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# Pabna Cattle of Bangladesh: A Review

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***Abstract***
*Pabna cattle is a local dairy type of cattle of Bangladesh derived from multiple zebu inheritance repositored in Pabna and Sirajgonj district evolved during 4th decade of 20th century. Milk Vita, the largest dairy cooperative of the country, emerged with the blessings of bathans of Pabna cows in Sirajgonj (flood plain Basin of Jamuna River) following independence in 1971. In order to have more milk per cow a steady revolution of exotic-local crossbreeding has been underway causing a threat against existence of this type of cattle. Bangladesh Livestock Research Institute (BLRI) has made an impetus to further develop and conserve this type ex-situ in the late eighties of 20th century and coined BCB-1 cattle. Pabna cattle appears with almost 100% red coat with black skin, muzzle and other exposed area. Bull and cow mature at 450 – 500 kg and 224 – 280 kg body size, respectively. Height at wither varies between 111 to 118 cm. This verge of body size placed them in between other types of indigenous cattle and temperate-zebu crosses. Highest lactation milk yield of Pabna cows averaged at 1367 L in 257 days with a mean daily yield of 5.3 L in Baghabarighat bathan of Sirajgonj. Position of Pabna cattle in terms of body weight, body size, growth rate and milk yield lies between exotic × deshi cross and indigenous cattle. However, milk yield studied ex- situ in BLRI showed that cows produce a bit lower milk yield than in in-situ. Bulls have a tremendous demand for sacrificial purposes during greatest Muslim religious festival called Eidul Adha. A collection of facts and figures on the morphology, productive and reproductive characteristics of the animals in question has been furnished in 7 tables and 2 photographs accumulated from available literature. Molecular genetic studies apart from merely phenotypic investigations need to establish intellectual property rights (IPR) and characterize this type of animals. In-situ improvement and conservation of this type of animals is a timely demand without which this precious bovine genetic resource may irreversibly be lost. Present narrative review might be beneficial in setting national action priorities for livestock conservation and sustainable improvement.*

***Key words****: Pabna cattle, BLRI, bathan, indigenous, phenotype*

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## I. Introduction:

Bangladesh owns 24.5 million heads of cattle of which 80% are non-descript indigenous cattle kept by the rural farmers (Habib and Bhuiyan, 2021). Among them, some types like Red Chittagong (RCC), Pabna, North Bengal Grey and Munshigonj cattle have been considered to be almost uniform phenotype and better in performance potential compared to other non-descripts (Hamid et al , 2017; Habib and Bhuiyan, 2021). Although home tract of each of the type is known but no survey work has yet been undertaken to disclose their exact number. However, because of on-going crossbreeding/upgrading program their population size has been shrinking day by day (BLRI 2005 and 2006; Habib and Bhuiyan, 2021). Pabna cattle is a dairy type localized in Pabna and Sirajgonj district which is considered to be The aim of this narrative review is to highlight Pabna cattle as a valued genetic resource that needs attention to set national priorities for sustainable use through its conservation and genetic improvement.

**History of how did Pabna cattle evolve**: Pabna cattle is recognized as a dairy type zebu cattle concentrated in Pabna and Sirajgonj district of Bangladesh (Nasim, 1965; Ahmed and Islam, 1987; Udo et al., 1990). Shahjadpur, Bera and Sathia upazila (sub-district) of greater Pabna district are the home of this type of cattle (BLRI 2005 and 2006). This type of cattle has been reported to evolve out of a blended composition from Hariana, Tharparker, Dhani, Sahiwal, Red Sindhi and local inheritance of Bos indicus bovine genetic resources bred over substantial number of generations that required more than 50 years. During that period intensive visual selection was likely to be happened (Ahmed and Islam, 1987; Deb et al., 2008; BLRI, 2011; Hamid et al., 2017; Habib and Bhuiyan 2021). Prior to appearance of Pabna cattle in the said low-lying Jamuna flood plain

basin only poor performer indigenous (deshi) cattle were raised by the subsistence farmers for the purpose of agricultural operation (Hamid et al., 2017). During the last decade of British rule Lord Linthgow, the then viceroy of India, paid his keen attention towards cattle development in this particular region. Active Brahmaputra and Jamuna flood plain agro-ecological zone (AEZ-14) of present Bangladesh includes Pabna and Sirajgonj district which was rich in alluvial soil and as a result became conducive for growing green and lustrous natural grasses following seasonal inundation (Ahmed and Islam, 1987; Deb et al., 2008; Hamid et al., 2017). Abundance of grasses as a natural cattle feed was an added advantage for high stocking density cattle raising in that locality (Ahmed and Islam, 1987). Exceptional localized potential stated above inspired Lord Linthgow to bring 1000 Hariana stud bulls from northern India and distributed in different parts of the then East Bengal including Pabna and Sirajgonj district (Ahmed and Islam, 1987; Majid et al., 1995). With the progress of time Tharparker, Sahiwal, Red Sindhi and Dhani bulls were introduced to breed cows apart from Hariana. Thus, local cattle became upgraded with north Indian *Bos indicus* blood over many generations of breeding. An intensive visual selection in the herd had been continued till 1950. This endeavor resulted in remarkable increase in animal's body size and milk yield. Fixation of genes and adaptation with the environment gave the animals a unique but almost uniform phenotypic characteristics and type and thus took the name "Pabna cattle". Some authors like BLRI (2005 and 2006) and Hamid et al., (2017) viewed Pabna cattle having potential for both milk and beef production. Mature body weight of bull and cow ranges between 450-500 kg and 250-300 kg, respectively (Deb et al., 2008). In 1973, Milk Vita (Bangladesh Milk Producers' Cooperative Union Limited, the largest dairy cooperative in this region) emerged with dairy development program in that particular region and beyond (Hossen, 2006).

**Further dairy improvement endeavor:** Milk Vita adopted AI program in the milk pocket area called "Bathan" in Baghabarighat, Shahzadpur with *Bos taurus* semen after possession of independence in 1971. Gradually government and some other NGOs came up aside with similar upgradation program of cattle thereby. With their effort Pabna cattle in large scale got crossed with Holstein Friesian, Jersey and Sahiwal. Farmers welcomed such sort of crossbreeding/upgrading because infusion of Bos taurus inheritance could increase milk yield of cows (BLRI, 2005 and 2006). These efforts caused a serious threat to Pabna cattle leading to a gradual decrease in the number of Pabna cows in pure genetics (BLRI, 2005 and 2006). No authentic survey has so far been made to enumerate Pabna genotypes available right now. However, small herds of Pabna cattle can still be seen in char areas of Bera, Sathia and Shahzadpur upazila in the house of low input farmers.

**Government improvement and conservation program**: Pabna cattle succeeded to draw attention of government in 1988. As an implementing organization (BLRI) made an impetus in order to further develop this genotype of cattle and thus established a small herd of purebred Pabna cattle in 1988. After 4 years, planned breeding works was launched to characterize, conserve and improve production potential of Pabna type cattle genetic resources (BLRI 2005 and 2006; BLRI 2008). Animals of the BLRI breeding herd were selected and bred on the basis of live weight and milk yield over twenty years (Deb et al 2012). As a result little improvement in liveweight and milk yield had been taken place. During this period, the genotype under discussion possessed prominent beef characteristics. Later, the genotype was named as Bangladesh Cattle Breed 1 (BCB-1). The physical appearance and performance of the animals were changed to a distinct type compared to its progenitor (Deb et al., 2012). A field trial to study their performance 2 bulls and 10 heifers were distributed to interested farmers of Chilmari upazila of Kurigram district in collaboration with an NGO called Grameen Shakti. Animals of next generation born there in were brought under full recording system of pedigree, production, reproduction and health aspects (Deb et al 2008). BLRI has been maintaining two institutional herds of which one in BLRI Head Quarter in Savar, Dhaka and the second one in Bhagabarighat, Shahzadpur, Sirajgonj. Shahzadpur, Bera and Sathia upazila are considered as home of Pabna cattle. Small farmers of Char areas of those upazilas still own and breed Pabna cattle in their herd. An attempt is underway to collect apparently better individuals from those home tracts and to breed them in the institutional herd of BLRI. BLRI continued a selection program for improving livewight and milk yield in Pabna cattle on station in Savar, Dhaka and periodic genetic progress was measured. In an evaluation of the period between 1992 and 2006 it was found that lactation milk yield and lactation length both increased at the rate of 5.84L and 1.29 d, respectively per generation in an on-farm selective breeding program (BLRI 2007). Positive changes in the reproductive traits were also achieved. In another report, it was stated that Pabna cattle improvement project launched in 1994 in BLRI achieved a substantial progress in genetic improvement. A breeding population comprised of 54 cows, 59 calves, 21 yearling bulls, 25 heifers and 16 mature bulls. Dairy traits and reproductive features improved to a great deal through selective breeding. Main phenotypic selection criteria were coat colour (red), body conformation (medium size, typical horn of Pabna cattle, body weight), average milk yield (5-6kg/d/cow) in first 100 day of lactation. In 1994 a selected stock comprising of 38 milking cows, 42 calves, 47 yearling bulls and heifers and 19 bulls was developed. From these stocks average daily milk yield increased from 3.18L to 4.15L in one generation selection. But in second generation improvement did not sustained. Birth weight changed from 20.10 to 20.20 kg in the same time (BLRI 2000). Both findings might be resulted from same herd and 14 breeding bulls but in different time period. The limitations of these selection programs were poorly

defined selection criteria, absence of reliable breeding value estimation technique and small and closed herd maintained *ex-situ*. After reviewing the limitations of breeding operation, an Open Nucleus Breeding System (ONBS) is in progress in BLRI regional station, Baghabarighat, Sirajgonj cattle herd. On-station herd of Pabna cattle in BLRI, Savar, Dhaka and Baghabarighat, Sirajgonj are composed of 180 and 140 animals, respectively. The former herd is a closed but 28 years old and the later herd is of 4 years old but having access to new individuals from villages. Program involving animals from village herds are still almost absent. In different endeavors of this type of cattle they were called in different names. Milk vita called them Pabna Milking Cow (Hossen, 1906), BLRI called BCB-1 (Deb et al., 2008; Deb et al 2012), Khan et al (2017) narrated them Pabna dairy Cattle and commonly called Pabna cattle (Hamid et al, 2017). Deb ei al., (2008) regarded this type of indigenous cattle as an assorted type of cattle known as Pabna cattle.

**Phenotypic characteristics**

**Coat Colour and pigmentation pattern**: Almost unicolour pattern of coat in Pabna cattle gave it a uniform appearance. Hamid et al., (2017) described coat colour of Pabna cattle to vary from solid red to grey or sometimes admixture of both Plate 1; Plate 2). Bulls often appears with deep grey to white coat along with shades on it. Red with gradual shift to fawn or light brick at the ventral part of the body were identified as the true representative coat colour pattern of Pabna cattle (Deb et al., 2008). According to Majid and Talukder (1995) the only 'red' is enough to express the coat colour phenotype of Pabna cattle. Siddiky (2018) described coat colour of Pabna cattle to be red or grey and bulls often may found with whitish coat or sometimes blackish shoulder on red background (Plate 1a and 1b). Peculiarly it was seen in Baghabarighat herd that coat colour changes within the range of bright to light red in same individual in different seasons of the year in some animals. Skin, muzzle, eyelid, hoof, horn and switch appear with black colour (Hamid et al., 2017;Talukder et al., 2017) or with reddish black (Talukder et al., 2017). Some animals come up with white horn as well (Talukder et al., 2017).

**Body measurements**: Body measurements or morphometry describe dimension of animals. Live weight and body dimension together can express actual size of an animal which characterizes a type or breed. Table 1. Summarizes body measurements of sex combined mature Pabna cattle in 3 different locations. Body length (shoulder point to pin bone) measured by different authors ranged from 111.38 to 164.39 cm. Observation made by Udo et al (1999) was the longest one. It might be due to animals sampled from their home tract or due to sampling error. Heart girth values centered within a small range of 147.00 to 151.05 cm. Height at wither varied from 111.00 to 118.21 cm which indicates an insignificant difference ($p>0.05$) between the observations. Average tail length, horn length, horn circumference and ear length were found to have very close values as reported by Talukder et al. (2017). It may be inferred that Pabna cattle at maturity has almost an uniform body size irrespective of location or management system. Uzzaman et al (2011) reported body measurements of Munshigonj mature cattle in Bangladesh. Their values for height at wither, body length and heart girth respectively, were 110.61, 113.91 and 89.7 cm respectively. There is a great variation of heart girth between Pabna cattle and Munshigonj cattle although body length and height at wither are at close. Habib et al (2003) measured height at wither, body length and heart girth of Red Chittagong Cattle (RCC) of Bangladesh and reported the measures to be 107.71, 114.38 and 139.85 cm respectively. Results show that height at wither and heart girth are shorter in RCC than in Pabna cattle although body length lies a within the same range. Namikawa and Tsubota (1984) cited by Hamid et al (2017) stated body measurements of Non-Descript Deshi (ND) cattle of Bangladesh of which every measurement was smaller than those in Pabna cattle reviewed herein. Therefore, it can be said that Pabna cattle is larger than ND but almost similar to the size of RCC or Munshigonj (lower heart girth) cattle.

**Production characteristics:**

**Live weight and growing efficiency**: Of live weight, birth weight data of Pabna cattle became available in plenty compared to live weight at subsequent ages. Table 2 represents birth weight records of Pabna cattle although most of them were recorded in BLRI nucleus herd in different years during ongoing selection program. Animals of this nucleus were named as BLRI Cattle Breed 1 (BCB-1). Table 2 shows that Pabna male calves weighed from 20 kg to 20.85 kg while female calves weighed from 18.19 to 19.29 kg. However, on farm records of 23.39 to 24.39 kg birth weight of sex pooled calves in Milk Vita bathan of Shahjadpur have also been reported (Hossen, 2006). Male calves always weighed heavier than female (Deb and Talukder, 2005; Talukder and Haque, 2005). Within breed variation in birth weight was partly genetic but varied largely due to environment specially health and nutrition (BLRI, 2001). Pabna calves weighed much heavier than contemporary calves of Red Chittagong (RCC) cows. RCC male and female calves weighed 12.69 (10-16) and 10.20 (8-12) kg, respectively (BLRI, 2005 and 2006). Pabna calves weighed heavier than calves of RCC which is heavier than deshi calves. Variations in birth weight of Pabna calves were found to be attributed significantly ($p<0.01$) by sex of the calf, calving order of dam, year of birth, sire of the calf and generation of selection in an experiment conducted in a nucleus herd of BLRI ( BLRI, 2005 and 2006). Birth weight of calves in Pabna cows

was found to be affected positively ($p>0.05$) by calving order of mother cow and sex of the calf. Average calf birth weight was found to linearly increase from 18.89 kg to 21.22 kg within 1st to 4th calving order in a nucleus herd of BLRI (Talukder and Haque, 2005). Friesian-Pabna (FP) and Sahiwal-Pabna (SP) crossbred calves were found to be heavier than pure Pabna calves as observed by Haque et al (1999). They reported average birth weight of 22.50, 21.26 and 17.92 kg for FP, SP and Pabna calves.

On-station live weight of Pabna male and female calves in BLRI herd at 6 months of age were recoded as 59.59 and 56.30 kg, respectively. At 12 months, corresponding live weights were 104.85 and 93.94 kg, respectively (BLRI, 2001). BLRI (2001) showed growth rate from birth to 6-month and birth to 12-month of age in male and female Pabna calves to be 228.74, 258.33 and 209.05, 212.15 g/d, respectively in the animals reared in BLRI Pabna cattle herd (Table 2). A good number of authors studied mature body weight of Pabna bulls and cows. Figures of their studies verged at 450 – 500 kg for bull and 224- 280 kg for cow (Table 3). Akhter et al (2004) compared growth rate of Pabna and Red Chittagong cattle in BLRI, Savar, Dhaka. According to them growth rate of Pabna ( 225±22.4 g/d) was a little higher than in Red Chittagong cattle (217±7.1 g/d) although they tested with small sample size and age of the animals had not been mentioned.

**Reproductive Performance**: Measures of reproductive efficiency of Pabna cattle was much better than that of any other local and even Sahiwal cows. Their age at first service, age at first calving, calving interval, post-partum service period, days open, dry period and lactation length all were better in Pabna cows compared to other indigenous cows of Bangladesh. Their age at first heat, age at first calving, gestation length, calving interval, post-partum service interval, days open, dry period and lactation length in days were 686.6, 1007, 283.1, 445.7, 158.5, 165.4 and 263.2, respectively (Majid and Talukder, 1995). In BLRI *ex-situ* institutional herd, heifers manifested age at first heat between 22 and 28 months (Deb et al, 2007; Majid and Talukder, 1995). But the same phenomenon manifested in heifers of Milk Vita region in Pabna and Sirajgonj district (home tract of Pabna cattle) took a bit longer time which figured at 33.31 to 39.23 months, respectively (Table 4). This discrepancy occurred might be due to difference in the management practices of which health and nutrition played the dominant role. Akhter et al (2004) observed that heifers of this type weighed 216.8±6.59 kg when they showed first estrus.

Khan et al., (1999) cited by Mostari et al., (2008) mentioned that number of service per conception in RCC and Pabna cows were 1.61 and 1.57, respectively which is very similar to the figures summarized in Table 4 for Pabna cows. Mostari et al (2008) viewed that number of determinants such as quality and quantity of semen, heat detection efficiency, timing of insemination, season of insemination, disease prevalence and inseminator's skill may contribute in the number of insemination required for conception. Management factors are more responsible than breed/type *per see* to control this phenomenon. Oestous cycle length of Pabna cows studied in BLRI resulted fairly in a consistent value of 21.0±0.05 days. Age and weight at first calving averaged at 42.10 m and 305.0 kg, respectively (BLRI, 2001) which have been demonstrated in Table 4. A perfectly consistent calving interval ranging from 435.50 to 453.63 days was found in the available literature irrespective of farming system which indicates regular calving fashion of this type of cattle. This virtue has been echoed in the short 'days open' period verged between 149.5 and 165.49 days (Table 4). Gestation length of Pabna cows was absolutely less variable and centered at 283 days as Tabulated in Table 4. This length is a little shorter than in RCC and deshi cows which required 286±1.11 and 285±1.14 days, respectively for the same purpose (Akhter et al, 2004).

Literature on male fertility of Pabna cattle was not adequately available except one on-station study with semen quality and quantity (Table 6). Since management attributes affect fertility, therefore, it is not a good indicator to describe any breed/type. Mostari et al (2009) recorded semen quality and quantity parameters of Pabna bulls of different ages (2-3 year to 6-7 year) in BLRI station. Age difference was not significant ($p>0.05$) except normal sperm percent (Table 5). However, no serious deficiency or unique evidence was noted in the semen profile. Literature on other bull fertility parameters including libido status have not yet appeared.

**Dairy potential :** Highest lactation milk yield of Pabna cows in Baghabarighat, Shahjadpur bathan averaged at 1367 L in 257 days (daily average 5.3 L) (Hossen, 2006). A selection program with Pabna cattle in BLRI resulted in an increase of daily milk yield from 3 L to 5 L during the period between 1992-'93 and 1997-'98 (BLRI, 1992'93 – 1997-'98 ). According to BLRI (2007) average daily milk yield of 354 BCB-1 cows figured at 3.608±0.81L in institutional herd. The cows reached their peak yield on 23.45±*1*4.89th days of lactation. At similar management RCC cows were found to produce 1.5 to 4.0 (mean 2.73) kg milk per day over a lactation period of 150-360 days (BLRI 2005 and 2006). Published information on lactation profile are mostly available from intensively managed herd which show that maximum and minimum lactation length are 203 and 257 day, respectively but lactation yield travelled over a wider range from 670 to 935 L. However, Hossen (2006) reported an amount of 1367 L milk in 267 days in Pabna cows managed extensively in *in-situ* bathan of Baghabarighat, Shahjadpur which is far above from those of BLRI on-station herd (Table 6). Lactation yield of RCC and deshi cows were found to be lower than in Pabna cows and the yield of these 3 types of cows averaged at 578±62.4, 552±15.87 and 876±26.55 L respectively (Akhter et al, 2004). Quddus and Amin (2010) mentioned that average daily milk yield of Bangladeshi native and crossbred cows of 1-8 lactation order ranged

from 1.6 - 2.0 L and 4.6 – 9.0 L, respectively. It shows that average daily milk yield of Pabna cows stood in between those two types of cows.

**Beef production efficiency:** Data on beef production in Pabna cattle are very scant in literature. Khan et al (2005) studied carcass characteristics of Pabna bull calf of 3 different age group such as 6-12, 12-24 and 24-36 months. In their experiment dressing percentage (DP) was not significantly ($p>0.05$) affected by age but *longissimus dorsi* muscle area, meat-bone ratio and weight of GI tract as percentage of live weight differed significantly ($p<0.05$) between age groups. *Longissimus dorsi* muscle area and meat-bone ratio increased linearly with increase of age but GI tract as percentage of live weight decreased linearly (Table 7). DP of Pabna bulls mentioned by Khan et al., (2005) gave poorer values compared to those reported by Alberti et al (2008) for some standard beef breeds in Europe. They mentioned that DP of Aberdeen Angus, Charolais and Limousine bulls were 56.2, 61.0 and 63.7 whereas mean DP of Pabna bulls reported by Khan et al., (2005) was 48.0$\pm$0.98 only. Genetic and non-genetic attributes might contribute in the discrepancies to happen. Moreover, genetic make-up and finishing condition of European standard beef breeds was far conducive than that was in case of Pabna bulls at BLRI.

## II. Conclusion:

Pabna cattle originated from blended inheritance of some Indian zebu cattle like Hariana, Thrparker, Red Sindhi, Sahiwal and Bangladeshi Local in the Pabna and Sirajgonj district of Bangladesh following 1939. Its performance as dairy cow is midway between crossbreds (Holstein Friesian x Local; Sahiwal x Local) and local ones and therefore, suitable for medium input or small scale farming system. Bulls are of greater choice to the beef producers as well as to the beef consumers. Most importantly, this type of cattle is predominantly habited in Pabna and Sirajgonj district especially in the Jamuna river basin area. It is worthwhile to mention that based on this type of dairy cattle Bangladesh Milk Producers' Cooperative Union Limited (Milk Vita) had started its journey in Baghabarighat, Sirajgonj as a mega dairy cooperative in the country. Almost uniform red coat, medium body size and characteristic body conformation phenotypically conform a breed but molecular genetic studies are still awaiting to recognize them as breed. As regards to body weight, body size, growth rate and dairy potential Pabna cattle is superior to deshi but inferior to exotic x deshi crosses and may be considered as a suitable type for small scale or medium input dairying especially in their home tract. Further phenotypic and genetic studies are necessary in order to characterize, to get its recognition as breed/type and to establish IPR. However, due to ongoing rigorous crossbreeding/upgrading program conducted by government or private commercial breeding companies, population of Pabna cattle in their home tract and beyond has been shrinking at a rapid speed. If serious attention is not immediately paid there is every chance of complete disappearance of this valued native well adapted bovine genetic resource of Bangladesh. This review, therefore, would might be immensely useful to identify national priorities for undertaking action to be taken for sustainable use, development and conservation of Pabna cattle, a promising domestic animal genetic resource in Bangladesh.

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**Table 1. Body measurements (Sex pooled mature cattle)**

| Measurements (cm) | BLRI regional station, Baghabarighat | Rural farms in Shahjadpur | P value | Pabna and Sirajgonj | Reference |
|---|---|---|---|---|---|
| Body length (shoulder point to pin bone) | 112.42±0.15 | 111.38±1.53 | 0.005 | 164.39±2.36 | Talukder et al., 2017 Udo et al., 1999 |
| Heart girth | 151.05±1.72 | 147.00±2.40 | 0.202 | 147.56±1.70 | Talukder et al., 2017 Udo et al., 1990 |
| Height at wither | 118.11±1.67 | 111.00±1.28 | 0.0016 | 118.26+3.25 | Talukder et al., 2017 Udo et al., 1999 |
| | | | | 118.21±3.25 | Hamid et al., 2017 |
| Tail length | 83.26±1.45 | 78.38±2.47 | 0.087 | | Talukder et al., 2017 |
| Horn length | 10.33±0.49 | 9.25±1.26 | 0.335 | | Talukder et al., 2017 |
| Horn circumference | 11.81±0.39 | 10.43±0.55 | 0.062 | | Talukder et al., 2017 |
| Ear length | 21.82±0.57 | 22.38±0.80 | 0.591 | | Talukder et al., 2017 |

**Table 2. Birth and pre-juvenile weight (Kg) and growth rate of Pabna calves**

| Stage | Male | Female | Sex pooled | Farming system | Reference |
|---|---|---|---|---|---|
| Birth weight | | | 18.80±0.34 – 21.60±1.58 | On station | BLRI, 2001 |
| | 20.00 | 19.00 | | On station | BLRI, 2004b |
| | | | 20.1±0.23 | On station | BLRI, 2004b |
| | | | 19.7– 20.4 (0-11 generation of selection) | On station | BLRI, 1999 |
| | | | 20-21 | On station | BLRI, 1997-'98 |
| | 20.21± 0.22 | 18.89±0.17 | | On station | BLRI, 2005-2006 |
| | 20.85±0.37 | 19.29±0.38 | | On station | Talukder and Haque, 2005 |
| | 20.21±0.22 | 18.19±0.10 | | On station | Deb and Talukder, 2005 |
| | | | 23.39±0.13 | On farm (Milk Vita) | Hossen, 2006 |
| | | | 24.39-29.07 ($1^{st}$ to $3^{rd}$ generation) | On farm (Milk Vita) | Hossen, 2006 |
| | | | 17.9 | On farm ( Shahjadpur) | Hoque et al 1999 |

| | | | | | |
|---|---|---|---|---|---|
| 6-month | 59.59±2.1 | 56.3±1.44 | | On station | BLRI 2001 |
| 12-month | 104.85±3.40 | 93.94±4.10 | | On station | BLRI 2001 |
| Growth rate (g/d) | | | | | |
| Birth to 6--month | 228.74±11.54 | 209.05±7.54 | 220.0±7.35 | On station | BLRI 2001 |
| 6- to 12- month | | | 242.55±12.32 | On station | BLRI 2001 |
| Birth to 12-month | 258.33±14.53 | 212.15±20.65 | | On station | BLRI 2001 |

**Table 3. Mature body weight (kg) of Pabna cattle**

| Bull | Cow | Sex pooled | Farming condition | Reference |
|---|---|---|---|---|
| | 277 | | On farm | Rahman et al., 2014 |
| 475 | 280 | | On station | Akhter et al.,, 2004 |
| | | 259 kg | On farm | Khan et al, 2017 |
| | 224±19.21 – 279.2±3.48 | | On station | Yeasmin et al., 2017 |
| 450-500 | 250-300 | | On station | Deb et al., 2008 |
| | 259.4 | | On farm | Khan et al., 2017 |

**Table 4. Female reproductive characteristics**

| **Trait** | **Mean** | **Condition** | **Reference** |
|---|---|---|---|
| **Age at first heat** | **843.65±17.77 d** | **On station** | **Deb et al ., 2007** |
| | **806.50+33.8 d (1st generation) 777.3+29.9 d (2nd generation)** | **On station** | **BLRI, 1999** |
| | **686.67+50.37 d** | **On station** | **Majid and Talukder, 1995** |
| | **34.40+1.63 m** | **On station** | **Akhter et al., 2004** |
| | **39.23±4.31 m** | **On farm** | **Hoque et al., 1999** |
| | **34.40±1.63 m** | **On station** | **BLRI, 2001** |
| | **33.31±0.11 m** | **On farm** | **Hossen, 2006** |
| | **843.65±17.77 d** | **On station** | **BLRI, 2007** |
| **Weight at puberty** | **216.8+6.59 kg** | **On station** | **Akhter et al., 2004** |
| **Age at first calving** | **42.10+1.65 m** | **On station** | **BLRI, 2001** |
| **Weight at first calving** | **305.0±22.96 kg** | **On station** | **BLRI, 2001** |
| **Length of estrous cycle** | **21.0±0.05 d** | **On station** | **BLRI, 2001** |
| **Service/conception** | **1.60±0.08** | **On station** | **BLRI, 2001** |
| | **1.50+0.83** | **On station** | **BLRI, 2007** |
| | **1.22±0.02** | **On farm** | **Hossen, 2006** |
| | **1.29+0.06** | **On station** | **Majid and Talukder, 1995** |
| | **1.8±0.20** | **On station** | **BLRI, 1999** |
| **Gestation length** | **283.0±0.06 d** | **On station** | **BLRI, 2001** |
| | **283.11±0.75 d** | **On station** | **Majid and Talukder, 1995** |
| **Calving interval** | **446.0±12.61 d** | **On station** | **BLRI, 2001** |
| | **414.90+1.55 d** | **On farm** | **Hossen, 2006** |
| | **451.65±6.51 d** | **On station** | **BLRI, 2007** |
| | **453.63±12.80 d** | **On station** | **Talukder and haque, 2005** |
| | **435.5±15.60 d** | **On station** | **BLRI, 1999** |
| **Post-partum heat period** | **133.23+1.51 d** | **On farm** | **Hossen, 2006** |
| | **105.51±3.95 d** | **On station** | **BLRI, 2007** |
| | **158.52±18.72** | **On station** | **Majid and Talukder, 1995** |
| **Days open** | **155.0±13.28 d** | **On station** | **BLRI, 2001** |
| | **165.49±16.64 d** | **On station** | **Majid and Talukder, 1995** |
| | **149.5±16.00 d** | **On station** | **BLRI, 1999** |

**Table 5. Semen quality of Pabna bull (age: 2-3 years to 6-7 years)**

| Parameter | Range | Reference |
|---|---|---|
| Ejaculate volume (ml) | 5.08 – 6.00 | Mostari et al. , 2009 |
| Sperm conc (million/ml) | 1314.38 – 1719.63 | |
| Initial mass motility (%) | 61.25 - 64.38 | |
| Normal sperm (%) | 66.38 – 78.53 | |
| Live sperm (%) | 78.09 – 81.73 | |

**Age did not have any significant effect (p.0.05) on semen quality and quantity except normal sperm (%) (p<0.0001).**

**Table 6. Dairy characteristics**

| **Lactation length (d)** | **Lactation yield (L)** | **Fat (%)** | **SNF (%)** | **Farming condition** | **Reference** |
|---|---|---|---|---|---|
| **256.93±1.23** | **1367.38±12.67** | **4.47±0.01** | **7.94±0.01** | **On farm** | **Hossen, 2006** |
| | | **3.85** | **9.69** | **On station** | **Rahman et el., 2017** |
| **256.55±61.21** | **918.16±28.46** | | | **On station** | **Deb et al., 2007; BLRI, 2007** |
| **202.60±10.70** | **669.70±5.4** | | | **On station** | **BLRI, 1999** |

| | | | | | |
|---|---|---|---|---|---|
| **236±5.40** | **876±26.55** | | | **On station** | **Akhter et al., 2004** |
| **227.68±9.04** | **935.26±51.60** | | | **On farm** | **Majid and Talukder, 1995** |
| | | | | | |

**Table 7. Carcass characteristics of Pabna bull calf in different age groups**

| Trait | Age group (Year) | | | Mean | Level of sig. |
|---|---|---|---|---|---|
| | 0.5- 1.0 | 1.0-2.0 | 2.0-3.0 | | |
| Dressing % | 45.1 | 46.8 | 51.9 | 48.0±0.98 | NS |
| Eye muscle area ($cm^2$) | 28.5 | 46.5 | 93.2 | 56.1±4.47 | P<0.05 |
| Meat-bone ratio | 2.89 | 3.45 | 4.73 | 3.69±0.013 | P<0.05 |
| GI tract % of liveweigt | 28.07 | 22.92 | 20.08 | 23.69±0.46 | P<0.01 |

Source: Khan et al., 2005

Plate 1a. Pabna Bull

Plate 1b. Pabna

Md. Ruhul Amin, et. al. "Pabna Cattle of Bangladesh: A Review." *IOSR Journal of Agriculture and Veterinary Science (IOSR-JAVS)*, 14(8), 2021, pp. 25-32.