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Review

Dairy buffalo production scenario in Bangladesh: a review

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Abstract: The objective of this review is to draw the present scenario of dairy buffalo production in Bangladesh and their contributions to the national economy. Buffaloes in Bangladesh are mostly indigenous type encompasses with swamp and river and are distributed throughout the country. However, the population is higher in coastal part, Meghna-Ganga and Jamuna-Brahamaputra flood plain, considered to be the buffalo pockets. The total buffalo population is 1.471 million which are mostly managed in household subsistence farming as well as *bathan* in coastal region. Buffaloes are normally used as a draught animal and in lower extent partially for milk and meat production. Most of the farmers are rural small holders; traditionally practiced crop-livestock integration upon which the management practices of buffalo usually depends. Buffaloes are raised in homestead and approximately 5-7 hours were grazes per day in household farming. Small amount of concentrate is usually offered to buffalo during dry season only by the economically viable farmers. On the other hand, in *bathan*, farmers are fully depended on grazing at public fallow land. Lower milk production efficiency, poor reproductive performance followed by under nutrition and low growth rate in buffaloes resulted insignificant contribution to the national economy of Bangladesh. Balanced nutrition and better management practices can improve buffalo productivity. In order to do so, a number of issues are required to be addressed such as establishment of nutrient requirements for dairy, development of buffalo calf feeding systems, artificial insemination technique, nutritional management of metabolic and reproductive anomalies, and understanding and exploitation of the buffalo gut ecosystem. Productivity of buffaloes can be mainly depended on genetic improvement, good nutrition, good management and also climatic conditions of an area. Extensive coordinated research and extension efforts are required for increasing dairy buffalo production in this country.

Keywords: management; breeding; nutrition; reproductive performance

1. Introduction

Buffalo is one of the most important livestock species populated largely in tropical and sub-tropical countries (Das and Khan, 2010). Dairy buffalo production has been a tradition in Asia especially in south Asian countries like Bangladesh, India, Pakistan and Afghanistan. Moreover, large number of buffaloes also found in Iraq, Turkey, Thailand, China, Egypt, Denmark, Bulgaria, Italy and Trinidad and Tobagob where fresh buffalo milk, cultured sour milk, ghee, yoghurt and special types of cheeses are of popular dairy products (Hamid *et al*., 2016). Like other developing countries, animal production systems and its use vary widely in Bangladesh

according with climatic condition, topography and socio-economic condition. The production systems are characterized by small number of animals with no or minimal inputs, low outputs and periodic demolition of animals by disease and mostly maintained under scavenging systems (Saadullah, 2012).

Buffaloes are better converter of poor-quality fibrous feeds into milk and meat. They are reported to have the capacity of digesting 5% more crude fiber than high-yielding cows; and 4-5% more efficient in utilizing metabolizable energy for milk production (Mudgal, 1989). Terramoccia *et al.* (2000) reported a better degradation rate of both crude protein (CP) and protein free dry matter (DM) in buffaloes than in cattle. Growing buffaloes may utilize coarse feed more efficiently than cattle, have more disease resistance ability and produce more solids in milk (Dubey *et al.*, 1997) and require less management inputs. It has also been reported that buffalo holds strategic place in overall livestock economy of Bangladesh and serves three important purposes such as milk, meat and draught power supply (Ghaffar *et al.*, 1991).

With increasing population and economic stability, the demand of milk and milk products like butter cheese, ghee, yogurt, ice cream is increased. During 2006-07, milk production in Bangladesh was 22.80 Lakh Metric Ton whereas the current production is 72.75 Lakh Metric Ton. Present demand of milk production in BD is 146.91 Lakh Metric Ton and availability is 72.75 Lakh Metric Ton hence the deficit is about 50.47%. Though milk production increased in 68.66% compared to last 10 years but there are also 74.16 Lakh Metric Ton, still we need to increase (50%) milk production in order to meet up the demand (DLS, 2015-16).

In India, white revolution occurred long ago through dairy buffalo rearing and 67.99% milk coming from buffalo whereas dairy buffalo production is very limited in Bangladesh as only 0.039% milk from buffalo. Major percentages (>90%) of milk is coming from dairy cow in Bangladesh. It is expected that buffalo will ultimately emerge as the future animal of dairy-cum-meat industry in the region (Dhanda, 2013). Therefore, we assume there are huge potential of dairy buffalo production in BD. That's why it is needed to gear up dairy buffalo production to enhance food security from livestock origin. The objective of this review is to illustrate the current status of Buffalo production in BD, its challenges and opportunities.

2. Buffalo population

The world buffalo population is estimated to be approximately 194.29 million over 42 countries (Hamid *et al.*, 2016). About 92.5% of the total buffaloes are found in Asia. Within the Asian, about 71.32% of buffaloes are in South Asia, 12.8% in East Asia and only 8.4% are found in South-East Asia. Compare to the other Asian countries, Bangladesh has only The 1.471 million buffaloes (Figure 1) mostly populated in the coastal regions about 40% (Faruque *et al.*, 1990).

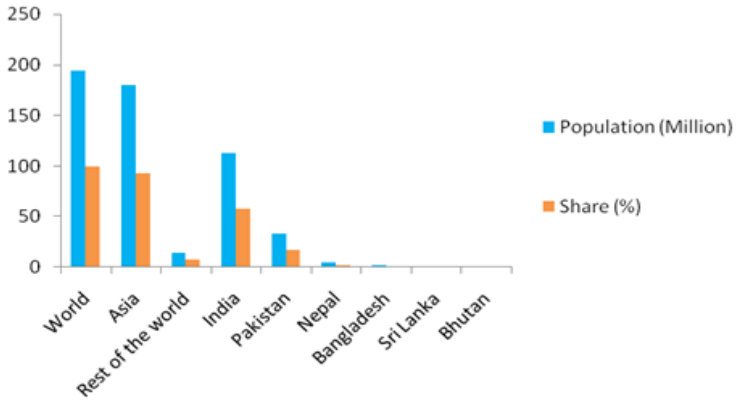

Figure 1. Total buffalo population in the world and Asia (FAO, 2012; Chakravarty, 2013; DLS, 2015-16).

The adult female buffalo reported to be 453 thousand including 121 thousand lactating buffalo cows (Huque, 2013). Within the adult buffalo, adult male and female were 58% and 33%, respectively, and, within the female, milking and dry buffalo were 27% and 37%, respectively (BBS, 2008). It could be Bangladeshi people use buffalo mostly for draught purpose. Population and growth rate of buffalo in Bangladesh are shown in Figure 2 (a and b).

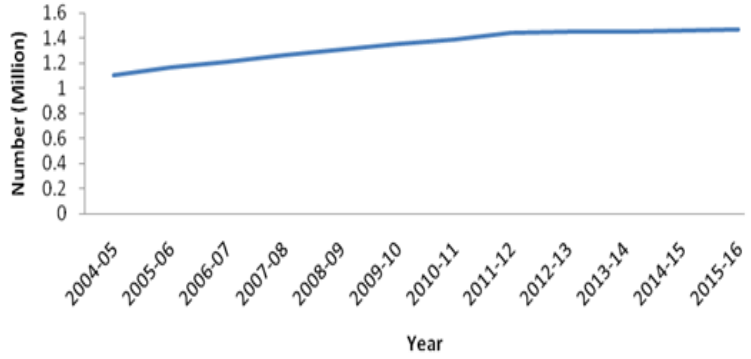

Figure 2(a). Population of buffalo in Bangladesh (DLS, 2015-16).

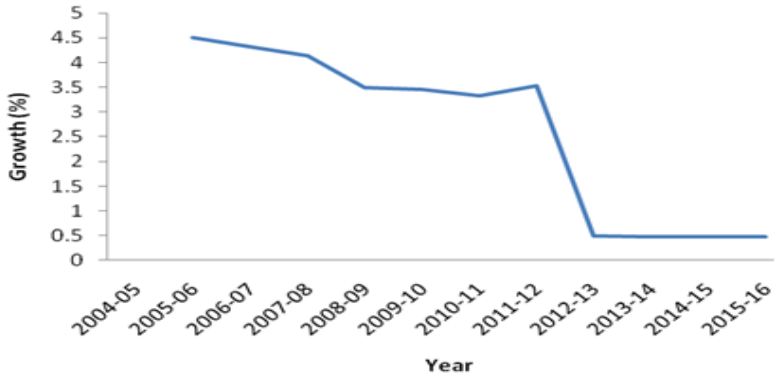

Figure 2(b). Growth rate of buffalo in Bangladesh (DLS, 2015-16).

3. Types or breeds of Buffaloes available in different regions of Bangladesh

Buffaloes in Bangladesh mainly classified into two categories: (i) indigenous buffaloes found in the coastal areas and marshy land of the country and (ii) migrated buffaloes from India and Myanmar found in the sugar-cane belt and Coxes's bazar district, respectively (Saadullah, 2012). The migrated buffaloes from India are generally of river types, and from Myanmar, coastal areas or marshy land are of swamp types, though a number of crossbred between swamp and river types are found in the coastal area (Faruque *et al.*, 1990; Faruque, 1992). There are several types of Buffaloes found in Bangladesh (Table 1). There is no recognized breed of water buffaloes in Bangladesh and are mainly indigenous non-descriptive types (Faruque *et al.*, 1990). However, two predominant type of buffaloes commonly available in Bangladesh such as riverine and swamp types (Sarwar *et al.*, 2002a,b). River buffaloes basically reared for the milk production (Dhanda, 2013). In addition, there are few buffalo pockets in Bangladesh including coastal area, Sylhet haor area, sugar cane belt of Jamalpur and Kanihari buffalo pocket in Trishal upazila of Mymensingh district of Bangladesh solely used for milk production over hundreds of years (Sohel and Amin, 2015).

Table 1. Types or breeds of buffaloes found in Bangladesh (Faruque, 2003).

Type/breed	Location	Population size, phenotypes and genotypes
Indigenous River type	Western & central part of the country	433000 head; coat colour- jet black to black; chromosome number-50 & medium in size.
Bangladeshi	Central & south west	4500 head; light black coat colour, chevron & white stocking present; chromosome number-50 & medium in size.
Indigenous Swamp type	Eastern part of the country	37500 head; grey coat colour, chevron & white stocking & crescent horns are present; chromosome number-48 & small in size.
Crossbred type (Indigenous × Nili-Ravi)	Southern part of the country	40000 head; phenotypes combination of Swamp type & Nili-Ravi; medium in size.
Non-descriptive type-central part	South west & southern part of the county	207569 head
Nili-Ravi	Buffalo breeding farm	60 head

Dairy buffaloes are observed sparsely all over the country. It has been reported that they are found to be concentrated in Meghna-Ganga flood plain as well as Brahammaputra-Jamuna flood plain (Faruque and Hossain, 2007). There are also some cross breed with Murrah, Nili-Ravi, Surti and Jaffrabadi surrounding of Indian border (Faruque *et al*., 1990; Huque and Borghese, 2012). The event of crossbred dairy buffaloes indicates that the genetic improvement programs in place (Faruque, 2000).

4. Herd size and distribution of buffalo

The distribution of buffaloes between household and *bathan* farming systems are presented in Table 2. In the household farming, the average herd size was less than three and it was about 82% of total respondents. Consequently, 62% of the total respondents had 51 *bathan* farming. In household farm mainly reared female animals and only 1% buffalo bull. On the other hand, 70% buffaloes were female and the remaining 30% was male dominantly growing bull and bullock in that farming system. Among the total female animals, the ratios between milch and dry buffalo were about 2:1 and heifer and adult cow 1:1 in both household and *bathan* farming (Uddin *et al*., 2016).

Table 2. Herd size and distribution of buffalo (Uddin *et al*., 2016).

Parameters		**% of respondents**
Herd size (number)		
a) *Household system*		
	1-3	82
	4-7	15
	8-10	3
b) *Bathan*		
	<50	11
	51-100	37
	101-200	25
	201-500	11
	>500	16
Distribution of animal		
a) *Household*		
Adult		
	Male (Bull)	1
	Female	99
Growing Calf		
	Male	3
	Female	97
b) *Bathan*		
Adult		
	Male (Bull)	30
	Female	70
Growing Calf		
	Male	0
	Female	100

5. Buffalo milk production in Bangladesh

With daily average milk production is only 2.8 L/day with an average lactation length of 227 days (Huque, 2013). Though total milk production of Bangladesh is about 72.75 Lakh Metric Ton in 2015-16 where buffalo milk production was only 3-4% of the total milk production (DLS, 2015-16). Indigenous buffalo cow produces two times more milk than cows, having more milk fat and total milk solids (Faruque *et al.*, 1990). Recently, buffalo milk production in Asia represents 97.02% of the total volume of the world's buffalo milk (FAO, 2010) (Table 3).

Table 3. Buffalo milk production (MT) in the world and in SAARC countries (Chakravarty, 2013).

Region/country	Total production (MT)	Share in world production (%)
World	95.815	100.000
Asia	92.962	97.020
Rest of world	6.525	2.980
SAARC countries	89.290	93.190
India	65.140	67.990
Pakistan	22.955	23.960
Nepal	1.109	1.157
Bangladesh	0.037	0.039
Sri Lanka	0.046	0.048
Bhutan	0.000084	-

The total milk yield per lactation depends on the genotypes and production systems of buffaloes. The buffalo raised under household (semi-intensive system) produced higher milk than those raised under *bathan* (extensive system); thus the household farming is more attractive as it gives milk and meat both. The comparison of milk production of different buffalo breeds are shown in Table 4 and milk production characteristics of buffalo in BD is shown in Table 5. The lactation yield in semi-extensive and extensive farming were 799 and 435 liters, respectively (Uddin *et al.*, 2016), which are much lower than the Nili- Ravi buffaloes reported by Mudgal (1989), Khan (1995) and ICAR (2000). This result of this study coincides with the result of Faruque *et al*. (1990) who reported that the lactation yield was 712 kg for buffaloes in Mymensingh district. Faruque and Amin (1995) reported that the lactation yield of indigenous buffalo in Khulna region are 280 liters and Hussen (1990) found a lactation yield of 830 liters for buffaloes in Tangail district. It could be concluded from the discussion that the possible important factors are inferior genetic merit of breed/genotype for lower milk production along with other factors.

Table 4. Comparison of milk performance in different buffalo breeds (litre/day).

Breed	Lactations (n)	Lactation length (days)	Milk yield Avg. (litre)	Milk yield per day (litre)	Highest daily milk yield (litre)
L	70	280.4±20.2	1092.8±207.4	3.79	6.60
M	237	324.7±73.9	2132.9±78.3	6.57	17.40
N	164	316.8±83.6	2262±663.9	7.14	18.40
MLF_1	157	313.7±96.7	1240.5±479.8	3.95	7.57
MLF_2	118	313.9±90.1	1423.3±534.5	4.53	8.30
NLF_1	45	326.7±96.4	2041.2±540.9	6.25	16.65
NLF_2	55	321.4±118	2325.6±994.4	7.22	19.35
$NMLF_2$	168	317.6±78.4	2294.6±772.1	7.22	18.80
$NLMG_1$	70	329.1±89.8	1994.9±635.0	6.06	18.50

L, Local; M, Murrah; N, Nili-Ravi, G, Santa Gertrudis.
Source: Bingzhuang *et al.* (2003) & Borghese (2005).

Table 5. Milk production characteristics of buffalo in BD (Uddin *et al*., 2016).

Parameters	% of respondents	
	Household	*Bathan*
Milk production		
a) Milking once in a day	33	87
b) Milking twice in a day	67	13
Milk yield/animal/day (litre)		
a) One to up to two	20	74
b) Two to up to five	38	26
c) Five and above	42	0

6. Milk quality of buffalo

Buffalo has inherent ability to produce milk with high milk fat contents ranging from 6.0-8.5%. Because of the higher milk fat contents, buffalo milk is preferred over cow milk and fetch better price in milk market (Sarwar *et*

al., 2002a,b; Khan *et al.,* 2008). Comparative milk composition in the buffalo and the cow is presented in Table 6. Buffalo milk is healthy as it is richer in saturated fatty acids, higher fat, protein, calcium and cholesterol contents. It also contains less cholesterol and more tocopherol which is a natural antioxidant. Buffalo milk appears whiter than cow milk because it does not contain the yellow pigment carotene.

Table 6. Typical composition of buffalo and cow milk (Anonymous, 1995).

Parameters	Buffalo milk	Cow milk
Total solids (%)	16.30	13.10
Fat (%)	7.90	4.30
Protein (%)	4.20	3.60
Lactose (%)	5.00	4.80
Tocopherol (mg/g)	0.33	0.31
Cholesterol (mg/g)	0.65	3.14
Calcium (mg/100g)	264.00	165.00
Phosphorus (mg/100g)	268.00	213.00
Magnesium (mg/100g)	30.00	23.00
Potassium (mg/100g)	107.00	185.00
Sodium (mg/100g)	65.00	73.00
Vitamin A (IU)	33.00	30.30
Vitamin C (mg/100g)	6.70	1.90

Buffalo milk contains various fatty acids, especially conjugated fatty acids (CLA), which possess beneficial biological activities in mammals. The cis-9, trans-11 CLA (rumenic acid, RA) has been shown to reduce the incidence of cancer. The CLA content of milk is strongly linked to the ruminal biohydrogenation (BH) of cis-9, cis-12 C18:2 (linoleic acid, LA) and cis-9, cis-12, cis-15 C18:3 (linolenic acid, LNA). In Argentina, the buffalo was recently introduced as an alternative breed with milk of good nutritional value and with high protein and fat content (Van Nieuwenhove *et al.,* 2004). The lower heat capacity and the higher thermal conductivity and thermal expansion of buffalo milk clearly indicate that a lower amount of heat energy is required to achieve certain desired heat effects in buffalo milk as compared to cow's milk (Sindhu and Arora, 2011).
Like cow milk, buffalo milk is used for different milk products such as butter, butter oil (ghee), soft plus hard cheeses, condensed milk, evaporated milk, ice cream, yoghurt and many more. The most popular of these products is the soft Italian cheese called mozzarella. A characteristic of buffalo milk is the very high fat content and the fat to protein ratio is about 2:1 (Addeo *et al*., 1993).

7**. Opportunities of dairy buffalo development in Bangladesh**

The improvement of dairy buffalo production could be considered for the following reasons: a huge number of buffaloes are rearing at free range condition having little milk production. Those females could be considered under planned development programme described below for increasing milk production. Buffalo rearing with cattle could reduce the feed wastage and proper utilization of all types of feeds. Milk price depends on the fat % of milk. Thus higher milk fat, protein and SNF of buffalo milk might be a useful concern for milk seller and buyer as well. Public awareness of buffalo milk should be increase which will play a positive role on the advancement of dairy buffalo production.
The following could be considered for the development of dairy buffaloes in Bangladesh: the buffalo farmers should be listed by local artificial inseminators either by government or private sectors. Buffaloes reared under farm and semi-extensive condition should be inseminated by the imported semen of proven buffalo bull. Capacity building of buffalo farmers should be developed on buffalo farming by training, workshop, field day and vaccination campaign etc. Exchanging the proved improvement at farm and semi-extensive levels to the free range buffalo farmers and inspire them to screen and rear the elite females at home rather than free range. Best to best mating at all rearing systems should be done according to milk production concept either by elite bull exchange or artificial insemination.

8. Challenges in dairy buffalo production in Bangladesh

8.1. Problems in general husbandry practices

The proper husbandry practices of the animals to some extent depend on the production systems. There are some problems in the general husbandry practices such as no housing system, no artificial insemination system, no routine vaccination programme, no animal identification and recording system. The management practices

adopted by buffalo farmers usually depends on the type of production in which they are involved. At the rural level production is usually based on a small herd of mixed ages and sexes generally for draught and breeding purposes. Cattle and buffaloes are kept at night, and spend the day time grazing for roughage, together with other animals. Grazing and browsing ranges over practically all village lands during the dry season but is restricted to upland non-cropped areas during the rainy season. Animals are more difficult to herd during the cropping season and buffaloes are considered to be more difficult to herd than cattle. Sometimes the whole village herd will lie down together in mud wallows remaining asleep or ruminating till evening. By about after noon they emerge out of their mud wallows covered with grey slime and graze on roads and other aquatic herbage till late in the evening. After this, they move to dry grounds where they remain till the day-dark. About 60% of the farmers dispose of dung and other refusal to pits for further use while the rest (40%) use them otherwise (as fuel and other purposes). Biogas plants are a very new concept to farmers during the early 2000s, and a very negligible (1%) of farmers had them (Huque, 2013).

8.2. Feeds and Feeding problems

Feeds and feeding of buffalo in Bangladesh is shown in Table 7. The major feed for buffalo is rice straw, crop residues supplemented with marginal quantities of cereal and oil seed by-products and weeds from crop fields (Saadullah, 1990). Lack of quality feeds, fodder and pasture land for buffalo rearing; hence, nutritional deficiency cause poor production profile of buffaloes in Bangladesh. Buffaloes are raised mainly under a semi-intensive system on plain land and marshy land where there is limited pasture land. Recently, an intensive system for buffalo production is practiced by Lal teer Livestock Limited. The basal diet for buffaloes is rice straw, poor quality roughage having inadequate source of energy and protein. Buffaloes are allowed to graze on natural pasture, fallow land or road side during the day time. No concentrate or mineral supplements are usually fed. For milch buffaloes, the calves are usually separated from the dam in the evening or night and the milking only once in the morning. Sugarcane leaves, micro silage of sugarcane leaves, cassava leaves, roadside grass, elephant grass, and maize with corn cob and pineapple bran are also rearly used as feeding stuffs (Faruque, 2003). However, buffalo in the tropical area for feeding systems are based on unrestricted grazing, tethering or stall-feeding and free grazing, sometimes under the control of herders, is common in countries with native grasslands and fallows. Tethering and stall-feeding are practiced in areas where there is limited land and with cropping. In many situations, there appeared to be roughage limitations for animals in the stall-feeding and tethering systems (Wanapat and Chanthakhoun, 2009).

Table 7. Feeds and feeding of buffalo in BD (Uddin *et al*., 2016).

Parameters	**% of respondents**	
	Household	***Bathan***
Sources of feed		
a. Own land	8	5
b. Public land	87	90
c. Leased land	5	5
Improved feed		
a. Mixed feed	-	-
b. Feed store	-	-
Feeding system		
a. Grazing in public land	12	100
b. Grazing in public land and cereal grain	88	0
c. Grazing in public land and rice gruel	0	0

In the household farming, after morning milking, buffaloes were allowed to graze in fallow or road side land up to evening that covers approximately 8-9 hours per day. From the evening to next morning, animals were tied up in homestead and they were offered mainly rice straw with little concentrate mixtures (wheat bran, rice bran, rice polish etc.). However, in *bathan* farming, buffaloes were raised in the open grazing area throughout the year. Except calves, all buffaloes (adult and growing heifers) were allowed to graze freely in the public land. In the evening, calves were enclaved in an area locally called "kella" to protect from wild animals. Any extra feed was not provided to buffalo in *bathan* farming (Uddin *et al.*, 2016).

8.3. Poor reproduction

Delayed puberty, seasonal breeding, long calving interval, and poor estrus detection hampered the reproductive efficiency in the female buffalo. The reproductive characteristics of buffaloes in Bangladesh are presented in Table 8. Most of the respondents reported that the average age at first heat was between 39 and 40 months in both household and *bathan* farming (Uddin *et al*., 2016). Nahar *et al.* (2012) also found similar findings of age of first heat in Mymensingh and Laximpur district. It was reported (Mudgal, 1999) that the age at first calving for Nili-Ravi buffaloes ranges from 30-54 months and for Khundi buffaloes ranges from 48-57 months. The natural mating system was practiced in both the system of farming and artificial Insemination (AI) was not yet practiced commercially in Bangladesh due to the weakness of oestrus symptoms and variability of oestrus length in buffalo. The review of Huque and Shahjahan (2016) showed the reproductive performances of Bangladeshi male and female buffaloes with different genotypes which agreed the few parts of present contents on reproduction.

Table 8. Reproductive characteristics of buffalo in Bangladesh (Uddin *et al.*, 2016).

Parameters	% of respondents	
	Household	*Bathan*
Age at first heat (months)	37	38
Service per conception (no.)	1.9	2.1
Gestation length (days)	310	315
Calving interval (days)	390	420
Post partum heat period (days)	125	130
Total lactation length (days)	270	215
Total milk yield/animal (liters)	799	435
Mating of buffalo		
a) Natural mating	95	99
b) Artificial insemination	5	-

8.4. Summer anoestrus in buffalo

Domestic buffaloes have a tendency to breed seasonally (Basu, 1962; Qureshi *et al*., 1999) showing a suspension of sexual activity during summer in almost all parts of the world (Hafez, 1955; Chaudhry, 1988; Shah, 1990). During this period, they remain sexually inactive without any signs of oestrus. This condition is popularly known as summer anoestrus. The incidence of summer anoestrus generally varies between 36.6% and 59.5% (Luktuke and Sharma, 1978; Singh *et al*., 1989). Furthermore, it was reported to be higher in nomadic buffaloes (83.0%) than the housed rural ones (63.0%) (Brar and Nanda, 2004). Summer anoestrus may be due to direct exposure to sunlight in the former case. The condition is characterized by inactive, smooth ovaries (Roy *et al*., 1972), abnormal hormonal profiles (Razdan, 1988). Serum or plasma gonadotrophin levels (ng⁄ml) in buffaloes during summer season are given in Table 9. Several factors like environment, hormones, nutrition and management have been proposed to cause summer anoestrus in buffaloes. Thermal stress is one among the environmental factors that play a very significant role. The effect of thermal stress and season on dairy cattle reproduction has been reviewed in several recent published reports (Wolfenson *et al*., 2000; De Rensis and Scaramuzzi, 2003). Post-partum anoestrus in buffalo has also been summarized in a number of reviews (Gupta and Das, 1994; El-Wishy, 2007a,b).

Table 9. Serum or plasma gonadotrophin levels (ng⁄ml) in buffaloes during summer season.

Stage	Prolactin	FSH	LH	Workers
Cycling	170.0-248.9	-	16.5-20.0	Sheth *et al*., 1978
	112.0-366.0	20.7-29.6	8.3-9.6	Heranjal *et al*., 1979a
	-	41.5-49.1	4.4-19.6	Janakiraman *et al.*, 1980
	-	-	0.7-1.8	Kaker *et al.*, 1980
	248.0-430.0	-	-	Kaker *et al.*, 1981
	319.0-371.0	-	0.9-1.3	Singh and Chaudhry, 1992
Anoestrus	504.0-800.0	15.3-17.4	6.9-9.4	Heranjal *et al*., 1979b
	-	-	2.5-8.7	Razdan *et al*., 1981
	249.0-739.0	-	-	Arya and Madan, 1983
	464.0-800.0	-	-	Heranjal *et al.*, 1984
	104.8-165.7	5.5-6.2	-	Jain 1987
	-	9.1	-	Madan, 1987

During hot summer months, buffaloes show hyper-prolactinemia (Sheth *et al*., 1978). Buffalo heifers show seasonal changes in the level of circulating FSH which coincide with the pattern of breeding (Sheth *et al*., 1978; Janakiraman *et al.*, 1980). The lowest value was observed in the non-breeding season (March to June) during hot months. In general, the FSH level in anoestrus buffalo's remains low (Heranjal *et al*., 1979b; Madan, 1987) when compared with the basal level (Heranjal *et al*., 1979a) recorded in normal cycling buffaloes (Table 9). Luteinizing hormone plays an important role in contributing ovarian inactivity in buffaloes during summer months (Razdan *et al.*, 1981). The secretion was lower during summer compared to winter (Heranjal *et al.*, 1979b; Razdan *et al.*, 1981).

8.5. Buffalo diseases

The retrospective study findings revealed that high incidence of hemorrhagic septicemia (HS) and calf pneumonia, helminthiais, enteritis and mastitis as the major disease problems for buffalo production in Bangladesh (Figure 3). To study the status of clinical and subclinical mastitis, a total of 114 milk samples were randomly collected from buffalo cows. The prevalence of clinical and subclinical mastitis in buffalo was found to be 23.68% and 31.57%, respectively. Hemorrhagic septicemia and calf pneumonia were reported to be the major disease problems by the farmers and local vets (Islam *et al.*, 2016).

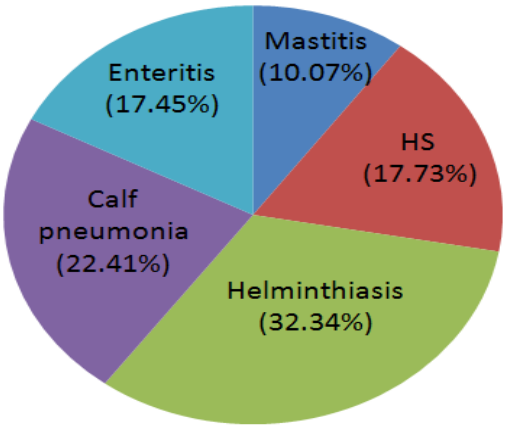

Figure 3. Overall diseases status of buffaloes in some regions of Bangladesh (Islam *et al.*, 2016).

The prevalence of GIT parasites was alarming in buffaloes in all over the areas of Bangladesh. Research findings of Islam *et al.* (2016) revealed that 64.2% of the studied buffaloes were infected with one or more species of gastro-intestinal parasites. Younger animals were found to be more susceptible to both parasitic and protozoan infections but sex was found not to affect the incidence. Most of the non-parasitic enteritis was caused by *E. coli* (62.5%) and *Salmonella* spp. (29.16%). Clinical and subclinical mastitis were recorded in 23.68% and 31.57% of samples analyzed, respectively. The most isolated pathogens (Figure 4) responsible for mastitis in buffalo was the Coagulase Negative *Staphylococci* (CNSs), *Streptococcus* spp., *Bacillus* spp. and *Staphylococcus aureus* (Islam *et al.*, 2016).

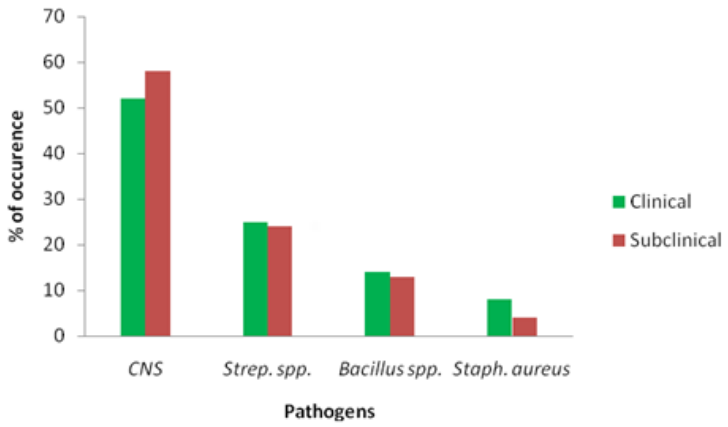

Figure 4. Causes of clinical and subclinical mastitis in dairy buffaloes (Islam *et al.*, 2016).

9. Conclusions

This review mainly focuses on the present situation and future prospects of dairy buffalo production in Bangladesh. Buffalo population has been increased more in the recent years than past. Buffalo could be a major source of milk to reduce the deficiency of milk in Bangladesh. The feeding system is still traditional and buffaloes are not getting balanced ration or feed as they required. There are high incidence of gastrointestinal tract parasitic and protozoan infestation, diarrhoea, hemorrhagic septicemia, calf pneumonia and mastitis as the major disease problems for buffalo production. Buffalo improvement programme through systemic breeding between screened local elite females and imported proven bull semen through AI at farm and semi-extensive levels could be a step towards the desire buffalo breed development. However, improved feed and management system as well as technical knowledge along with milk value chain in different farming systems will increase the dairy buffalo production in Bangladesh.

Conflict of interest

None to declare.

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