

Phenotypic characterization and performance evaluation of Balang cattle: Unique cattle germplasm in Arunachal Pradesh of Eastern Himalaya

G. Kadirvel^{1*} • Doni Jini² • Rakesh Kumar³ • Rahul Katiyar¹ • N. Suraj Singh¹ • Nikita Chanu¹

¹Division of Animal and Fisheries Sciences, ICAR-Research Complex for NEH Region, Umiam, Meghalaya-793 103, India.

²ICAR-Research Complex for NEH Region Arunachal Pradesh Centre, Basar.

³ICAR Research Complex for Eastern Region, Patna

ARTICLE INFO

Article history:

Received: 03 December, 2022

Revision: 08 December, 2022

Accepted: 17 December, 2022

Key words:

DOI: 10.56678/iahf-2022.35.02.29

ABSTRACT

The study was conducted to assess the phenotypic variability, morphometric characteristics and performance traits of Balang cattle in different districts of Arunachal Pradesh. The pre tested questionnaire was completed by 85 tribal farmers from 16 villages to generate information on different management practices and 410 animals of different ages and sexes were measured for physical and morphometric traits. Balang cattle are small to medium sized, having small hump with tuft of hairs both on forehead and in ears. There were white patches on forehead of some animals. The coat color varied which included brown (23.8%), light brown (14.2%) and majority being black (62%). The average body length, heart girth, height at wither, horn length, ear length, face length and tail length, neck length of Balang Bull were 101.06±0.38 cm, 135.29±0.44 cm, 104.01±0.46 cm, 12.11±0.20 cm, 18.90±0.11, 38.34±0.17 and 90.39±0.32 cm respectively. Whereas, the corresponding values for the Balang cattle were 97.67±0.96 cm, 128.64±0.68 cm, 99.73±0.32, 9.96±0.17 cm, 18.46±0.17 cm, 37.99±0.15 cm and 86.69±0.18 cm respectively. The average daily milk yield, peak yield, lactation length were 1.10±0.67 L, 1.31±0.51 L and 170.24± 9.32 days respectively. Milk fat % and SNF % were 4.52± 0.48 and 8.27±0.54 respectively. This unique cattle population is declining due to inbreeding, making it vital to register as a breed and develop genetic improvement programs to increase productivity.

1. Introduction

Cattle are important livestock of farming system in North-east India. Rearing of cattle is extremely important to India's animal husbandry industry and provides a living for millions of rural residents. It is reared mostly for milk, meat and draft purposes. It also contributes towards overall development of agricultural sector. Due to social and religious acceptance, consumption of beef in this region is higher than other parts of the country. Another important contribution from the livestock is its manure which is used in organic production of crop and vegetables in the region. Milk from the livestock is mostly used for preparation of milk products such as paneer, curd, yogurt, butter, cream etc. In hilly areas, cattle are widely used for ploughing, threshing of rice and transportation of heavy loads.

Total cattle population of India is 192.52 million, which includes 142.11 million indigenous cattle. Indigenous cattle which constitute about 73.82 % of total cattle population (BAHS, 2019) constitute of 43 recognized breeds spread over various states across the country (NBAGR 2018). These breeds are known for their own characteristic features and utility, whether specific for milk production, draught power or both. However, the tribal farmers in the area, who are referred to as indigenous locals, raise a variety of undefined farm animal breeds/populations. These native resources are essential for preserving the ecosystem's genetic variety as well as the people's security of food and livelihood. Even in low or zero-input production systems, these native cattle are suited to live and breed in challenging agro climatic conditions. These indigenous cattle reared by tribal farmers are yet to be explored, characterized and documented.

*Corresponding author: velvet.2007@rediffmail.com

Arunachal Pradesh (Land of the Dawn-Lit Mountains) lies in Eastern Himalayan zone of India. It has an area of 83743 sq. km and has international border with Bhutan to the west (160 km), China to the north and north-east (1,080 km) and Myanmar to the east (440 km). It is situated between latitude 26° 30' N and 29° 30' N and longitude 91° 30' E and 97° 30' E. Arunachal Pradesh is considered as one of the world's bio-diversity spots due to its diverse geography, suitable climatic conditions, and abundance of wild flora and fauna. The land is mostly mountainous with the Himalayan range along the northern borders, inhabited by 25 tribes and more than 100 sub-tribes. Mema, Boka and Ramo are tribes in Arunachal Pradesh live in harmony with nature in the subalpine to alpine climate of the Mechuka Valley, which is bordered on the north by Tibet. They are followers of Lama cheeji Lengbo who practice the Nyingmapa sect of Mahayana Buddhism. The Membas' traditional agro-pastoralism is distinctive in that they employ wise management and sustainable resource use for their subsistence (Lollen and Laskar, 2011). These tribes reared non-descript indigenous cattle called Balang in Shi-Yomi district of Arunachal Pradesh. These cattle were reared by tribal farmers for milk, meat and manure.

The Balang cattle are sturdy and well adapted to the high altitude of 1030 m-amsl. These cattle favorably survive and reproduce in adverse climatic locations of Indo-China border areas. Since, these cattle has vital role in uplifting the livelihood and nutritional safety of the tribal farmers, documentation of genetic information is of particular importance. Keeping the utility of this breed and unique characteristics in mind, characterization of this breed is essential to conserve the germplasm in its home tract.

2. Materials and methods

2.1 Study area, sampling pattern and population distribution

In order to locate their geographical distribution and population status, preliminary survey was conducted in different districts of Arunachal Pradesh. Population of Balang cattle was identified in the Shi-Yomi district and further detailed study was conducted in this area. The geographical location of the study place lies between 28°37'27''N latitude to 94°6'30''E longitude and altitude of 1030 m-amsl.

In total, 85 Balang cattle farmers from 16 villages in Shi-Yomi districts of Arunachal Pradesh were interviewed to determine the habitat, feeding, management, breeding practices and performance of the existing cattle population using structured pre tested questionnaire. The farmers were asked questions related to reproductive and productive traits like birth weight, daily milk yield, lactation length, age of first calving, dry period, service period, and calving interval.

2.2 Phenotypic characterization and performance evaluation

Information on the morphometric characteristics *viz.* body length, chest girth or heart girth, height at withers and qualitative confirmation attributes, such as horn length, ear length, etc., with shapes and orientations of 410 animals were recorded. The different body measurement was taken using measuring tape as per Food and Agricultural Organization (FAO, 2012) guideline. While recording body measurement, each cattle was properly restrained in natural position on plain ground and each dimension was taken in duplicates to avoid possibility of errors. Information on existing traditional cattle production system including housing, feeding, breeding management, reproductive performance, disease prevalence was recorded. For body weight, birth weight was recorded for 102 calves and adult body weight of 107 animals were recorded.

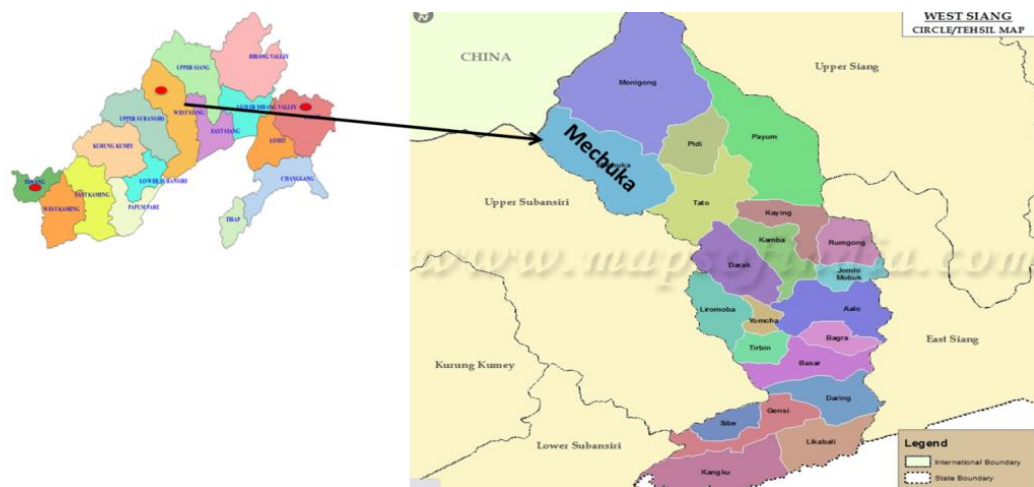


Figure1. Population distribution of Balang Cattle.

3. Results and Discussion

3.1 Distribution and population intensity

Balang is an indigenous cattle found in hilly region of Arunachal Pradesh. It is reared by Memba, Boka and Ramo tribe since time immemorial. The study revealed that the home tract of the local indigenous non-descript cattle of Arunachal Pradesh were mostly distributed in interior hilly regions of the state. The highest density populations of these local cattle are distributed in Dechentang village in Mechuka, a small town in Shi-Yomi district (Fig.1) and not found in other districts of the state. The geographical location of the home tract lies between 28°37'29''N latitude to 94°6'32''E longitude and altitude of 1030 m-amsl. In comparison to the previous census, indigenous cattle populations have decreased by 1.03 times from 2012 to 2019, whereas crossbred population increased by 0.207 times (BAHS, 2019).

3.2 Management practices

Housing, feeding, breeding and health care

The Balang cattle were reared mostly by extensive system. The housing system was made up of locally available materials like bamboos and wooden planks. Majority (90.2%) of the farmers constructed cattle sheds with roof made from bamboo and walls from pinewood. Around 7% used roof made of galvanised iron sheets and walls from wood or bamboos. Usually, the floors of the cattle shed were kuccha floor. However, 10% farmers used dried fern leaves as bedding material due to the cold climatic condition in the region (Fig.2). The sheds constructed by the farmers are not as per the standards regarding space requirements, shed areas, heights, lengths, feeding and water troughs, etc., since the animals are not reared intensively. Usually, the sheds were only for the purpose of shelter at night, easier management of the animals during disease treatment or vaccination or inspections of the animals for sales.

The Balang cattle are solely managed on grazing only and allowed to graze near villages and resident area from 7:00 am to 3:00 pm. Sometimes the animals are allowed

to free range in the forest lands, where the animals stay in herd and managed themselves for a long period. The animals are not supplemented with any concentrate mixture, mineral and vitamin supplementations, or any extra ration other than grazing. However, 15.1 % provided flour meal along with millet, paddy straw for cows. Some farmers provide salt for stimulation of sexual behavior. The expenditure incurred in feeding of animals is almost negligible, but it also reduced production performance of the animals. The herd size ranges from 5 to 50. Farmer's practiced natural method of breeding and no artificial insemination was done.

Farmers had limited knowledge about vaccination and deworming and were not practiced by majority of the local farmers. The reason for non-vaccination of cattle was lack of awareness and less availability of vaccines and expertise in many places. Majority (91%) of the respondents reported FMD (56%), external and internal parasite infestation (22%), diarrhea (15%) and leech infestation (7%). As the animals are allowed to graze into the forest for a very long time, sometimes it is very difficult for the farmers to always attend and observe the animals, which results in poor health status due to delay in giving treatments. Due to remoteness of many villages, there is a very limited access to the farmers for veterinary services, reduced number of veterinary dispensaries, limited man power, etc. Moreover, availability of medicines is also a problem in many areas. For such reasons, many farmers followed age old traditional practices for treatment of animals. None of the farmers did dehorning of cattle.

3.3 Phenotypic traits

Balang are small to medium sized, well-built cattle. The coat colour of Balang cattle varies in different colours like brown (23.8%), light brown (14.2%) and majority being black (62%) (Fig.3). Muzzle colours are black (62%) and brown (38%). Eyelids were mostly black in colour. Tail switch had different colours like black (52.3%), brown (38.1%) and white (9.5%). Colour of the hooves was brown (19.1%), black with white (33.3%) and majority had black (47.6%). Horns are of



Figure 2. Housing system



medium size, black (71.4%) and grey (28.6%) in colour with orientation mostly of curved upward (66.7%) and then curved upward and inward (33.3%). Some animals had small, flattened forehead with mild depression and some had straight and convex head. The ears were moderate to large sized (15.3-18.9 cm) and horizontal in orientation. Special feature observed was presence of tuft of hairs both on forehead and in ears (Fig.4). There were white patches on forehead of some animals. Both hump and dewlap were small. The udder was small, bowl shaped with non-prominent milk vein. The teats were pointed or round and cylindrical (37.5%) shaped while 62.5% were funnel shaped. Naval flap was not prominent. The tail length was below the hock joint with black (52.3%), brown (38.1%) and white (9.5%) switch. Bulls were wild in temperament while cows were docile.

3.4 Morphometric traits

The body measurements of the Balang bull/bullock were done manually and the average body length, heart girth, height at wither, horn length, ear length, face length and tail length, neck length were 101.06±0.38 cm, 135.29±0.44 cm,

104.01±0.46 cm, 12.11±0.20 cm, 18.90±0.11, 38.34±0.17 and 90.39±0.32 cm respectively (table 1). Whereas, the corresponding values for the Balang cattle were 97.67±0.96 cm, 128.64±0.68 cm, 99.73±0.32, 9.96±0.17 cm, 18.46±0.17 cm, 37.99±0.15 cm and 86.69±0.18 cm respectively. The current study indicated that the estimated morphometric traits concurred closely with the reports of indigenous cattle of Manipur (Pundir *et al.*, 2015b), Tripura (Pundir *et al.*, 2014) and Garhwal cattle of Uttarakhand (Pundir *et al.*, 2013). In addition, higher corresponding values were observed in indigenous cattle of Meghalaya (Kadirvel *et al.*, 2021), Siri cattle of Sikkim (Pundir *et al.*, 2016) and Mizoram (Pundir *et al.*, 2015a).

3.5 Production characteristics

The average productive traits of Balang cattle of Arunachal Pradesh are presented in table 2. The average birth weight as per the survey report was 14.28±0.52 kg. The average daily milk yield, peak yield, lactation length were 1.10±0.67 L, 1.31±0.51 L and 170.24± 9.32 days respectively. Milk fat % and SNF % were 4.52± 0.48 and 8.27±0.54 respectively.



Figure 3. Balang Bull (A) and Balang Cow (B) in Mechuka of Arunachal Pradesh

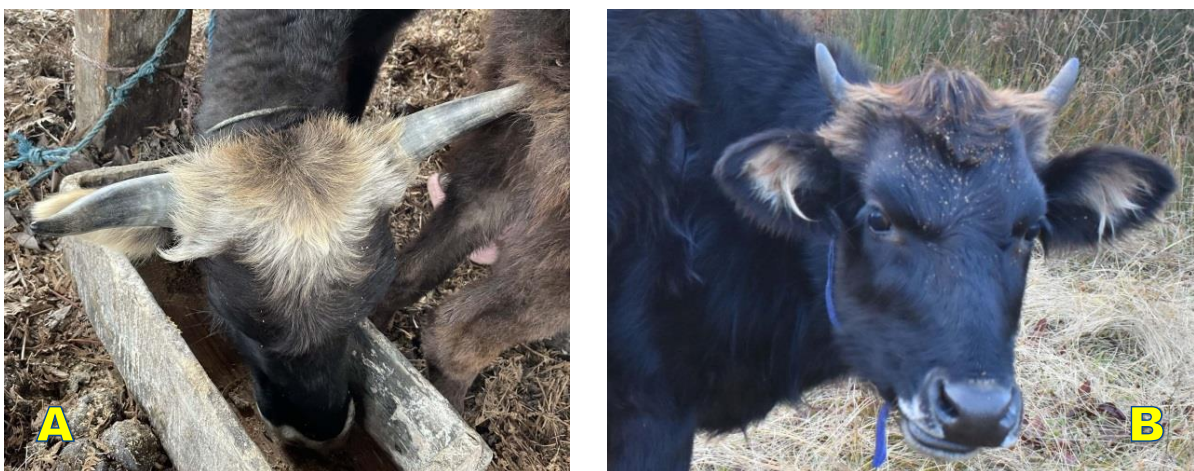


Figure 4. Tuft of hairs on forehead (A) and ears (B) in Balang cattle

The cattle produced 12-14 kg of manure per day, which was used as organic fertilizer. The cattle were milked once a day and milk was utilized for making ghee, churpi and butter tea. A unique item was prepared from skin of the cattle known as “Den”. These cattle are not used for draught purpose.

To a great extent, the average daily milk yield and peak yield of Balang cattle agreed with the report of Pundir *et al.* (2014) for Tripura cows, however it was lower than reports of Zaman and MKG (2021) in indigenous cattle of Arunachal Pradesh. The average birth weight, lactation length, milk fat % and SNF % were lower as compared to cattle of Meghalaya (Kadirvel *et al.*, 2021), Manipur (Pundir *et al.*, 2015b) and Malnad Gidda cattle in the Western Ghat region of Karnataka (Murugeppa *et al.*, 2020).

3.6 Reproductive characteristics

The reproductive traits of the Balang cattle are presented in table 3. Age at puberty is an important economic trait which determines the reproductive efficiency. Balang cattle attained puberty at 32.18±2.88 months. The age at first calving was 37.54±1.91 months. Generally, indigenous cattle gave birth to the first calf at the age of 3-4 years. The age at first calving of Balang cattle was comparable to indigenous cattle of Manipur (Pundir *et al.*, 2015b), Malnad Gidda cattle in Western Ghat region of Karnataka (Murugeppa *et al.*, 2020) but was lower than indigenous cattle of Meghalaya (Kadirvel *et al.*, 2021) and indigenous cattle of Tripura (Pundir *et al.*, 2014). The mean calving interval of Balang cattle was 16.2±0.46 months, which was comparable to the indigenous cattle of Meghalaya (Kadirvel *et al.*, 2021) however, it was higher than Tripura's native cattle. (Pundir *et al.*, 2014), Uttara cattle breed from Uttarakhand (Pundir *et al.*, 2013) and Malnad Gidda cattle in Western Ghat region of Karnataka (Murugeppa *et al.*, 2020). Pundir *et al.* (2015b) reported higher calving interval (19.6 months) in indigenous cattle of Manipur. The gestation period was about 271.35±4.84 days which was comparable with indigenous cattle of Meghalaya (Kadirvel *et al.*, 2021) but higher gestation length was reported in Malnad Gidda cattle in Western Ghat region of Karnataka (Murugeppa *et al.*, 2020). The service period, herd life and lifetime productivity were comparable to indigenous cattle of Tripura (Pundir *et al.*, 2014) and Manipur (Pundir *et al.*, 2015b). However, higher service period, herd life and lifetime productivity were reported in indigenous cattle of Meghalaya (Kadirvel *et al.*, 2021).

4. Conclusion

Home tract of Balang cattle is restricted to Mechuka of Arunachal Pradesh and reared by Memba, Boka and Ramo tribes. These cattle small to medium sized, having long hair coat and well adapted to cold. Despite being reared under zero input system, Balang cattle play a very crucial role

in providing variety of products to the tribal farmers such as milk products, meat and manure. Considering the importance of this breed, selection and conservation programme of Balang cattle may be initiated for upgrading the genetic potential to improve the livelihood of the tribal farmers.

5. Acknowledgements

The authors thankfully acknowledge to the Director, ICAR Complex for NEH Region, Umiam, Meghalaya for providing the facilities to conduct the research.

6. References

- BAHS (2019). Basic Animal Husbandry Statistics. Department of Animal Husbandry, Dairying and Fisheries, Ministry of Agriculture, Government of India.
- Lollen, M. and Laskar, B.A. (2011). Soil fertility management by Memba tribe of Mechuka Valley, Arunachal Pradesh. *Current Science*.101(11): 1399.
- NBAGR (2018). “Registered pig Breeds,” ICAR- National Bureau of Animal Genetic Resources, (NBAGR), Karnal,India. <http://www.nbagr.res.in/regpig.html>
- Kadirvel G, Kumar R, Jamatia K, & Debbarma B (2021). Phenotypic characterization and performance evaluation of Silumkhasi and Masipnar cattle: Unique indigenous germplasm of northeastern region of India. *Indian Journal of Hill Farming* 34 (2): 173-183.
- Pundir R K, Singh PK, Dangi PS, Kumar A, Borah S, Mahanta N and S L Mettei (2018). Phenotypic characterisation of indigenous cattle of Meghalaya State. *Indian Journal of Animal Research*. DOI: 10.18805/ijar.B-346
- Pundir R K, Singh P K, Dangi P S and B Kumar (2016). Siri cattle-An Endangered breed of Sikkim, India. *Indian Journal of Animal Sciences* (Accepted, August, 2016)
- Pundir R K, Singh P K, Dangi P S, Kumar A, Singh N B and DK Sadana (2015b). Indigenous cattle of Manipur-Characterization and performance evaluation. *Indian Journal of Animal Sciences* 85 (4) :382-385.
- Pundir R K, Singh P K, Sadana, D K, Dangi P S, Lalhruaipuii, Vanlalpeka K, Laldinthara F, Singh N M and L Andrew (2015a). Characterization of Mizoram Native Cattle of Indian Origin. *Journal of Animal Research* 5 (4):801-806.
- Pundir RK, Malik S, Singh PK, Sharma D and DK Sadana (2014). Indigenous cattle of Tripura-Characterisation and Performance Evaluation. *Indian Journal of Animal Research* 84(9): 974-977.

Pundir RK, Singh PK, Neelkant, Sharma D, Singh CV, Prakash B (2013). Uttara- A new cattle germplasm from Uttarakhand hills. *Indian Journal of Animal Research* 83(1): 51-58.

Zaman, MKG (2021). Production and reproduction traits of indigenous cattle of Arunachal Pradesh.

Murugeppa A, Tandle MK, Shridhar NB, Prakash N, Sahadev A, Shettar VK, Nagaraja BN and Renukaradhya GJ (2020). Study of certain reproductive and productive performance parameters of malnad gidda cattle in its native tract. *The Pharma Innovation* 20 9(9): 270-274

Table 1. Body measurement (cm) traits of Balang cattle at different age groups (N=410)

Age (Months)	Body Length	Chest Girth	Height at wither	Horn Length	Ear length	Face length	Tail length
6-12 (Male)	71.75±0.34	96.55±0.48	84.02±0.33	NP	15.06±0.21	27.39±0.86	70.35±0.23
6-12 (Female)	67.19±0.16	94.95±0.13	80.65±0.14	NP	15.41±0.10	29.31±0.14	59.67±0.22
12-36 (Male)	86.25±0.16	119.57±0.18	91.94±0.25	7.41±0.07	16.12±0.14	33.44±0.10	85.49±0.17
12-36 (Female)	82.43±0.35	110.89±0.58	87.51±0.32	6.67±0.08	16.70±0.21	33.20±0.17	83.46±0.65
Above 36 (Male)	101.06±0.38	135.29±0.44	104.01±0.46	12.11±0.20	18.90±0.11	38.34±0.17	90.39±0.32
Above 36 (Female)	97.67±0.96	128.64±0.68	99.73±0.32	9.96±0.17	18.46±0.17	37.99±0.15	86.69±0.18

Table 2. Productive traits of Balang cattle.

Parameters	LSM ± SE
Birth body weight (kg)	14.28±0.52 (102)
Adult body weight (kg)	145.63±4.81 (107)
Average daily milk yield (L)	1.10±0.67 (109)
Peak yield (L)	1.31±0.51 (110)
Lactation length (days)	170.24± 9.32 (112)
Fat (%)	4.52± 0.48
SNF (%)	8.27±0.54

Table 3. Reproductive traits of Balang cattle

Parameters	LSM ± SE
Age at puberty (months)	32.18±2.88 (104)
Age at calving (months)	37.54±1.91 (102)
Inter calving interval (months)	16.2±0.46 (112)
Gestation period (days)	271.35±4.84 (110)
Dry period (days)	160.51±9.22 (102)
Service period (days)	130.41±4.85 (105)
Herd life (yrs.)	16.24±1.55 (102)
Life time productivity (No. of calving)	10.64±1.42 (108)