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Milk constituents of Luit buffalo of upper Brahmaputra valley of Assam

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Abstract
The present study was carried out to analyze the various milk constituents of Luit buffalo of Assam. A total of 172 milk samples were randomly collected from farm (ICAR-Network project on Buffalo, Assam Agricultural University, Khanapara, Guwahati, Assam, India) as well as field conditions (Dhemaji, North Lakhimpur and Sivasagar districts of Assam, India). Milk Analyzer, LAKTAN 1-4 (Model: 220) was utilized to measure different milk constituents. Statistical analysis of data was carried out in the Department of Animal Genetics and Breeding, College of Veterinary Science, Assam Agricultural University, Khanapara, Guwahati-22. The overall least-squares means (μ) along with standard error (SE) for percentage of milk fat, solid-not fat, milk protein and total solids were found to be 7.591±1.148, 9.047±0.052, 3.032±1.126 and 16.638±1.125, respectively. Effect of location was found to have significant influence (p<0.05) on milk fat percentage, protein percentage and total solid percentage.

Keywords: Luit buffalo, milk constituents, milk fat %, protein percentage, solid-not fat %

1. Introduction
Assam, a state in the north-east India, possesses fairly a large population of livestock in comparison to the other North-Eastern states. Livestock sector has been playing a major role in contribution of plenty of employment opportunities, effectively to the small and marginal landless farmers adding up to the economic development of the state. Almost every household of the rural population are engaged in livestock rearing (Pegu, 2019) [17]. The dairy farming in this regard has occupied primary position in offering a nutritive food supplement, income, employment, and also organic manure to the poor farmers. The total milk production of the state of Assam is 882.27 thousand tonnes (Basic Animal Husbandry Statistics, 2019) [1] with an average per capita availability of 71gm /day/ person (National Dairy Development Board). Next to cattle, buffalo is one of the major contributors to the total milk production of the state. The total buffalo population in Assam is 4,21,715 (20th Livestock Census, 2019) [12]. Indigenous buffalo was registered as a breed named 'Luit' by National Bureau of Animal Genetics and Resources (NBAGR) in the year 2014 bearing accession no. India_Buffalo_ 0212_Luit_ 01014. Luit buffalo is predominantly swamp-type. It is an integral part of Assamese society and has an ample ability to survive under a low-maintenance system. They are reared by the farmers inhabiting in the embankment or near the island of river Brahmaputra who are mostly the small marginal farmers and landless labourers. They are hardy and can withstand harsh climatic conditions like the floods, which can be considered an annual reoccurring condition of the state. Though they produce milk in small quantities but the farmer rears them in large herds, the herd may consist up to 100-150 numbers of buffaloes. This results into large amount of milk from a single herd and the farmers are benefitted much by selling it in the market that too in zero-input system. Owing to the high fat percentage (13% as reported by Das *et al*., 2018) [6], the milk has been preferred for preparing curd, ghee, cream, and other milk products as compared to the cow milk. The swamp buffalo milk is observed to be traditionally attached to the people of the state. During the festive times, especially during *Magh Bihu* there is great demand of buffalo milk and its different products throughout the state. Study of milk fat, solid-not fat, milk protein and total solid of buffalo milk can provide knowledge on milk composition to milk producers, processors and consumers and this can further help in enhancing quality of milk produced and thus can earn more profit. Keeping this in context, the present study has been conceived to study different milk constituents of indigenous swamp buffalo milk.

2. Materials and Methods

A total of 172 milk samples were collected randomly from Luit buffaloes for the study covering farm as well as field conditions. 46 samples were taken from Buffalo farm (under ICAR- Network Project on Buffalo), Assam Agricultural University, College of Veterinary Science, Khanapara, Guwahati, Assam. 126 milk samples were collected from the buffalo *khutis* belonging to three districts namely Dhemaji which covered Gohain goan, Samajan, Nalanipam and Moridhol villages; North Lakhimpur which covered Rangajan, Ghilamara and Boginadi villages; and Sivasagar which covered Afolamukh, Panidihing and Nitaipukhuri villages. The milk samples were collected aseptically during morning milking hours and were transported in icebox wherever required. It was then brought to room temperature and analysis for milk constituents *viz.*, milk fat (%), solids not fat (%), milk protein (%) and total solids (%) was performed following standard procedures. The total solids% was calculated by adding fat% and SNF% on each milk samples. Various analysis was done in the temporary laboratory facility with the help of Milk Analyzer, LAKTAN 1-4 (Model: 220). The data recorded were classified for location *viz.* F1 (Farm data) and F2 (Field data). The least-squares analysis of variance technique (Harvey 1990) [9] was carried out in order to study the effect of location on various milk constituent's traits. Duncun's Multiple Range Test (DMRT) as modified by Kramer (1957) [11] was carried out to make pairwise comparisons among the means wherever significant differences among different levels of factors were observed. The entire statistical analysis of data was carried out in the Department of Animal Genetics and Breeding, College of Veterinary Science, Assam Agricultural University, Khanapara, Guwahati-22, Assam, India.

3. Results and Discussion

The least-squares means and standard errors and the results of the DMRT for the effect of location on milk fat, solid not fat, milk protein and the total solids are presented in Table 1. The overall least-squares means (μ) for milk fat% was found to be 7.591±1.148%. The mean milk fat% as reported by Nie *et al.* (2022) [16] in crossbred buffaloes of China (7.25±1.74), Yasmin *et al*. (2020) [22] in the Nili-Ravi buffaloes of Pakistan (7.45%), Zhou *et al*. (2018) [24] in buffalo breeds of China (7.31%), Balusami (2015) [2] in Murrah breeds of Tamil Nadu (7.33±0.57) and Meena *et al.* (2007) [13] in Jaffaradi buffaloes (7.40%) corroborated with the present finding. However, Garau *et al*. (2021) [8] found a higher milk fat % (8.5%) in Italian Mediterranean buffalo. Also, Yang *et al.* (2013) [21] in crossbred buffaloes of China reported a higher milk fat% (8.16±1.11%). In contrary, Chandrakar *et al*. (2018) [4] observed lower milk fat % in buffaloes of Chhattisgarh (6.50±0.05%). The effect of location was found to be significant in milk fat %, which was observed higher in field animals as compared to the farm animals. In agreement with present report of a significant influence of location on milk fat% was recorded by Rizqiati *et al.* (2015) [18] in the swamp buffaloes of south Sumatera, Indonesia and Chantalakhana (1981) [5] in swamp buffaloes of Thailand. In the present study, the average solid-not fat% was observed to be 9.047±0.052% which was found to be comparable with the findings of Chandrakar *et al*. (2018) [4] in buffaloes of Chhattisgarh (8.88±0.03%), Balusami (2015) [2] in Murrah buffalo of Tamil Nadu (9.47±0.09%), Misra *et al.* (2008) [14] in Mehsana buffalo (9.13±0.06), Dubey *et al.* (1997) [7] in Murrah buffalo (9.22±0.03) and Zaman *et al.* (2007) [23] in swamp buffalo of Assam (9.197±0.039). However, higher estimates have been reported by Yang *et al.* (2013) [21] in the crossbred buffaloes of China (10.91±0.13) and Yasmin *et al.* (2020) [22] in Nili Ravi buffaloes (10.36±1.7) while lower values were recorded by Meena *et al*. (2007) [13] in non-descript buffaloes of Kumaon hills of Uttarakhand (8.34%). The effect of location exerted non-significant effect on solid-not fat%. A similar observation was reported by Meena *et al.* (2007) [13] in Murrah and Jaffarabadi buffaloes maintained at organized farms in Uttarakhand and Chantalakhana (1981) [5] in swamp buffaloes of Thailand. The overall least-squares means for milk protein% was found to be 3.032±1.126%. Khan *et al*. (2011) [10] reported milk protein to be in range between 3.10 to 3.7% with a mean value of 3.31±0.13% in dairy buffaloes, which was found to be in conformity to present observation. Similar observations also reported by Misra *et al.* (2008) [14] in Bhadwari buffalo (3.92±0.07), Mehsana buffalo (3.87±0.05) and Surti buffalo (3.93±0.05). Tyagi *et al.* (2016) [20] has also reported quite comparable findings to the present study in Surti buffaloes (3.57±0.04). Higher than the present milk protein has been reported by Nie *et al*. (2022) [16] in crossbred buffaloes of China (4.72±0.6), Yasmin *et al.* (2020) [22] in Nili Ravi buffalo (4.17±0.51), Rizqiati *et al.* (2015) [18] in swamp buffaloes of south Sumatera, Indonesia (5.73%) and Yang *et al.* (2013) [21] in the crossbred buffaloes of China (4.96±0.03). There was a significant effect of location on milk protein in the present study. Rizqiati *et al.* (2015) [18] in swamp buffaloes of south Sumatera, Indonesia have also found different protein% in two districts of study. The average mean for the total solids% was found to be 16.638±1.125%. Bustamante *et al.* (2016) [3] in the buffaloes of Columbia (16.90%), Balusami (2015) [2] in graded Murrah buffaloes (16.54±0.03%) and Meena *et al.* (2007) [13] in the non-descript buffaloes of Uttarakhand (16.33%) have reported similar findings. Higher total solid% was observed by Nie *et al.* (2022) [16] in the crossbred buffaloes of China (17.90±1.82) and Yang *et al.* (2013) [21] in the crossbred buffaloes of China (18.58±1.07). Lower observations as compared to the present result was reported by Misra *et al.* (2008) [14] in Mehsana (15.59±0.18) and Surti (14.96±0.21) buffaloes. Effect of location was found to be non-significant on total solid%. Correspondingly, Meena *et al.* (2007) [13] have also reported non-significant effect of location in case of non-descript buffaloes maintained at organized farms in Uttarakhand.

Table 1: Least-squares mean and Standard Error and the Results of the DMRT for various factors affecting milk Fat (%), solid not fat (%), protein (%) and total solids (%)

Effect	No. of observation	Milk fat (%)		Solid not fat (%)		Protein (%)		Total solids (%)	
		LSM	SE	LSM	SE	LSM	SE	LSM	SE
μ	172	7.591	1.148	9.047	0.052	3.032	1.126	16.638	1.125
Location									
F1	46	7.243^{a}	0.253	9.021	0.089	2.972^{a}	1.045	16.264^{a}	1.086
F2	126	7.935^{b}	1.153	9.074	0.054	3.092^{b}	1.927	17.009^{b}	1.273

N.B. LSM = Least-squares means; SE = Standard error; Sub-class means with different superscript differ significantly (p<0.05)

4. Conclusion

In dairy sector, equal emphasis is needed for both quantitative traits as well as qualitative traits. Further, the quality analysis of milk is important for quality milk production, consumption, distribution, preparation of different dairy products and the fluctuations in the market prices. The constituent of Luit buffalo milk reported in the present study can act as a reference for quality and composition of buffalo milk of Assam.

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