver-grey with white markings on forehead, face, legs and tail	195	1025	524	1744
	Total	514	2371	943	3828
Body conforma-tion and head	Deep massive frame, short head and broad back	127	435	197	759
	Broad and elongated head and light neck	173	966	213	1352
	Broad and elongated or short head and neck	214	970	533	1717
	Total	514	2371	943	3828
Size	Large	113	268	319	700
	Medium	282	1267	319	1868
	Small	119	836	305	1260
	Total	514	2371	943	3828
Horns	Short and coiled	142	396	219	757
	Long and sickle-shaped; downward, backward and upward	159	924	211	1294
	Short, sickle-shaped; backward and upward	213	1051	513	1777
	Total	514	2371	943	3828
Limbs	Short and massive	158	361	187	706
	Long and medium	139	1152	268	1569
	Short	217	858	488	1563
	Total	514	2371	943	3828
Udder	Moderately developed	71	197	176	444
	Less developed	162	905	363	1430
	Miscellaneous	201	918	284	1403
	Total	434	2020	823	3277

Bsl., Barishal; Pkl., Ptuakhali and Bhl., Bhola

Moreover, 759 heads (Bsl., 127, Pkl., 435 and Bhl. 197) had near about deep massive frame, short head and broad back; total 1352 heads (Bsl., 173, Pkl., 966 and Bhl. 213) had relatively broad and elongated head and light neck; and total 1717 heads (Bsl., 214, Pkl., 970 and Bhl. 533) had fairly broad and elongated, and short head and neck. The body size of total 700 animals (Bsl., 113, Pkl., 268 and Bhl. 319) having fairly large; total 1868 animals (Bsl., 282, Pkl., 1267 and Bhl. 319) having comparatively medium; and total 1260 animals (Bsl., 119, Pkl., 836 and Bhl. 305) having small. Both males and females were found to bear their various sizes and patterns of horns, and of which total of 757 (Bsl., 142, Pkl., 396 and Bhl. 219) had their short and coiled horns; 1294 (Bsl., 159, Pkl., 924 and Bhl. 211) had their long and sickle-shaped patterns with downward, backward and upwardly placed; and 1777 (Bsl., 213, Pkl., 1051 and Bhl. 513) had their short, sickle-shaped patterns with backward and upwardly placed. Various forms of limbs observed among the animals at experimental zones were short and massive, long and medium, and short; however, 706 (Bsl., 158, Pkl., 361 and Bhl. 187) of them having short and massive limbs; 1569 (Bsl., 139, Pkl., 1152 and Bhl. 268) having long and medium limbs; and 1563 (Bsl., 217, Pkl., 858 and Bhl. 488) having short limbs. It was interestingly revealed that the udders of buffaloes in this region were not as developed as their body sizes. Maximum animals of 1430 heads (Bsl., 162, Pkl., 905 and Bhl. 363) having less developed udders followed by 1403 (Bsl., 201, Pkl., 918 and Bhl. 284) and 444 heads (Bsl., 71, Pkl., 197 and Bhl. 176) having miscellaneous and moderately developed udders, respectively. Faruque (2000) reported that Bangladeshi buffaloes were black in colour, having white spot on the forehead and tail-switch in some cases and possessed curled and short horns which somewhat matched with present experiment.

Surti type buffaloes in study areas
(Having similarities in some characteristics with Surti buffalo breed)

Figure 6. Typical Surti and Surti type (in study areas) buffaloes

Types of buffaloes examined at study areas

Types of buffaloes examined at study areas are shown in Table 9. The different parameters of buffaloes studied and estimated in this experiment were only of mature stocks. However, sometimes the pictures of immature animals were also considered and shown in some figures (Figure 8).

Table 9. Types of buffaloes examined at study areas

Types		Study areas				Grand total	%
		Baris	Patu	Bho`	Total		
Surti type	M	30	105	46	181	1514	40
	F	159	949	225	1333		
Nili-Ravi type	M	24	55	22	101	697	18
	F	103	293	200	596		
Crossed/ Mixed type	M	26	191	52	269	1617	42
	F	172	778	398	1348		
Total		514	2371	943	3828	3828	100

M, Male; F, Female

According to the phenotypic characteristics (Table 8) and analyzed of their conformation and appearances, it revealed that 1514 heads (M, 181 & F, 1333) (Table 9)of buffaloes at study areas was Surti type (Figure 6) having the similarities to typical Surti; 697 heads (M, 101 & F, 596) (Table 9)was Nili-Ravi type (Figure 7) having the sensible similarities to typical Nili-Ravi; and 1617 heads (M, 269 & F, 1348) (Table 9) having the combined representation of Surti, Nili-Ravi and indigenous buffaloes, and

Nili-Ravi type buffaloes in study areas
(Having similarities in some characteristics with Nili-Ravi type buffalo breed)

Figure 7. Typical Nili-Ravi and Nili-Ravi type (in study areas) buffaloes

were Crossed/Mixed type (Figure 8). However, these three forms like Surti type, Nili-Ravi type and Crossed/Mixed type of buffaloes at study areas observed 40, 18 and 42%, respectively (Table 9). Faruque (2000) observed that the indigenous Bangladeshi buffaloes of River type found in the South-West, however the remaining parts of the country they were either Swamp or crosses of exotic breeds like Nili-Ravi and Murrah type, but in present experiment either Murrah or their crosses were not found.

Figure 8. Crossed/Mixed type buffaloes in study areas

Some others important pictures of buffaloes at study areas (Figure 9 &10)

Figure 9. Measuring body of buffalo with a tape for weight determination

Figure 10. Buffalo calves and dams with them in some cases at study areas

Conclusions

Buffaloes are financially and culturally very important livestock species especially in developing countries. They possess the highest potential for meat and milk production in Bangladesh with a promising gene pool, which is not yet fully used. In Bangladesh, water buffaloes would preferably be the important and popular livestock for milk production. The present study revealed three different forms of buffaloes in coastal regions as Surti type, Nili-Ravi type and Crossed/Mixed type thought to be derived from Surti and Nili-Ravi breed mixing with indigenous buffaloes because these were matched in some of the phenotypic characteristics with typical Surti and Nili-Ravi breeds of Indian water buffaloes. The mean weight of matured male observed 347.9±2.70 kg in Bhola was distinctly ($p<0.01$) heavierto 339.4±3.58 and 312.70±3.64 kg in Patuakhali and Barishal, respectively. Similarly, the mean matured weight of female found to be 260.7±2.46 kg in Bhola was also significantly ($p<0.01$) differed over 243.4±2.30 and 238.20±2.24 kg in Patuakhali and Barishal, respectively. The buffalo cows in Bhola produced averaging 2.42±0.062 litters of milk per day was distinctly ($p<0.05$) higher than those produced 2.27±0.060 and 2.21±0.059 litters milk daily in Patuakhali and Barishal district, respectively. The study also exposed that a lot of buffaloes were raised in study areas, but a large number (73%) of uneducated farmers being unskilled and unable to maintain animal health properly and as a result the production performance of their buffaloes found to be bellow than expectation. Besides, wants of quality animals and proper breeding policy, scarcity of feeds due to flood or overflow of water and shortage of grazing lands/chars, inadequate veterinary assistance, lack of capital, lack of buffalo keepers and high cost of them, communication and low price of milk and milk products etc. were the different forms of constraints was established in study areas as well. Finally, it is concluded that for obtaining optimum benefit from buffaloes need to improve the current buffaloes and their production potential through scientific breeding with quality breeds, improved management system, providing training, credit and finance, consultancy service, adequate veterinary service, feed conservation, adoption of improved forage and use of agro-industrial by products such as oilseed cakes and also infrastructure to increase the production of buffaloes in these areas and in Bangladesh as well.

Acknowledgments

The author is very grateful to Research and Training Center (RTC), Patuakhali Science and Technology University, Dumki, Patuakhali for financial help to conduct and complete of the study.

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