Effects of Some Environmental Factors on Birth Weight of Anatolian Buffalo Calves

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A R T I C L E I N F O	A B S T R A C T
	This study was conducted to determine the effects of some environmental factors on birth weight (BW) in Anatolian Buffalo calves born in the scope of the project of improvement of Anatolian Buffalo in public hand supported by General Directorate of Agricultural Research and Policies reared in Amasya province of Turkey. A total of 228 heads calves born between 2014 and 2015 were constituted the study material. Sex of calf, maternal age, birth season and location were assessed as affecting factors on BW. The data were analyzed using the SPSS statistical package program. Average BW was determined as 29.3 ± 0.43 kg. The effects of calf sex, maternal age and birth season on BW were detected to be statistically significant. The average BW of the male calves (32.2 ± 0.57 kg) was found to be higher than those of the female calves (26.0 ± 0.50 kg). BW of calves born in autumn had the lowest value. In addition, BW was tented to increase with advanced maternal age.
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Introduction

Buffalo raising is one of the important financial income to many countries in the world because of its main source of economic milk and meat (Marai et al., 2001). However, Anatolian Buffalo population as an important genetic resource of Turkey has been reduced drastically during the last few decades (Atasever et al., 2011). Genetic potential for milk and fertility of Anatolian buffalo in Turkey is still low has therefore been declining because researches on buffaloes are very scarce.

Birth weight (BW) is the first observable polygenic character of animal, and it can be considered as the first phenotypic expression of individual's genotype and the difference of their subsequent growth (Yadav et al., 2001). BW is connected to the adaptability and survivability (Zaman et al., 2007) and is also used as an indicator trait in selection programs to decrease the risk of dystocia (Hossein-Zadeh et al., 2012). The BW of buffaloes are influenced by many environmental factors, for example sex of calf (Zaman et al., 2007; Hossein-Zadeh et al., 2012), maternal age (Thiruvenkadan et al., 2009), birth season (Hossein-Zadeh et al., 2012), location (Zaman et al., 2007), nutrition and etc. These factors may suppress the animal's true genetic potential for growth (Thevarnanoharan et al., 2001). Although factors

affecting calf BW in cattle have been studied, reports on the influence of different factors on BW of buffalo calves are scanty (Marai et al., 2001; Çakmak et al., 2013). Thus, further studies are needed to determine on BW of Anatolian Buffalo. The aim of the present study was to investigate the effects of some factors on BW in Anatolian buffalo calves.

Materials and Methods

The date were collected from a total of 228 calves born between 2014 and 2015 in Amasya province, Turkey. Amasya province is in the Mid-Black Sea Region of Turkey with 34° 57' 06" - 36° 31'53" east longitudes, and 41° 04' 54"-40° 16' 16" north latitudes. The province has a climate with a transition feature between a Mid-Black Sea maritime climates. Long-term average annual temperature varies from 2.7 to 24.1°C and average relative humidity is 52.5 to 69.4% (MARA, 2015).

BW was obtained from individual farms. The lactating buffaloes grazed outside between April to December, while being kept and fed indoors through the winter. The buffaloes were fed a total mixed ration in winter. Buffalo calves were fed on milk in the morning and evening. The

environmental factors were evaluated as sex of calf, maternal age, birth season and location. The statistical model assumed for the evaluation of environmental factors on BW was as fallows;

$\gamma_{ijk\ell m}$ = $\mu + a_i + b_j + c_k + d_\ell + e_{ijk\ell m}$

$\gamma_{ijk\ell m}$ = The mth observation in the ith sex of calf, j^{th} maternal age, k^{th} birth season and ℓ^{th} location.

μ = overall mean,

a_i = effect of ith sex of calf (*i: Male and Female*)

b_j = effect of jth maternal age (*j: 3 to 10*)

c_k = effect of kth birth season (*k: Autumn, Winter, Spring and Summer*)

d_ℓ = effect of ℓth location (*ℓ: Goynucek, Gumushacikoy, Hamamozu, Merkez, Merzifon, Suluova and Tasova*)

$e_{ijk\ell m}$ = Random error.

All statistical analyses were examined by using general linear model in SPSS for Windows statistical package program (SPSS, 13.00). Significance of the differences among means were compared with Duncan's multiple range test (P<0.05).

Results and Discussion

The analysis of variance results for the evaluation of the influence of sex, maternal age, birth season and location on BW is given in Table 1. The overall mean BW in the present study was found as 29.3 ± 0.43 kg. This result was higher than Sahin and Ulutas (2013), and lower than the values found by Çakmak et al. (2013) in Anatolian Buffalo calves. However, BW determined in this research was lower than the values found in the some studies with different breeds (Thevarnanoharan et al., 2001; Barbosa et al., 2006; Kaygısız, 2008; Thiruvenkadan et al., 2009).

In the present study, the effect of sex on BW was determined to be statistically significant (P<0.01). The overall mean BW was found to be 32.2 ± 0.57 kg for male calves and 26.0 ± 0.50 kg for female calves (Table 1). BW of male calves was 6.2 kg heavier than female calves. Also, the result of this study was closely in agreement with some study results (Thevarnanoharan et al., 2001; Zaman et al., 2007; Hosein-Zadeh et al., 2012; Çakmak et al., 2013; Sahin and Ulutas, 2013) in which reported BW of the male calves was higher than female calves. Hossein-Zadeh et al. (2012) emphasized that this effect could be probably due to greater body size of male calves than female. In the present study, this finding indicates that sex of calve was an important parameter for BW. In contrary, Yadav et al. (2004) reported that sex on BW had no significant effect.

As seen from Table 1, BW of the calves increased with maternal age (P=0.031). As parallel with this case, some researchers (Thevarnanoharan et al., 2001; Thiruvenkadan et al., 2009; Sahin and Ulutas, 2013) reported that effect of maternal age on BW was significant. While Hossein-Zadeh et al. (2012) indicated that calves of older buffaloes had the highest BW, Rao and Rao (1996) estimated that BW in Murrah males was significantly lower in the first parity calves than that of the later parity calves. Thevarnanoharan et al. (2001) emphasized that the buffaloes in the earlier parities produced lighter calves than those in the later parities. Conversely, Zaman et al. (2007) found that effect of parity on BW was not significant. One explanation of these results is that early-parity buffalos continue to grow until reaching adult size and may compete with the fetus for available nutrients during pregnancy (Koçak et al., 2007).

Table 1 Means of birth weight in Anatolian Buffaloes

Factors		n	$\bar{X} \pm S_{\bar{X}}$	P-value
Sex	Male	119	32.2±0.57[a]	<0.001
	Female	109	26.0±0.50[b]	
Maternal Age	3	45	27.9±0.82[ab]	0.031
	4	34	26.5±0.86[b]	
	5	44	31.3±1.13[a]	
	6	36	30.2±1.15[ab]	
	7	24	29.3±1.15[ab]	
	8	11	30.1±1.45[ab]	
	9	16	28.1±1.68[ab]	
	10	18	31.2±1.93[a]	
Birth Season	Autumn	26	26.8±0.87[b]	0.048
	Winter	19	29.6±1.29[a]	
	Spring	92	29.2±0.74[a]	
	Summer	91	29.9±0.69[a]	
Location	Suluova	37	27.0±0.91	ns
	Tasova	65	28.8±0.81	
	Goynucek	29	29.4±1.10	
	Gumushacikoy	17	29.7±1.99	
	Merkez	36	30.4±1.15	
	Merzifon	40	30.6±0.99	
	Hamamozu	4	31.1±4.72	
	Overall	228	29.3±0.43	

ns: not significant

Table 1 shows that effect of birth season on BW was statistically significant (P=0.048). Similarly, Marai et al. (2001), Thevarnanoharan et al. (2001) and Sahin and Ulutas (2013) found that BW in calves was significantly affected by calving season. Thevarnanoharan et al. (2001) determined that BW of the calves born in the winter was the lowest. Marai et al. (2001) expressed that the highest BW was measured in autumn and the lowest BW was recorded in winter and spring seasons. Naqvi and Shami (1999) reported that male calves born in spring were heavier than those of the calves born in summer. This may be caused by differential availability of pasture due to variable weather conditions during autumn season (Messine et al., 2007). Because, pasture and grazing composition during in this season which is transition period, is deteriorated. However, these results were not supported with the study reports of Hossein-Zadeh et al. (2012) and Thiruvenkadan et al. (2009).

Table 1 also presents that effect of location on BW was not significant. This result was in agreement with earlier results conducted in different breeds by Yadav et al. (2004) and Hossein-Zadeh et al. (2012). Differences of the findings between present study and the others could be explained by variations among the breeds, regions or climate.

Conclusion

This research revealed the importance of environmental factors such as sex of calf and maternal age on BW of buffalo calves. It was determined that male calves were significantly heavier than female calves. Consequently, the effects of non-genetic factors must be taken into account to provide the best estimates of genetic parameters and breeding values in the Anatolian Water Buffalo for selection. However, further investigations on BW and other traits of Anatolian buffalo calves should also be carried out.

Acknowledgement

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