

Mithun: A Promising Milch Animal of the Northeastern Hill Region of India

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Abstract

Mithun (Bos frontalis), a rare bovine of Southeast Asia, is the descendent of wild Indian gaur (Bos gaurus gaurus). This unique animal is found mainly in four different states of the North-Eastern Hills region of India viz., Arunachal Pradesh, Nagaland, Manipur and Mizoram, and also in some locations of Bhutan, Myanmar, Bangladesh and China. Though the mithun is mainly reared for meat, it has the potential for milk production. Mithun produces milk of high quality containing double the quantity of energy than cattle cow milk. In addition, mithun milk contains high quantity of lactoferrin; an antimicrobial element combats for pathogenic infection. Unfortunately, mithun has not yet been explored fully as a milch animal. Milk production potential of mithun can be enhanced significantly through using suitable scientific packages of practices and appropriate technological interventions.

Keywords: Mithun, milk, lactation, milk yield, milk products

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INTRODUCTION

Mithun (*Bos frontalis*), a semi-wild rare ruminant, is believed to have originated more than 8000 years ago and considered to be descendent from wild Indian gaur (*Bos gaurus gaurus*) [1–10]. This hypothesis is supported by the resemblance, distribution, and absence of a sterility barrier between the mithun and the gaur [2]. Moreover, the existence of sterility barrier between mithun and cattle, different haemoglobin genotypes in mithun and zebu as well as different karyotype in European cattle but similar in the gaur are also in favour of the gaur origin of the mithun [2].

The taxonomic classification of mithun is: Kingdom: Animalia, Phylum: Chordata, Subphylum: Vertebrata, Class: Mammalia, Subclass: Prototheria, Order: Artiodactyla, Suborder: Ruminantia (True ruminants), Family: Bovidae, Genus and species: *Bos frontalis* [2]. Mithuns are found mainly in four different states of the North-Eastern Hills region of India and also in some locations of Bhutan, Myanmar, Bangladesh and China. As per 19th Livestock Census (2012), Govt. of India, India has a total of 0.29 million of mithuns. Mithun is mainly reared by tribal communities as a meat animal and mithun meat (meef) is preferred over the meat other

livestock because of its unique texture, taste and flavor. Besides mithun meat, milk obtained from mithun cows is reported to be superior in terms of quality over the milk of other bovines. Milk production potential of mithun can be enhanced significantly through using suitable scientific packages of practices and appropriate technological interventions.

MILK PRODUCTION POTENTIAL OF MITHUN

Though India ranked first in the world for the highest milk production, there is still exists a wide gap between the requirement and availability of milk in the country. Huge interregional and interstate differences of milk production in India have also been noted. To fill such gaps or disparity between the states and regions of India, nonconventional source of milk from animals other than cattle and buffalo cows is placed an important role. It is the need of the hour to explore the milk production potential of mithun for the benefits of the farmers rearing this prized animal. Though mithun milk is suitable for human consumption, it produces very less quantity of milk ranging between 1.0 and 1.5 kg milk per day per animal. However, mithun milk has been found to be nutritious in terms of higher content of fat, protein, SNF and an

antibacterial component called lactoferrin thereby it holds promise to have medicinal value too. It is also reported that the mithun milk contains double the quantity of total energy value than the traditional cow milk.

LACTATIONAL CURVE IN MITHUN COWS

Lactational curve depicts the change of milk yield throughout the lactation period in any milch animals. Determination of lactation curve characteristics is not only important for analyzing the milk production potentiality, but also important for improving milk yield or obtaining desired lactation curve. Moreover, lactation curve assists in assessing the nutritional and health status of milking animals and helps in determining suitable time to end milking. Results of a study revealed that the mithun cows can produce 2.75 to 3.50 kg fat rich milk, while the mithun x Siri cattle though produced more quantity of milk but with inferior quality [11]. Nevertheless, there are other reports available that indicates variable milk production capability of mithun cows ranging from 1.0 to 3.5 lit./day/cow.

The characteristic of lactation curve in mithun is described by Mech et al. [12]. Under adequate feeding condition, the average lactation length was recorded to be 340 ± 2 d with mean milk yield ranging between 0.87 and 1.46 kg/d. The peak milk yield of 1.62 kg/d was recorded as early as on 30 d of lactation and this was persistent until 90 d. However, the suitable time to end milking in mithun was suggested to be approximately 255 d as milk yield was less than 40% of peak yield after this period. Beyond 315 d of lactation, milk yield was found to be less than 0.5 kg/d. The milk production of free range Mithun without any supplementary feed was estimated to be only 0.45 kg/d. This reveals that there is a scope of improving the milk yield of this animal with proper feeding intervention.

PHYSICOCHEMICAL PROPERTIES OF MITHUN COLOSTRUM

The physicochemical properties of 0 day colostrum are presented in Table 1. The colostrum is very rich in total solids and protein but poor in fat and lactose content. The characteristic of milk changes with

advancement of post-partum days and becomes stable from 10 d post-partum.

Table 1: Physicochemical Characteristics of Mithun Colostrum [13].

Particulars	Observation
Colour	Golden yellow
PH	6.28
Specific gravity	1.06
Relative viscosity	7.25
Total solid (%)	41.60
Protein (%)	38.51
Fat (%)	2.05
Lactose (%)	1.04

PHYSICOCHEMICAL PROPERTIES OF MITHUN MILK

Mithun milk is white to creamy white in colour and sweet with an aromatic flavour. The pH lactometer reading at 15.5°C and density (g/ml) of mithun milk have been found to be 7.09, 36.03 and 1.023, respectively [11]. These values are comparatively higher than cow milk. Higher specific gravity and relative viscosity of mithun milk compared to cattle and buffalo might be due to higher total solid (TS) content. The variations in milk yield, TS, fat, total protein, casein, solid-not-fat (SNF), lactose, nonprotein nitrogen (NPN), milk urea (MU) and ash contents during different lactation stages in mithun are presented in Table 3. As evident from the table, the contents of TS, fat, protein and SNF are higher in mithun milk compared to sheep, goat, cow and buffalo milk. However, the milk lactose content is comparable with cow and buffalo. The higher level of TS, fat, protein, SNF and ash contents in mithun milk were probably due to the unique genetic makeup of this species with low average milk yield, which might be needed to meet the nutritional requirement of calf (Table 2).

Table 2: Physical Properties of Mithun Milk [14].

Characteristics	Observation
Colour	White to creamy, White
Flavour	Aromatic
Taste	Sweet
Appearance	Clear to flaky surface
Lactometer reading at 15.5°C	36.03 ± 0.98
PH	7.09 ± 0.06
Density (g/ml)	1.023 ± 0.002

Table 3: Variation (mean \pm SE) in Milk Yield and Milk Compositions in Mithun in Early (7 to 105 d), Mid (106 to 210 d) and Late (211 to 315 d) Lactation Stages [12].

Particulars	Early lactation (7–105 d)	Mid lactation (106 to 210 d)	Late lactation (210 to 315 d)
Milk yield (kg/d)	1.46 \pm 0.04	1.22 \pm 0.05	0.87 \pm 0.05
TS (%)	20.94 \pm 0.19	21.76 \pm 0.21	22.62 \pm 0.36
Fat (%)	7.72 \pm 0.15	8.61 \pm 0.16	10.25 \pm 0.25
Total protein (%)	6.31 \pm 0.08	6.71 \pm 0.16	6.78 \pm 0.09
Casein (%)	4.38 \pm 0.05	4.77 \pm 0.09	4.44 \pm 0.10
SNF (%)	13.41 \pm 0.20	13.70 \pm 0.38	13.40 \pm 0.22
Lactose (%)	4.60 \pm 0.07	4.36 \pm 0.14	4.44 \pm 0.08
NPN (%)	0.43 \pm 0.01	0.41 \pm 0.02	0.43 \pm 0.01
Urea (mg/dl)	36.65 \pm 0.87	39.14 \pm 0.94	43.54 \pm 1.59
Ash (%)	0.93 \pm 0.01	0.90 \pm 0.01	0.90 \pm 0.01

MILK PROTEIN COMPOSITION

The protein content of milk is of significant importance in dairy processing as it determines the quality of different dairy products. The total protein nitrogen content of bovine milk can be categorized into three broad fractions. These are casein nitrogen, whey protein nitrogen and nonprotein-nitrogen (NPN). The greatest portion of milk NPN is urea N [15].

Milk yield (kg/d) was found to be significantly ($p < 0.05$) higher in the early (1.46) and mid lactation (1.22) stages than the late lactation stage (0.87). Milk fat content (%) was found to be significantly ($p < 0.05$) lower in the early (7.72) and mid lactation (8.61) stages than the late lactation stage (10.25). The content of TS (%) and MU (mg/dL) was found to be significantly ($p < 0.05$) higher in the late lactation (22.62 and 43.45) stage than the early (20.94 and 36.65) and mid lactation (21.76 and 39.14) stages. In contrast, the content of total protein (6.31 to 6.78%), casein (4.38 to 4.77%), SNF (13.40 to 13.70%), lactose (4.36 to 4.60%), NPN (0.41 to 0.43%) and ash (0.90 to 0.93%) did not vary significantly among the different lactation stages [12].

The change in different casein fractions from 0 day colostrum to 13 day postpartum milk in mithun cows is presented in Table 4. The distribution different casein protein fractions (α_1 , α_2 and β casein) in mithun milk are comparable with that of cow and buffalo milk

[13]. Moreover, the distribution of different casein fractions is similar in colostrum and milk. Whereas, the immunoglobulin is predominated in colostrum and β -lacto globulin is predominated in milk (Table 5.)

Table 4: Distribution of Isoelectric Precipitated Casein Protein Fractions in Colostrum and Milk [13].

Post partum days	Casein fractions (g/dl)		
	α casein		β casein
	α_1	α_2	
Colostrum			
0	4.27	0.23	4.05
2	4.64	0.16	3.20
3	4.40	0.24	3.20
Milk			
10	4.00	0.32	3.52
13	4.36	0.17	3.92

MITHUN MILK PRODUCTS

Mithun milk is suitable for producing different milk products of high qualities like paneer, lassi, curd, ghee, barfi, rasgulla etc. [16]. There exists further scope for technological intervention to produce certain other dairy products like cheese as mithun milk is rich in protein. Nevertheless the prime challenge ahead is to exploit the milk production ability of this unique bovine species to its fullest genetically potentiality by implementing scientific managerial system keeping in view the economic aspect as well.

Table 5: Distribution of Total Whey Protein Fractions in Colostrum and Milk in Mithun [12].

Post partum days	Whey protein (g/dl)	Ig (g/dl)	Unknown (g/dl)	Blood serum albumin (g/dl)	α Lactalbumin (g/dl)	β Lactoglobulin (g/dl)
Colostrum						
0	30.48	19.80	0.60	1.20	1.20	6.60
2	13.65	7.70	0.28	0.56	0.42	5.04
3	5.28	2.80	0.10	0.10	0.10	1.90
Milk						
10	2.78	0.42	0.33	0.52	0.15	1.68
13	1.72	0.20	0	0.14	0.32	1.32

ANTIMICROBIAL EFFECT OF MITHUN MILK

Mithun milk lactoferrin concentrations was found to be significantly higher ($P < 0.01$) during early lactation than that of mid or late lactation. Similar trend was followed for the cattle milk during different stages of lactation. When compared the milk lactoferrin concentrations between cattle and mithun milk, mithun milk contains significantly higher concentration of lactoferrin during each stages of lactation. In a study on antimicrobial potential of mithun milk, the MIC of mithun lactoferrin (mLF) for *E. coli* and *S. aureus* was observed to be 3 and 3 ± 0.5 mg/ml, respectively. It was observed that mLF could reduce growth of *E. coli* by 30% and for *S. aureus* by 50% with respect to control. Mithun lactoferrin could inhibit the growth of *S. aureus* and *E. coli* by 53 and 28%, respectively and was observed to be comparable to Ampicillin and Kanamycin [17].

CONCLUSIONS

Mithun could be used as a potential source of milk to provide nutritional security to tribal population of this North-Eastern Hill Region of India. Although, the average daily milk yield of mithun is comparatively less than cattle and buffalo cows, under ideal managemental condition the milk yield can be optimized to 3 to 3.5 liters/day/cow. The additional advantage which makes mithun milk highly valuable lies in its antimicrobial property which helps in combating many pathogenic microorganisms. The mithun milk products could be sold as prime product which will not only fetch premium price as rare milk product but also strengthen the economy of poor mithun rearers.

ACKNOWLEDGEMENTS

The authors are grateful to the Director, ICAR-National Dairy Research Institute, India for providing the facilities for the present work. The authors also acknowledge the funding received from the Department of Biotechnology, Govt. of India for conducting the present work.

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Cite this Article

Mondal M, Singh RK, Baruah KK *et al.* Mithun: a promising milch animal of the northeastern hill region of India. *Research & Reviews: Journal of Dairy Science and Technology.* 2015; 4(3): 17–21p.