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Research Article

Influence of Non-genetic Factors on Pre-weaning Survivability of Lambs in Three North-Western Districts of Bangladesh

Md. Asaduzzaman Jemy[1], Mohammad Musharraf Uddin Bhuiyan[1], Shankar Biswas[1], Amit Saha[1], Md Ismail Hoque[2] and Farida Yeasmin Bari[1]✉

[1]Department of Surgery and Obstetrics, Bangladesh Agricultural University, Mymensingh-2202, Bangladesh
[2]Government Sheep Farm, Rajshahi, Bangladesh

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Correspondence
Farida Yeasmin Bari
✉: faridabari06@gmail.com

ABSTRACT

The productivity as well as earnings from a lamb farm largely depends on the pre-weaning survivability of lamb. This study was intended to assess the factors affecting pre-weaning survivability of lamb in field conditions. Data from a total of 133 lambs produced from 82 mother ewes was collected from beneficiary farmers of three North-western districts (Gaibandha, Bogura, and Rajshahi) of Bangladesh. Various non-genetic factors i.e. dam age, suckling, mothering behavior, sex, birth weight (g), body condition score (BCS), types of birth were determined form birth to weaning. The results showed that the overall survivability was 92.5% and 94.3% for birth to seven days and eight days to weaning, respectively. The survival percentages of young sheep in birth to seven days was significantly affected ($p < 0.05$) by the suckling, mothering behavior, birth weight (kg), BCS and type of birth. The highest survivability was observed for those lamb who had age of 4 yrs (96.6%), suckled for several times (96.9%), provided with good mothering behavior (98.7%), had birth weight in between 1 and 2 kg (97.5%), BCS more than 3 (97.3%) and twin born (95.2%). Whereas, dam age (4 yrs; 98.2%), suckling (twice; 98.8%), mothering behavior (Good; 97.5%), birth weight(>1 kg; 98.7%) greatly responsible for lamb survival in eight days to weaning stages ($p < 0.05$).In addition, the sexes of lamb found no significant relationship ($p > 0.05$) in terms of survivability during pre-weaning stages. Therefore, it could be said that dam age, suckling, mothering behavior and birth weight help to increase lamb survivability at pre-weaning stages.

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Introduction

Sheep production plays a crucial role in the agrarian economy of many tropical and subtropical countries like Bangladesh as it provides major sources of meat, wool and leather along with that the farming of sheep is profitable, creating employment opportunities, increasing income sources and helps in securing livelihood of small to large scale farmers (Abebe et al., 2023; Hossain et al., 2021; Mukasa-Mugerwa et al., 2000). The production of sheep in Bangladesh is about 3.82 million and considered to be the third most produced livestock crop of Bangladesh (DLS, 2023) Moreover, it contributes noteworthy shares in the national GDP of Bangladesh after cows and goats, for an instance, the share of livestock including sheep production in agricultural GDP is approximately 16.52% (BBS, 2023). In Bangladesh, sheep are farmed mostly in semi-intensive culture system together with that intensive and traditional culture system is also followed (Rakib et al., 2022). The indigenous sheep reared in Bangladesh is highly prolific since it provides multiple new born and give birth two times per year (Hassan and Talukder, 2012). However, the pre-weaning mortality of lamb is a worldwide problem because all the lamb are not able to pass pre-weaning stages and sometimes this mortality rate ranges between 10 to 30% (Aktaş et al., 2015; Boujenane, 2006; Mukasa-Mugerwa et al., 1994). Consequently, the sustainable farming of sheep is highly affected by the mortality of lamb during pre-weaning stages that in turn causes great economic loss (Boujenane et al., 2013; Amer et al., 1999).

Several studies reported that the survivability of young sheep depends on many factors that could broadly classified as genetic factors (heritability, inbreeding and breed differences) (Vostrý and Milerski, 2013; Riggio et al., 2008; Matos et al., 2000) and non-genetic factors like dam age, sex, size, parental care, suckling, body

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condition score (BCS), birth weight (kg), type of birth and parity of dam etc (Getachew et al., 2015; Mandal et al., 2007; Morel et al., 2008; Mukasa-Mugerwa et al., 1994; Nash et al., 1996; Sawalha et al., 2007; Vatankhah and Talebi, 2009). Furthermore, environmental factors such as season of the year and occurrence of fatal diseases like pneumonia, diarrhoea, parasites and septicemia etc. at prenatal stages greatly reducing the pre-weaning survivability of lambs (Mandal et al., 2007; Sušić et al., 2005; Morris et al., 2000). Along with management strategies such as housing, deworming, vaccination, feeding etc. also have significant impacts on the survivability of young sheep (Belay and Haile, 2011). Besides, scientific articles documented that non-genetic reasons are largely attributed to the increased survivability of lambs (Besufkad et al 2024; Wilson et al 2025). However, the detailed work on the non-genetic factors affecting lamb survivability at pre-weaning stage at field level is yet to be done in Bangladesh. Therefore, this study was aimed to determine the factors affecting the survivability of lamb in two phases i) birth to seven days and ii) eight to sixty days on field condition.

Materials and Methods

Study area and sample size

This study was conducted in the remote char areas (river bed) of three North-Western districts of Bangladesh namely Gaibandha, Bogura and Rajshahi. The data were collected over a period of three (03) years ranging from 2020-2023. The selected sheep farms were encouraged by the lamb propagation projects under various government (GO) and non-government organizations (NGO). A total of 82 ewe (N) gave birth of 133 new born lamb (n) was selected for this study on the basis of some factors such as- ewe weight (13-18 kg), number of parity (2-4), body condition score (3.0-3.5) and vaccinating & deworming data. The age of ewes was recorded by observing the teeth and calculated by using dental formula (Smith et al 1997). The locations and sample number of ewes and lambs in the targeted areas were located in Gaibandha (25.30°N, 89.61°E; 25.39°N, 89.63°E; 25.52°N, 89.64°E; N=51; n=86), Bogura (24.66°N, 89.50°E; 24.64°N, 89.50°E; 24.69°N, 89.48°E; N=14; n=19) and Rajshahi (24.37°N, 88.55°E; 24.37°N, 88.49°E; 24.34°N, 88.56°E; N=17; n=28).

Flock management practices

The selected ewes were maintained under semi-intensive farming system (grazed for 8-9 hours on open field and supplemented with concentrated feed and supply water adlibitum. Breeding sheep were regularly vaccinated (with LRI-PPR live vaccine, S/C route at over three month of age) and dewormed (with Lizol-4®, orally at three months interval). The breeding season was selected for late September to November due to its peak fertility time (Rosa et al 2003). The estruses of ewes were synchronized by administering 175 µg injection of Cloprostenol (Ovuprost®, Bomac Laboratories Ltd, Manukau) via intramuscular injection. Then the heat of ewes was detected by an aproned ram and finally inseminated artificially through transcervical artificial insemination (TCAI) technique.

Data collection

A semi-structured questionnaire was prepared to collect data regarding various aspects of mother ewe and new born lamb. Data were collected targeting two different phases of pre-weaning stages i) birth to 7 days and ii) eight days to weaning (60 days). Information on non-genetic factors such as dam age, type of birth, sex of lamb and birth weight of lamb was recorded during field visit. The birth weight was recorded immediately after birth by using digital weighing machine in kilogram (kg) (during field work as well as by owner). Other information like suckling and mothering behavior was recorded through observation as well as owner response (good mothers= care all young equally and lactating their lamb 3-5 times daily, poor mother= not careful about all young and lactating 1-2 times daily). Body condition score (BCS) is a vital factor that establish the body fat or the condition of lamb physiology and its score ranges from 1 to 5(Matos et al., 2000; Sawalha et al., 2007). This score explains that BCS less than 2 suggest very thin body with under developed physic whereas score more than 5 indicates excess fat deposition. Moreover, BCS value between 3 and 4 indicates ideal condition such as fat on ribs with visible backbone (Russel, 1984; van Burgel et al., 2011).

The survivability was calculated using following formula-

Survivability (%) = [Total no. of survival/ Total number of new born * 100]

Statistical analysis

All the collected data were enlisted in excel spread sheet and statistical analysis was performed by using SPSS software (version 22). Data were analyzed by employing descriptive stastistic and $p<0.05$ was considered as significance.

Results

Survivability of lamb from birth to 7 days

The overall survival rate of lambs from birth to seven days was 92.5% (123 out of 133). The non-genetic factors affecting the survivability percentages of lamb is presented in Table 1. The mother ewe selected for this study were 2, 3, and 4 years old and their respective percentage of lamb survivability was 83.5%, 93.02% and 96.6%. The mortality of young sheep was highest for 2 years old ewe (16.1%) and lowest in 4 years (3.4%).

However, the survivability of lamb had no significant influence (p>0.05) on the dam age in the periods of birth to 7 days. The survivability of lamb increased which good maternal care and showed significant differences (p<0.01) in case of increasing lambs' survivability. The young sheep suckled for mothers' milk once had low survival rate (64.5%) and at the same time lambs suckled for two or several times had comparative greatest rate of survivability.

Table 1. Non-genetic factors affecting lamb survival percentages from birth to seven days

Factors	Number of lamb	Mortality Number	Survivability (%)	p- value
Dam age				
2yrs	31.0	5.0	83.90	0.092
3 yrs	43.0	3.0	93.02	
4yrs	59.0	2.0	96.60	
Suckling				
Once	17.0	6.0	64.50	**0.000**
Twice	83.0	3.0	96.30	
Several times	33.0	1.0	96.90	
Mothering behavior				
Good	82.0	1.0	98.70	**0.000**
Poor	51.0	9.0	82.30	
Sex of lamb				
Male	66.0	4.0	93.90	0.527
Female	67.0	6.0	91.04	
Birth weight of lamb (kg)				
0.5-0.9	23.0	6.0	73.90	**0.002**
1-1.9	80.0	2.0	97.50	
2-2.9	19.0	1.0	94.70	
more than 3	11.0	1.0	90.10	
Body condition score (BCS)				
2 to 3	57.0	8.0	85.90	**0.014**
> 3	76.0	2.0	97.30	
Type of birth				
Single	40.0	3.0	92.50	**0.008**
Twin	84.0	4.0	95.20	
Triplet	9.0	3.0	66.70	
Overall	133.0	10.0	92.50	

Significant differences at 95% confidence interval

Besides, new born lambs with birth weight less than one (0.5-0.9) kg resulted lowest survival percentage of 73.9% whereas highest in (1-1.9) kg (97.5%) followed by (2-2.9) kg (94.7%). However, birth weight (kg) of the lamb had a substantial (p<0.05) impact on lamb survivability in the period of post birth to seven days. The present study also reported that the type of birth had a considerable (p <0.05) impact on the survival of young sheep; single birth and twin had the survivability percentages of 95.0%, while triplet survivability was lowest (83.3%). The survivability of young lamb was not significantly (p>0.05) affected by the gender during the period of birth to seven days. Body condition score (BCS) had significant influence on the young lamb survivability (P<0.05). The score of body condition ranges from 2-3 had a lower survivability percentage (89.7%), while lamb with a value of more than 3 recorded higher survivability rate (97.3%).

Lamb survivability from eight days to weaning

The overall survival rate of lambs from eight days to weaning period was 94.3% (116 out of 123). The non-genetic factors affecting the survivability percentages of lamb is presented in Table 2. The results exhibited that the survivability rate of lamb (98.2%) was found highest when lamb was produced from 4 years old mother followed by the 3 years old mother ewe. While lamb produced from less than 2 years mother, the mortality rate of young sheep raised up to 15.4%. However, the statistical analysis showed significant (p<0.05) differences in dam age in terms of lamb survivability for eight days to weaning. Besides the mothering behavior or maternal care also imparted significant variance in lamb survivability (p<0.05). The survivability of young sheep escalated when the maternal care was good as well.

Table 2. Non-genetic factors affecting lamb survival percentages from 8 days up to weaning

Factors	Number of lamb	Mortality Number	Survivability (%)	p- value
Dam age				
2 yrs	26.0	4.0	84.60	
3 yrs	40.0	2.0	95.00	**0.044**
4 yrs	57.0	1.0	98.20	
Suckling				
Once	11.0	5.0	54.50	
Twice	80.0	1.0	98.80	**0.000**
Several times	32.0	1.0	96.90	
Mothering behavior				
Good	81.0	2.0	97.50	**0.032**
Poor	42.0	5.0	88.10	
Sex of lamb				
Male	62.0	4.0	87.80	0.714
Female	61.0	3.0	86.50	
Birth weight of lamb (kg)				
0.5-0.9	17.0	4.0	76.50	
1-1.9	78.0	1.0	98.70	**0.004**
2-2.9	18.0	1.0	94.40	
more than 3	10.0	1.0	90.00	
Body condition score (BCS)				
2 to 3	49.0	5.0	89.70	0.790
> 3	74.0	2.0	97.30	
Type of birth				
Single	37.0	2.0	94.50	
Twin	80.0	4.0	95.00	0.491
Triplet	6.0	1.0	83.30	
Overall	123.0	7.0	94.30	

Significant differences at 95% confidence interval

The lamb suckled mothers' milk for twice to several time had higher survivability rate ranging from 96.9% to 98.8% ($p<0.05$). However, survivability significantly reduced when suckled for only one time a day which was observed during field visit or from owner response. The birth weight of lamb had great influence in enhancing its survival after seven days. The survivability of new born observed highest (98.7%) when the weight of lamb is more than one (1-1.9 kg). In contrast, the mortality of young sheep increased when the birth weight is less than one (0.5-0.9 kg). Whereas, the percentage of lamb survivability considerably high where the initial weight of lamb was more than two (2-2.9 kg) (94.4%). The survivability rate of lamb from eight days to weaning had also been impacted by the type of birth. Lower survivability percentage was recorded in triplet (83.3%) whereas twin birth showed greater percentages of survivability (95.0%). The gender of new born lamb showed no significant influence on its survival in this period as well. Body condition score (BCS) had a significant impact on the lamb survivability from eight days to 60 days (weaning) ($p <0.05$). The results showed that lamb with comparatively better survivability had BCS more than three (>3) whereas mortality enhanced when the body condition score was below 3 (10.3%).

Discussion

This study was conducted to assess the non-genetic factors responsible for lamb survival during two phases i.e. a) birth to seven days and ii) eight days to weaning (60 days) in three remote char areas of Bangladesh over a period of three years ranging from 2020-2023. The results showed that the factors had obvious influence on the increased survivability of young sheep in pre-weaning stages. The overall survival of young sheep was 92.5% (birth to 7 days) and 94.3% (8 days to weaning). During birth to seven days; suckling, mothering behavior, BCS, birth weight (kg) and type of birth imparted significant differences in lamb survivability whereas the survival of lamb was commonly influenced by dam age, suckling, mothering behavior and birth weight (kg) in eight days to weaning.

In this study, the highest percentages of lamb survival were recorded in both the selected phases of pre-weaning stage where the age of dam was ranged between 3 to 4 years. Previous studies found that the dam age of 3-4 years is also positively correlated with the enhanced pre-weaning survivability of lamb; whereas lamb survivability reported least when the age of dam was observed below 2 years or more than 5 years (Aktaş et al., 2015; Morris et al., 2000). The instance of escalated lamb survival produced from the

mother ewe of 3-4 years age could be elucidated by its enhanced milk producing capacity and improved maternal care during pre-weaning stage (Boujenane et al., 2013; Hatcher et al., 2009). Besides, mortality of lamb observed reduced when the young sheep suckled milk for two to several time and received good mothering care during the time ranged from birth date to 60 days (pre-weaning). The survival percentage of young sheep also exhibited for those who received colostrum for fulfilling nutrition and for improving immunity against disease (Nash et al., 1996). In this study, it has been observed that the increased survivability of lamb was attributed to suckling frequency and good mothering behavior in both the pre-weaning phases.

Gender either male or female had negligible effect on the survival of young sheep to weaning in this study ($p > 0.05$). This finding differs with Hatcher et al., (2009), since it was reported in their study that male lamb was more prone to prenatal mortality than that of female whereas other studies reported negligible differences between genders. In contrast, different researches showed that gender had impact on lamb survivability (Gama et al., 1991; Sawalha et al., 2007). Here, value of body condition in birth to seven days and eight to weaning increased the lamb survival when the value of BCS was 3 to 4. Our findings also showed that the survival of lambs born to ewes was poorer when ewes had a lower BCS. It has been reported that lambs born to Merino ewes in the high BCS had greater survival than those born to ewes in the low BCS. Ewes in poorer condition have less ability to buffer any nutritional shortfalls through mobilising their body reserves and are subsequently at greater risk of metabolic disease, dystocia and death. Fatter ewes and their lambs are predisposed to dystocia, and pregnancy toxemia also increases the risk of dystocia (Haslin et al 2023).

In this study, the birth weight imparted significant variation ($p<0.05$) in pre-weaning stage and best results of survivability was observed in lambs with age 1-1.9 to 2- 2.9. In general, the lambs born with comparatively low birth weight shows greater percentages of mortality than that of heavy weight lamb during pre-weaning stages and average weighted lambs showed highest survival percentage (Aktaş et al., 2015; Morel et al., 2008). The young sheep weighed below 1.5 kg showed reduced survivability whereas survivability increased to 98.0% when birth weight recorded between 2-3 kg (Belay and Haile 2011). However, birth weight of lambs also varies depending upon the litter size, type of species, supplementary diet to mother ewe, prenatal nutrition, geographical location and fetal genetic makeup (Haughey, 1991; Mandal et al., 2007). Besides, management practices as well as good fostering over the period of pre-weaning could help to increase survivability of lamb in spite of low birth weight (Belay and Haile, 2011). In addition, the type of birth had significant differences in birth to seven days ($p<0.05$) and conveyed no statistical significance in between eight days to 60 days ($p<0.05$). The single or twin born survived more likely than that of triplet. The findings of this study comply with the results of other studies where single or twin survived most during first seven days from birth (Getachew et al., 2015; Vatankhah and Talebi, 2009). The competition among triplet, insufficient supply of milk and poor mothering protection might be the reasons of lamb mortality in pre-weaning phases (Boujenane et al., 2013; Mukasa-Mugerwa et al., 2000).

Conclusion

In conclusion, it could be said that different non-genetic factors had definite significance in increasing lamb survivability from birth to weaning. The major factors were dam age, suckling, mothering behavior and birth weight that determined the survivability of young sheep. Farmers need to be aware of the factors that are responsible for enhanced lamb survivability to reduce pre-weaning mortality.

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