



REARING AND FEEDING STRATEGIES OF INDIGENOUS BUFFALO IN SELECTED AREA OF BANGLADESH

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ABSTRACT: *The study was carried out to identify the rearing scenario and existing feeding management practices of buffaloes in selected areas of Rajshahi, Pabna, Jamalpur and Bhola districts, respectively. A direct survey on 200 household buffalo farmers were conducted. The survey results revealed that 78% of buffalo farmers were literate. Higher extensive rearing systems were practiced in Madarganj (96%), whereas maximum semi-intensive farming at Godagari (90%), compared to other areas. Additionally, only 8% of household farmers were practiced in intensive way and higher in Ishwardi. Maximum average herd size was found in Madarganj (24.54±7.94) followed by Ishwardi (16.36±8.91), Char Fasson (14.12±7.64) and Godagari (13.84±5.52) upazilas. Rice straw, bathan mixed local grass, concentrate feed and other unconventional feed resources were the main feed for rearing buffaloes in the study areas. About 53% of the farmers were supplied concentrate feed for their lactating buffalo and the supplied amount was below 0.5 kg. Results showed that calf birth weight was significantly ($P<0.05$) higher (33.24 kg) in Madarganj followed by Ishwardi (26.62 kg), Godagari (24.88 kg) and Char Fasson (21.20 kg). Significantly ($P<0.05$) higher lactation length was found in Ishwardi (225.50 days) whereas higher milk production was also found in Godagari (3.37 kg/d). Average age at first heat of buffaloes were significantly ($P<0.05$) lower in Madarganj whereas the calving interval was lower in Godagari (14.76±0.89). This study attempts to unearth the present scenario and find out the constraints of buffalo production. Further research with large samples and increased areas should be conducted to find out the overall scenario of buffalo rearing and feeding management practices in Bangladesh.*

KEYWORDS: Buffalo, Herd size, Rearing, Feeding practices, Char and Coastal areas.



INTRODUCTION

Buffalo (*Bubalus bubalis*), a tamed animal that provides high-quality milk and meat for nutritional security, is a member of the bovine group which has better digestion abilities compared to others in the group (Agarwal *et al.*, 2008; Paul *et al.*, 2023). In Bangladesh, about 1.5 million buffaloes are of indigenous origin, and the country is home to both swamp and river varieties (Hamid *et al.*, 2016; DLS, 2021-22) whereas 40% are spread over the coastal regions. Buffaloes are second only to cattle in Bangladesh, where they are primarily raised for smallholder farmers' household subsistence and significant grazing in the char and saline coastal regions. In terms of the national economy, buffalo produce roughly 1.4% milk of national demand and 0.95% meat (Hamid *et al.*, 2016; Siddiky & Faruque, 2017). The buffalo management technique is mainly dependent on the geography, and locally available seasonal feed resources (Hasnat *et al.*, 2019; Uddin *et al.*, 2016). Buffaloes are raised all over the country, with a concentration in coastal saline region, plain land and marshy land which fully depends on the availability of feed resources (Hamid *et al.*, 2016). There are four main rearing systems for buffaloes: (a) Household subsistence farming; (b) Semi-intensive farming; (c) Intensive farming; and (d) Extensive farming system. It was reported that 65–75% of the total cost accounted for feed (Yucel & Taskin, 2018). Buffaloes graze at char land and few concentrate feeds, such as wheat bran, rice bran, and pulse bran, are supplied. There are few green grasses found in char land seasonally for grazing, roadside grass, and rice fields after rice harvesting. Some smallholder farmers also used crop waste as buffalo feeds, primarily. These unstable feeding management hampered the reproductive efficiency of buffaloes in Bangladesh and consequently led to poor production profiles, including stunted growth and milk production, delayed puberty, seasonal breeding, prolonged calving intervals, and poor estrus detection. Though the buffalo is an important livestock, there has been very little documented research so far on the scenario of buffalo rearing and feeding strategies. It is essential for Bangladesh to develop buffalo breeds, feeding technology, and their production and reproduction performances through various scientific programs. To increase buffalo production in Bangladesh, it would be important to know details about the scenario of buffalo breeds, rearing system, feeding strategies, production and reproduction performances, etc. Therefore, the present studies were carried out to identify the rearing scenario and feeding strategies of buffaloes in selected areas of Bangladesh.

Materials and Methodology

Ethical Considerations:

Ethical approval was obtained from the relevant institutional review board (BLRI) prior to data collection. Informed consent was obtained from all participants, and their confidentiality and anonymity was ensured throughout the study.

Selection of Study Area

Four upazilas: Gadagari, Ishwardi, Madarganj, and Char Fasson under the districts of Rajshahi, Pabna, Jamalpur, and Bhola, respectively were the sites of the survey. The study areas were selected based on Bangladesh's geographical dispersion, which includes char land and coastal regions.



Determination of Sample Size and Sampling Technique

$$n = \frac{n_0}{1 + \frac{(n_0-1)}{N}}$$

The sample size was determined by using Cochran's Formula.

Here,

n = Adjusted sample size (295)

n₀ = Cochran's sample size (385)

N = Population size (1261)

Using the equation considering 95% confidence interval and 5% marginal error, the adjusted sample size was calculated as 295. However, considering practical constraints such as budget, time, and resources available for data collection, about 200 samples were surveyed for the study. A total of 200 household farmers were selected using simple random sampling technique from 25 villages in 04 upazilas. Interviews were conducted with the spontaneous participation of respondents. Feeding patterns were observed and milk production per day was measured during milking at selected areas.

Development of the Questionnaire

A combination of close-ended and open-ended questions were set by ensuring that each question was clear, concise, and directly related to the research objectives. The questionnaire was structured in a logical order, starting with introductory questions and progressing to more complex or sensitive topics and group related questions together to maintain coherence and flow. Further, the review of the drafted questionnaire was done to ensure clarity, relevance, and completeness. Finally, a pilot test was executed with a small group of samples to identify any ambiguities or issues with the questions. Following the advice of experts after revising and refining, the final questionnaire was prepared for the survey.

Enumerators' Training

Enumerators' training was an important part because they were responsible for collecting accurate and reliable data from respondents through interviews, questionnaires, or other data collection methods. For the current survey, an inclusive training was given to the selected enumerators. Enumerators were briefed on the objectives of the data collection effort, the importance of their role, the scope of the study, use of survey instruments and proper way to fill out forms and record responses. They were trained on effective communication and interviewing techniques to engage with respondents, build rapport, and encourage honest and accurate responses. Furthermore, they were trained about the ethical principles of data collection, including confidentiality, privacy, and informed consent. They were made to understand the importance of protecting respondents' rights and data and also trained on how to face the challenges they may encounter during data collection, such as reluctant respondents, language barriers, or sensitive topics. They learn strategies for resolving conflicts and maintaining professionalism.



Method of Data Collection

The direct interviewing method was used to get data from each respondent. A preliminary visit was conducted to the study areas and selected farmers. Most interviewees were given explanations of the study's goals to get their cooperation and direction. Before the interview, a brief explanation of the study's objectives was given to the participants. Systematic questions were posed, with explanations offered when needed. The data provided by the participants were explicitly documented on the schedule for the interview. The data were collected in the winter season, November 2021 to February 2022.

Data Sorting, Cleaning, Input, Outliers Test, and Error Minimization

Data sorting, cleaning, inputting, identifying outliers and minimizing errors were crucial steps in preparing survey data for analysis. Data were sorted based on relevant variables such as respondent ID, demographics, or survey questions. Then, duplicate entries were removed to avoid double-counting, check missing values and decide on appropriate strategies for handling them (e.g., imputation, deletion). Cross-validation procedures were conducted to minimize the data entry errors. However, the cleaned data were entered into MS Excel software using appropriate data formats for each variable (e.g., numeric, categorical, date). Furthermore, an outlier detection analysis was conducted to identify extreme or unusual values in the data use box plots, and Tukey's method was used to detect outliers.

Statistical Analysis

Quantitative data were analyzed directly and qualitative data were converted into quantitative data by using scoring techniques or coding wherever applicable. All data were analyzed by descriptive statistics; if the F-value was significant ($P < 0.05$), then it was continued with the Duncan Multiple Range Test (DMRT) to compare the treatment means for different parameters. Statistical analysis was done by using the IBM SPSS 22.0 program.

RESULTS AND DISCUSSION

Farmer's Personal Profile

Education Level of Buffalo Farmers

The education level of buffalo farmers were shown in Table 1. The literacy level of buffalo farmers were classified into illiterate, literate, primary pass, SSC, HSC and Hon's respectively. Results showed (Table 1) that the number of illiterate buffalo farmers were higher in Madarganj and Ishwardi but lower in Char Fasson and Godagari. The literacy rate of buffalo farmers was higher in Godagari followed by Ishwardi, Char Fasson and Madarganj, respectively. The majority (56%) of the farmers were with primary pass in Madarganj, followed by Godagari (40%), Char Fasson (38%) and Ishwardi (36%). Results also showed that buffalo farmers have passed SSC were found higher in Char Fasson and lower in Madarganj whereas the HSC pass buffalo farmers were higher in Ishwardi and lower in Char Fasson. There were no Hons. Pass buffalo farmers in the study area (Table 1). M. Miah *et al.*, (2023) was observed that maximum subsistence livestock farmers in Bangladesh had very little education level and poor knowledge



to livestock management. Consequently, subsistence farmers were unable to maintain record keeping, ration balancing, schedule vaccination and deworming.

Table 1. Education level of buffalo farmers

Educational Level	Madarganj (%)	Ishwardi (%)	Godagari (%)	Char fasson (%)	Overall (%)
Hons.	0	0	0	0	0
HSC	2	6	0	2	2.5
SSC	4	12	26	28	17.5
Primary pass	56	36	40	38	42.5
Literate	8	16	28	10	15.5
Illiterate	30	30	6	22	22

Land Ownership, Buffalo Rearing Experiences and Age of Farmers

The land ownership, experience of buffalo rearing and age of farmers were shown in Table 2. The results revealed that there were a significantly ($P < 0.05$) different land ownership of buffalo farmers in the study areas. Buffalo farmers had higher land in Ishwardi (906.52 dec.), lower in Char fasson (117.26 dec.), Godagari (44.21 dec.) and Madarganj (30.7 dec.), respectively. The result showed that significantly ($P < 0.05$) higher buffalo rearing experience was found in Char Fasson followed by Madarganj, Ishwardi and Godagari upazila. There were no significant ($p > 0.05$) difference in ages of buffalo farmers in the study areas.

Table 2. Land ownership, buffalo rearing experiences and age of farmers

Parameter	Locations (<i>Mean</i> ± <i>SD</i>)				Level of sig.
	Madarganj (%)	Ishwardi (%)	Godagari (%)	Char Fasson (%)	
Total land (dec.)	30.70 ^c ±2.8	906.52 ^a ±17.5	44.21 ^c ±5.9	117.26 ^b ±14.07	**
Experiences (year)	29.96 ^a ±12.5	12.44 ^b ±8.13	8.94 ^b ±3.35	30.54 ^a ±11.52	**
Age of farmers (year)	43.08 ^a ±10.02	41.60 ^a ±10.29	41.36 ^a ±10.96	45.68 ^a ±8.98	NS

**=significant ($P < 0.05$), NS=Non significant ($P > 0.05$).

Buffalo Rearing System

The rearing system of buffaloes in the study areas were shown in Figure 1. Both semi-intensive and extensive buffalo rearing systems were found in the study areas. Result showed that an extensive farming system were found higher in Madarganj (96%), followed by Ishwardi (82%), Char Fasson (40%) and Godagari (6%), allowing them full time grazing at char land and coastal land. The semi-intensive farming system was found higher in Godagari (94%), followed by Char Fasson (60%), Ishwardi (10%) and Madarganj (4%) areas, allowing for grazing for 5-8 hours in a day. This present finding was consistent with the findings of Amin *et al.* (2015) who reported that about 85% of the buffalo farmers reared buffalo in a semi-intensive system. Maximum buffalo farmers did not have any buffalo shed. Only 8% of the farmers in Ishwardi areas used the intensive farming system. Extensive and semi-intensive rearing systems have no

housing facilities but the intensive rearing system has housing facilities for all buffaloes. R. C. Chanda *et al.*, (2021) stated that about 83.3% buffalo farmers did not provide shed or housing for their buffalo. The research results also consented to the different literature.

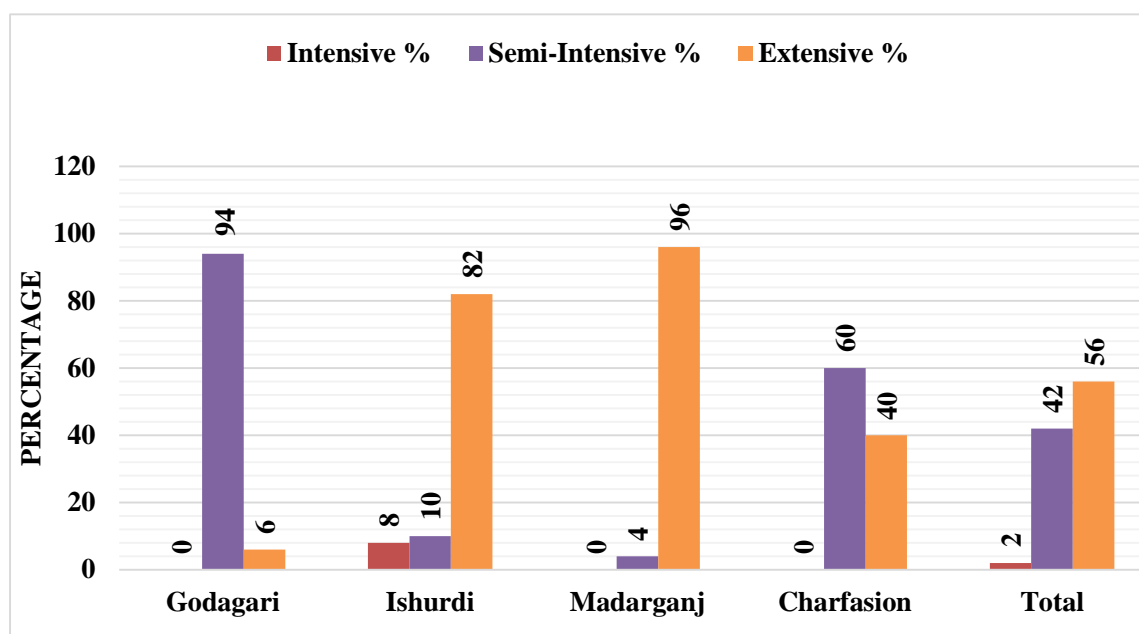


Figure 1. Buffalo rearing system

Herd Size and Different Stages of the Buffalo Population

The herd size and different stages of buffalo population were shown in Table 3. Maximum herd size was found in Madarganj (24.54 ± 7.94) and minimum in Godagari (13.84 ± 5.52), whereas overall herd size of the study areas was 17.21 ± 8.81 . The results revealed that dairy and pregnant buffalo cows were found higher in Madarganj, whereas dry buffalo cows were found higher in Ishwardi areas compared to other areas. Heifer buffalo and buffalo bull calf were also found higher in Ishwardi areas compared to other areas. Generally, subsistence farmers sold their buffalo calf after weaning age; they kept the relatively best buffalo in the herd for replacing stock or fattening. R. C. Chanda *et al.*, (2021) reported that a ratio of 38.3% farmers reared their buffalo for more than 2 years, whereas 61.70% farmers reared for 2 years or below in small scale.

Table 3. Herd size and buffalo population at different stage

Type of buffalo	Locatons (<i>Mean</i> ± <i>SD</i>)				
	Madarganj	Ishwardi	Godagari	Char fasion	Overall
Herd size	24.54±7.94	16.36±8.91	13.84±5.52	14.12±7.64	17.21±8.81
Dairy buffalo cow	9.16±6.63	6.64±4.31	3.76±1.51	3.48±2.12	5.76±2.74
Pregnant buffalo	9.96±3.46	5.68±4.00	1.40±0.96	3.08±2.25	5.03±2.79
Dry buffalo	1.62±1.33	3.62±1.55	1.96±0.95	2.64±1.36	2.21±1.35
Heifer	4.46±2.62	5.22±2.56	2.64±1.25	2.82±1.40	3.79±1.37
Bull calf	2.84±1.60	4.32±2.82	4.08±2.69	2.10±1.28	2.84±1.62



Feeds and Feeding Management Practices of Buffalo at Different Areas

Feeds and feeding management practices of buffalo at different areas were shown in Table 4. Results show that rice straw, bathan mixed local grass (Vadail, Durba, Birkani, Choilla, Nol grass, Wily grass, Salondi grass, Hachi grass, and Bokra), concentrate feed and other unconventional feed resources were the main feed for rearing buffaloes in the study areas. Majority of the farmers (40%) in Godagari supplied straw as a main feed for their buffaloes. About 100% of the farmers supplied natural local grass for their buffalo in Madarganj, Godagari and Char Fasson areas whereas 92% of the farmers in Ishwardi areas supplied natural local grass for their buffalo.

Table 4. Feeds and feeding management of buffalo at different areas

Parameter		Research area (Percentage)				
		Madarganj j	Ishward i	Godagar i	Char fasson	Overall
Straw feeding		8.0	12.0	40.0	8.0	17.0
Natural grass feeding		100.0	92.0	100.0	100.0	98.0
Cultivated fodder (kg/d)		0	0	0	0	0
Concentrate supplementations	No	14.0	10.0	12.0	18.0	13.5
	(0- 0.5kg/d)	48.0	36.0	74.0	54.0	53.0
	(0.5-1.0 kg/d)	20.0	28.0	12.0	16.0	11.5
	(1.0-2.0 kg/d)	4.0	6.0	0	2.0	3.0
Feed cost per kg milk production (BDT./kg)		40.07±4.90	42.02±6.20	38.42±3.74	36.87±5.25	39.34±5.02

Present findings agreed with the findings of Kabir *et al.* (2022) who found that 91% of the farmers provided roadside or local grass for their animals. Sarker *et al.* (2013) also reported that the majority of buffaloes in Bangladesh were kept in free-gazing systems with certain stall feeding methods. Farmers were not supplied cultivated fodder for their buffaloes at the study areas. Result shows that the majority of the farmers (53%) were supplied concentrate feed at the rate of 0.50 kg to 1.0 kg per buffalo per day whereas 13.5% of the farmers were not supplied concentrate for their buffaloes. These findings were consistent with the findings of R. C. Chanda *et al.* (2021) who reported that about 58.4% of the farmers provided their buffaloes with rice straw with concentrates of about 16.7%. The milk production cost (per kg) was higher in Ishwardi (42.02±6.20) and lower in Char fasson (36.87±5.25) areas, compared to other areas. This result agreed with the findings of R. C. Chanda *et al.* (2021) who stated that due to demographic distribution and existing management system, milk production cost showed different results whereas maximum cost was involved in feed cost for buffalo rearing. Maximum farmers fed their buffalo in a group in the study area. In the selected areas, the farmers migrated their buffaloes at Cholonbil, Sirajganj Char from Ishwardi and Madarganj, rests stay their own place.



Performances of Buffaloes at Different Areas

Productive Performances of Buffalo

The productive performances of buffaloes were shown in Table 5. The present findings showed that the calf birth weight significantly ($P < 0.05$) differed in selected study areas whereas calf birth weight (kg) was higher in Madarganj (33.24 ± 1.69) and lower in Char Fasson (24.20 ± 2.85) areas, compared to other areas. This agreed with the findings of Amin *et al.*, (2015) who indicated that crossbred buffalo calves' birth weights under village conditions were 30.1 kg. The lactation length (d) of buffaloes were found significantly lower in Char fasson (214 ± 20.93) followed by Madarganj (215 ± 10.40), Godagari (223.30 ± 17.10) and Ishwardi (225.50 ± 16.8) areas. The longer lactation period of the current study was in agreement with the findings of R. C. Chanda *et al.* (2021) who reported that small-scale buffalo in Trishal upazilas had a lactation duration of 230.6 days. According to Siddiquee *et al.* (2010), the lactation length of buffaloes varied from 258.67 to 289.82 days. The average buffalo milk production was significantly ($P < 0.05$) higher in Godagari (3.37 ± 0.56) and lower in Char Fasson (2.80 ± 0.49) compared to other areas. These present findings were inconsistent with the findings of Siddiquee *et al.*, (2010) and Amin *et al.* (2015), who stated that average milk production was 4.2 ± 0.3 kg/day which was slightly higher compared to the current study. On the other hand, R. C. Chanda *et al.*, (2021) showed that the average daily milk production of buffaloes raised on a small scale was 3.8 ± 0.2 L/d. that agreed to the current study results.

Table 5. Productive performances of buffalo at different areas

Parameter	Locations (Mean \pm SD)					
	Madarganj	Ishwardi	Godagari	Char fasson	Overall	Sig. Level
Calf Birth weight (Kg)	$33.24^a \pm 1.69$	$26.62^b \pm 2.72$	$25.88^b \pm 1.43$	$24.20^c \pm 2.85$	27.48 ± 4.91	**
Lactation Length (d)	$215.00^b \pm 10.40$	$225.50^a \pm 16.88$	$223.30^a \pm 17.10$	$214.90^b \pm 20.93$	219.67 ± 17.31	**
Avg. Milk Production (Kg/d)	$3.22^{ab} \pm 0.82$	$3.00^b \pm 0.74$	$3.37^a \pm 0.56$	$2.80^c \pm 0.49$	3.09 ± 0.70	**

^{a,b,c} Mean in the same row with different superscripts differ significantly ($P < 0.05$); **=significant ($P < 0.05$), NS=Non significance ($P > 0.05$).

Reproductive Performances of Buffaloes

The various parameters related to reproductive performances of buffaloes at different areas were shown in Table 6. The age (m) at first heat of buffaloes were shown significantly ($P < 0.05$) lower in Madarganj (36.82 ± 0.89) and higher in Char Fasson (45.40 ± 4.14) areas compared to other areas.

**Table 6. Reproductive performances of buffalo at different areas**

Parameter	Locations (<i>Mean±SD</i>)					
	Madarganj	Ishwardi	Godagari	Char fasson	Overall	Sig. Level
AFH (Month)	36.82 ^c ±0.89	40.27 ^b ±1.93	40.78 ^b ±2.10	45.40 ^a ±4.14	40.81±3.97	**
CI (Months)	17.58 ^c ±1.29	15.18 ^b ±1.11	14.76 ^a ±0.89	18.54 ^c ±0.78	16.51±1.11	**
Dry Period (d)	77.28±17.75	79.40±11.85	82.10±12.41	83.10±12.20	80.47±13.86	NS
GL (d)	311.08±4.08	310.98±4.28	311.48±3.68	312.82±2.20	311.59±3.70	NS

^{a,b,c} Mean in the same row with different superscripts differ significantly ($P<0.05$); **=significant ($P<0.05$), NS=Non significance ($P>0.05$); AFH-Age at first heat; CI- Calving interval; GL-Gestation Length.

The present findings were in agreement with the findings of Siddiquee *et al.*, (2015), Amin *et al.* (2015) and Siddiquee *et al.*, (2010), who reported that buffalo first calving age varied from 36 to 59 months. Furthermore, Siddiquee *et al.*, (2010) found that buffalo in the coastal region of Companiganj reached puberty at the age of 54 months, which differs from current study. Calving intervals (m) were significantly ($P<0.05$) lower in Godagari (14.76±0.89) and higher in Char Fasson (18.54±0.78) areas, compared to other areas. The present findings were consistent with the findings of Khan *et al.* (2014), who showed that the buffalo calving interval ranged from 16.1 to 25 months. Post-partum heat period (d) and gestation length (d) did not significantly ($P>0.05$) differ among the areas. The present study results showed similar results with Amin *et al.*, (2015) who reported that the buffalo's postpartum heat period varied from 30 to 171 days.

CONCLUSION

Majority of the buffalo farmers reared buffaloes in extensive rearing systems whereas the fewer intensive rearing system were found. The feeding strategies at winter season was practiced traditionally grazing at char land without balancing the ration. The buffalo failed to maximize their production due to under nutrition. After all, Buffaloes reared on char land, performed better compared to coastal part. Further research could be conducted on year round rearing scenario and feeding management practices in Bangladesh.

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AUTHORS' CONTRIBUTION

N Sultana supervised the research work; GK deb worked on conceptualizing the research work; M Miah, MA Alam, MR Amin and MT Islam developed the interview schedule, completed the survey and computerized the data. M Miah and MR Amin analyzed the data and wrote the manuscript. N Sultana and GK deb were involved in the editing and critical checking of the manuscript. All authors have read and agreed to the published version of the manuscript.

CONFLICTS OF INTERESTS

The authors declared that there were no conflict of interests regarding the publication of this article.

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