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MORTALITY OF SWAMP BUFFALO CALVES DURING THE LACTATION PERIOD

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Abstract: This study was conducted to determine mortality of swamp calves under semi-intensive rearing conditions at Shtiha government Station in Al-Ghab District, Syria. A total of 501 buffalo calves born throughout period 2008-2018 were analyzed for suckling calf mortality rate study. SAS software (2012) was used to compare four mathematical models [basic and full linear fixed models, logistic, and logarithmic (Log linear) models] to estimate calf mortality during nursing period from birth to 90 days of age. Overall mean mortality rate ranged from 14.5±3.3 to 19.2±2.7%. Sex effect of a calf was significant in the basic model. Calving period and calf weight at birth were significant according to the basic and full models. Interaction between the calving periods and birth weight was highly significant by full linear fixed and Log linear models, confirming that birth weights during the calving period were heterogeneous. The maximum likelihood analysis shows that calf sex, calving period, and birth weight were significant in the logistic model. The parity and birth weight were significant in the linear Log linear model. Effect of birth weight was significant in all models, which confirms its importance in calf mortality. In conclusion, management of buffalo calves and improvement of birth weight to be greater than 30 kg is required to reduce mortality rates during the lactation period of buffalo calves.

Keywords: Bubalus bubalis, Buffalo calves, Mortality rate

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1. Introduction

In Syria, a total number of buffaloes is about 7500 heads (FAO, 2019) which supply more than 620 and 6195 tons of meat and dairy products, respectively (MOAAR, 2011). Environmental factors greatly affect buffalo production. Among these factors, the death of calves before weaning is a major problem for breeders. Each calf surviving from a dam is an advantage in increasing productivity of farm because it saves more weight at weaning and more milk. It is accepted that calf deaths occur during nursing period. Many studies have reported that environmental factors affect calf survival before weaning. Unfavorable calving seasons lead to the mortality of calves, so health management and proper nutrition are key factors in calves' survival. Calf mortality control is vital, not only to improve calf welfare but to increase productivity. Higher calf mortality rates can be associated with higher numbers of calves in herd, breeder performance, severe weather, and nursing period covering first two months of life. Diseases appear in calves when breeders fail to transfer immunoglobulins to them, resulting in increased neonatal mortality (Katsuji, 2019). Maximum mortality has been found in young calves due to diseases as infections so special care is needed for such pathological problems (Dinesh et al., 2015). To control the mortality of calves, the effects of environmental factors should not be ignored to improve the care of calves.

This study was, therefore, conducted to estimate the mortality rate of calves, the effect of calf sex, year of calving, parity, and weight of calves at birth during the nursing period under the conditions of semi-intensive Syrian rearing.

2. Material and Methods

2.1. Animal Materials

This study was conducted at Shatiha station for buffaloes; which is located about 73 km northwest of the Al-Ghab area in Syria. Buffaloes are raised freely in the pastures located on the sides of water channels. Where they go out to pasture in the morning and return in the evening and spend the daytime napping in waters of canals from eleven in the morning until four in the afternoon to escape from the high summer heat. Napping in canal waters in autumn and spring, while almost non-existent in winter. At night, buffaloes take haven in open pens. The calving takes place in the winter and the newborns are weaned in the spring to go out with their dams to the pastures. Newborn calves were left with their dams for a week to feed colostrum. After that, the calves received milk from their mother twice a day, morning and evening, for a month. Calves gradually get used to green grass, concentrated feed, and hay during the first month of age. Then the amount of milk that the newborn takes from his dam gradually absorbs what remains after

milking and continues until the dam rejects it.

2.2. Statistical Analysis

A total of 501 records of buffalo calves were analyzed during the period 2008-2018. Each record included the identity of a calf, the sex, parity, year of birth, birth weight, and the fate of the calf whether it was weaned or dead during the lactation period. The data were analyzed using SAS (2012) software according to four mathematical models to study the non-genetic factors that influence the mortality rate of buffalo calves:

$$Y_{ijklm} = \mu + X_i + PR_j + PE_k + BW_l + E_{ijklm} \quad (1)$$

$$Y_{ijklm} = \mu + X_i + PR_j + PE_k + BW_l + XPR_{ij} + XPE_{ik} + XBW_{il} + PRPE_{jk} + PRBW_{jl} + PEBW_{kl} + E_{ijklm} \quad (2)$$

Where, Y_{ijklm}=calf mortality during the suckling period of the $ijklm^{th}$ records, μ=grand mean. X_i=effect of i^{th} sex of calf, PR_j =effect of j^{th} parity, PE_k=effect of k^{th} period of calving, and BW_l=effect of l^{th} birth weight of calf [first=BW<=30, second=BW>=31/kg). E_{ijklm}=random error term associated with the Y_{ijklm}observations with zero mean and variance $I\,\sigma^2 e$.

$XPR_{ij} + XPE_{ik} + XBW_{il}$=the interaction of the calf sex with parity, a period of year and birth weight, respectively. $PRPE_{jk} + PRBW_{jl}$=the interaction of the parity with a period of year and birth weight, respectively. $PEBW_{kl}$=the interaction of the period of years with birth weight.

Duncan's (1955) multiple-range test was used to detect differences between the means of effects. Statistical significance was declared at (P<0.05).

$$RES_{ijklm} = A + X_i + PR_j + PE_k + BW_l + LR_{ijklm} \quad (3)$$

$$RES_{ijklm} = X_i \times PR_j \times PE_k \times BW_l \times RES_{ijklm} + LR_{ijklm} \quad (4)$$

Where, RES=Response (Mortality, Survival) of the $ijklm^{th}$ records that were 16 samples for Logistic and 29 Responses for Log-linear models. A=Intercept, LR=Likelihood Ratio, Other symbols are explained in the previous models.

3. Results and Discussion

The overall calf mortality rate ranged from 14.5±3.3 to 19.2±2.7% according to models (Table 1). These values are relatively high due to poor management and unfavorable environmental conditions during the lactation period as 15-25% before weaning calf mortality is seen as an indicator of poor calf management (Moran, 2011). The overall mortality rates for buffalo calves were found at 9.4 and 11.05 in Pakistan and Egypt, respectively, and these values display accepted management of calves during the suckling period (Zaman et al., 2006; El-Regalaty and Aboul-Ela, 2014). On the other hand, there were total mortality rates for buffalo calves of 17.98%, 18.78%, and 15.89% in Peshawar, Punjab, and Nagpur (Zaib Ullah et al., 2007; Bilal et al., 2019; Kharkar et al., 2019), respectively; These values indicate poor management during the suckling period. Some studies reported high mortality values of 31%, 38.8%, and 42.11% before weaning (Oswin, 1999; Thiruvenkadan and Devendran, 2014; Amit et al., 2017), respectively, and these values may point to poor management and unfavorable environmental conditions for the care of buffalo calves. In Pakistan, the mortality rate of buffalo calves was 60% and 79.51% due to worms, lack of preventive measures, and male neglect due to low expected return (Ahmad et al. 2009; Bilal et al. 2009), respectively. Therefore, the calf needs to improve various aspects of calf breeding such as nutrition, housing, and weaning (Bilal et al., 2019). Archana et al. (2020) noted that parasites killed 34.21% of buffalo calves, of which 58.33% were males, 23.07% were females, and 75% of dead calves had diarrhea.

In the basic model (equation 1), the male mortality rate was found to be 8.1% higher than females. Calves' mortality in the second period (2014-2018) was 11.1% higher than the first period (2008-2013).

Table 1. Least Square Means (LSM) and Standard Errors (SE) of the calf mortality rates from birth to weaning at 90 days of age, in buffaloes

Source of Variance		Obs.	LSM±SE	
			Main Fixed Model	Full Fixed Model
Overall mean (μ)		501	0.192±0.027	0.145±0.033
Sex	Male	249	0.232±0.024[a]	0.222±0.028
	Female	252	0.151±0.023[b]	0.181±0.026
Parity	1st	127	0.177±0.029	0.189±0.030
	+2nd	374	0.207±0.021	0.213±0.024
Calving period	2008-2013	228	0.086±0.022[b]	0.060±0.024[b]
	2014-2018	273	0.297±0.025[a]	0.343±0.030[a]
Birth weight of calf, kg (BW)	BW<=30	117	0.270±0.031[a]	0.291±0.031[a]
	BW>=31	384	0.113±0.020[b]	0.113±0.022[b]

[a,b] Mean values with different superscripts in the same effects indicate a significant difference (P<0.05).

The mortality rate of calves born with weight equal to or less than 30 kg was higher by 15.7% than that of 31 kg or more during the nursing period based. Whereas the mortality rate in the second period (2014-2018) was 28.3% higher than the first period (2008-2013) and the mortality rate of calves born with weight equal to, less than 30 kg was higher by 17.8% than that of 31 kg or more in the full model (equation 2). The mortality of calves may be due to the higher sensitivity of unfavorable environmental conditions during the nursing period (Table 1).

Table (2) shows that the effect of sex was significant (P<0.01) in the basic model (equation 1). The calving period and calf weight at birth were significant (P<0.01) according to the basic (equation 1) and full models (equation 2). The interaction between a calving period and birth weight was highly significant (P<0.01), confirming that the birth weights during the calving period were heterogeneous. Calving period and birth weight effects demonstrated the importance of environmental factors and management practices on mortality of buffalo calves from birth to weaning at 90 days of age under semi-intense buffalo rearing conditions.

Table 2. Analysis of variance for the mortality rate of calves from birth to weaning at 90 days of age, in buffaloes

Source of Variance	DF	Fixed Model			
		Main		Full	
		MS	Pr.>F	MS	Pr.>F
Gender	1	0.822	0.0070	0.130	0.2760
Parity	1	0.076	0.4104	0.040	0.5434
Period of calving	1	5.436	0.0001	6.072	0.0001
Birth weight	1	1.977	0.0001	2.291	0.0001
Gender×Parity	1			0.011	0.7435
Gender×Period of calving	1			0.023	0.6474
Gender×Birth weight	1			0.222	0.1555
Parity×Period of calving	1			0.003	0.8517
Parity×Birth weight	1			0.001	0.9083
Calving period×Birth weight	1			1.339	0.0005
Residual	490	0.112		0.109	

Non-available

An analysis of the probability of maximum mortality variation showed that the sex of the calf, the period of calving, and the birth weight were significant (P<0.01) through the logistical model (equation 3). The calving period and birth weight were significant (P<0.01) in the Log linear model (equation 4, Table 3). The Log linear model (equation 4) showed that there is real differentiation in mortality response (survival and mortality). The differences between birth weights, calving periods, and sex of calves within the mortality response were heterogeneous. Differences in birth weights in each period of calving, parity, and calf sex were heterogeneous. There is considerable variation in the sex of calves during calving periods (Table 3). Differences in response to mortality, and calving periods, sex calves within parity were homogeneous (Table 3).

In reviews of the literature, Hammad et al. (2013) demonstrated that sex is the most important source of difference in mortality for buffalo calves, with Amit et al. (2017) finding that the male sex is significantly higher in mortality as in the current study. While Zaman et al. (2006) reported that the effect of sex was not significant on the mortality rate of Nili Ravi calves. Amit et al. (2017) found that male calves had a higher mortality rate than females at 60.47% for males compared to 23.53% for females due to male calves being neglected. While Kharkar et al. (2019) reported that female mortality was higher than male mortality, and Khatun et al. (2009) reported that female calves showed 42.85% compared to 28% for males, where females were more likely to be infected.

There is no significant effect of parity (Nitin et al., 2016; Kharkar et al., 2019), respectively as in the current study while El-Regalaty and Aboul-Ela (2014) determined the significant effect of parity on the mortality rate of buffalo calves. Mortality rates of calves born from dams in parities 1 to 6 were similar and ranged between 14% and 16.7%, while mortality rates of calves increased significantly in parities 7 and beyond, reaching the highest value of 27.5%. This may be due to dams getting older, which makes them less caring for the newborn during suckling (Table 1). Zaman et al. (2006) reported that the mortality rate for Nili-Ravi calves was 11.3% at first parity.

Mortality of calves had been significantly affected over the years (El-Regalaty and Aboul-Ela, 2014; Kharkar et al., 2019) in line with the current study, while in other studies this did not affect the mortality of buffalo calves (Hammad et al., 2013; Nitin et al., 2016). Table 1 shows that calf mortality rates were represented by two periods of years. The first period (2008-2014) and the second period (2015-2018) spanned and the differences between them were real. These real differences between the two periods reflect the importance of calf cares to reduce mortality during suckling time.

Table 3. Maximum Likelihood analysis of variance for the mortality rate of calves from birth to weaning at 90 days of age, in buffaloes

Source of Variance	DF	Logistic Model		Log linear Model	
		Chi-Square	Pr>ChiSq	Chi-Square	Pr>ChiSq
Gender	1	6.53	0.0106	1.91	0.1674
Parity	1	0.66	0.4151	29.43	<.0001
Period of calving	1	37.26	<.0001	0.69	0.4057
Birth weight	1	16.25	<.0001	11.77	0.0006
RES	1			90.71	<.0001
Birth weight×RES	1			16.89	<.0001
Period of calving×RES	1			29.00	<.0001
Parity×RES	1			0.57	0.4505
Gender×RES	1			8.86	0.0029
Calving Period×Birth weight	1			8.06	0.0045
Parity×Birth weight	1		Non-available	39.44	<.0001
Gender×Birth weight	1			4.86	0.0275
Parity×Period of calving	1			0.71	0.3995
Gender×Period of calving	1			6.10	0.0135
Gender×Parity	1			1.43	0.2317
Likelihood Ratio	13	14.50	0.2065	13.34	0.4219

The mortality rate was significantly affected by the weight of the calf (El-Regalaty and Aboul-Ela, 2014) as in this study, while the effect of birth weight was not significant on the mortality of Neil Rafi calves (Zaman et al., 2006). Table 1 shows that calves weighing more than 30 kg had a 17% lower mortality rate compared to calves of equal or less birth weight and could withstand unfavorable conditions during the lactation period. Therefore, work must be done to improve birth weight. Elsayed et al. (2020) showed in a study on the same herd that the estimate of genetic change was very low and non-significant; confirming that effective selection for birth weight was not present during the study period.

4. Conclusion

The results of present study indicated that all models gave an odds ratio for the effect of birth weight on calf mortality, taking into account other explanatory variables. Whereas the interaction between birth weight and birth periods was heterogeneous in both the full and Log linear models. Therefore, good care and management are essential for reducing calf mortality. Moreover, selection for calf weight at birth to be more than 30 kg should be applied to avoid the risk of mortality.

Author Contributions

A single author made all tasks and reviewed and approved the manuscript.

Conflict of Interest

The author declared that there is no conflict of interest.

Ethical Consideration

Ethical permission was taken from the Syrian General Commission for Scientific Agricultural Research (GCSAR) (2018-1).

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References

Ahmad S, Yaqoob M, Hashmi N, Zaman MA, Amjad MS. 2009. Farmers' attitude towards interventions regarding buffalo calf health care and management practices under field conditions. Pakistan Vet J, 29(3): 125-128.

Amit S, Biswajit R, Baghel RPS. 2017. Studies on buffalo calf mortality in Jabalpur district of Madhya Pradesh. Buffalo Bull, 36(3): 521-524.

Archana B, Madhu S, Amita D. 2020. Cryptosporidiosis in Buffalo Calves. Buffalo Bull, 39(2):195-200.

Bilal M, Yusen X, Ishtiaque RM. 2019. Assessment of calf health care and management practices under smallholder production system in Punjab, Pakistan. Buffalo Bull, 38(1): 57-66.

Bilal MQ, Hameed A, Ahmad T. 2009. Prevalence of gastrointestinal parasites in buffalo and cow calves in rural areas of Toba Tek Singh, Pakistan. J Anim Plant Sci, 19(2): 67-70.

Dinesh MAK, Gupta AU, Avtar S, Mukesh B, Binoy CN, Malhotra R. 2015. Effect of non-genetic factors on disposal pattern in female calves up to age at first calving. Indian J Dairy Sci, 68(2): 159-162.

Duncan DB. 1955. Multiple Range and Multiple F tests. Biometrics, 11: 1.

El-Regalaty HA, Aboul-Ela HB, 2014. Non-genetic factors affecting incidence of abortion, stillbirth and post–natal mortality of Egyptian buffaloes. J Anim Poult Prod, 5(6): 313-324.

Elsayed M, Al-Momani AQ, Amin MJ, Al-Najjar KA. 2020. Genetic, phenotypic, and environmental trends towards improving birth and weaning weights of Syrian buffalo calves. J Livestock Sci., 12: 76-84.

FAO. 2019. The second report on the State of the World's Animal Genetic Resources for Food and Agriculture, edited by

Scher BD, and Pilling D. FAO, Rome. URL: https://www.fao.org/publications /card/fr/c/fea3da3d-d6ed-4a27-8f58-2d83222b29d9/ (access date: August 05, 2021).

Hammad AH, Tunio MT, Shuming Y, Mohsina Z, Jing Q, Gang C, Ailiang C. 2013. Factors affecting mortality in buffaloes and calves. Int J Agric Sci Vet Med, 1(2): 1-6.

Katsuji U. 2019. Newborn calf welfare: A review focusing on mortality rates. Animal Sci J, 84: 101-105.

Kharkar KP, Raghuwanshi DS, Thakre PD, Lende SR, Khati BM. 2019. Effect of non-genetic parameters on mortality pattern in nagpuri buffalo calves. J Anim Health Prod, 7(1): 1-4.

Khatun MR, Arifuzzaman MD, Ashraf A. 2009. A comparative analysis on factors affecting calf mortality of Buffalo in a breeding farm. Pakistan J Biol Sci, 12(23): 1535-1538.

MOAAR. 2011. Ministry of Agriculture and Agrarian Reform, URL: http://www. http://moaar. gov.sy /main /archives /category (access date: August 01, 2021).

Moran JB. 2011. Factors affecting high mortality rates of dairy replacement calves and heifers in the tropics and strategies for their reduction. Asian-Aust J Anim Sci, 24(9): 1318-1328.

Nitin MG, Mehra ML, Puneet M. 2016. Studies on effect of non-genetic parameters on mortality pattern in Murrah buffaloes. Buffalo Bull, 35(3): 365-370.

Oswin PBMA. 1999. Reproductionin water buffalo: comparative aspects and implications for management. J Reprod Fert Suppl, 54: 157-168.

SAS. 2012. Institute Inc.: SAS/STAT User's Guide: Version 9.3, SAS Institute Inc., and Cary, NC, USA.

Thiruvenkadan AK, Devendran P. 2014. Effect of non-genetic factors on replacement rate and its components in Murrah buffaloes of Tamil Nadu. Indian J Anim Sci, 84(12): 1325-1327.

Zaib Ullah K, Sarzamin K, Nazir A, Abdur R. 2007. Investigation of mortality incidence and managemental practices in buffalo calves at commercial dairy farms in Peshawar city. J Agri Biol Sci, 2(3): 16-22.

Zaman T, Khan A, Akhtar MZ. 2006. Some of the risk factors of Nili-Ravi buffalo (Bubalus Bubalis) neonatal calf mortality in Pakistan. Pakistan Vet J, 26(3): 121-125.