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EFFECTS OF SOME ENVIRONMENTAL FACTORS ON CALF BIRTH WEIGHT AND MILK YIELD OF ANATOLIAN WATER BUFFALO (*BUBALUS BUBALIS*)

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Abstract

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This research was conducted to determine the effects of some environmental factors on calf birth weight, milk yield and lactation length in Anatolian Water Buffalo. The data on birth weight of 1006 buffalo calves, 470 total milk yields and 470 lactation lengths were from the records of the Anatolian Water Buffalo Breeding Association in Giresun Province in Turkey.

The effects of calving season, age at calving and lactation length on birth weight and total milk yield were assessed. The records, four calving seasons were established; winter, spring, summer and fall. Age was divided into three groups: 3-4, 5-6 and 7 yrs and older. Lactation length was divided into five groups 101-150, 151-200, 201-250, 251-300 and 301-350 days. Least square analyses were used for statistical analyzes. Statistical significances among subgroups were determined with the Tukey Multiple Range Test.

The overall means of calf birth weight, total milk yield and lactation length were 26.95 kg, 925.43 kg and 231.89 days, respectively. Birth weight was significantly influenced by sex of calf ($P < 0.05$) and age of dam ($P < 0.001$), and increased with the age of dam. There was no significant effect of age on the total milk yield and lactation length ($P>0.05$). The total milk yield ($P < 0.01$) and lactation length ($P < 0.001$) of dams calving in winter-spring were higher than for summer-autumn.

In conclusion, calf birth weight and total milk yield in Giresun province is satisfactory for Turkish conditions. Births of calves should be planned for winter due to buffaloes calving in winter-spring producing the highest total milk yield.

Key words: buffalo; birth weight; milk yield

Introduction

Water buffalo *(Bubalus bubalis)* is the major dairy animal for some South Asian countries, including Nepal, Pakistan, India and Sri Lanka, contributing approximately 67.41%, 62.47%, 52.94% and 20.42%, respectively, of the total milk produced in those countries (Anonymous, 2014). Water buffalo are also husbanded in Italy where the buffalo milk yield has increased 12.10% in the last decade (Anonymous, 2014).

The Anatolian Buffalo breed is classified as a Mediterranean Water Buffalo among river type buffaloes. This breed has spread to all parts of Turkey, great majority of the buffalo population in Turkey is located in Central Black Sea Region (Soysal et al, 2005; Soysal, 2013). The Anatolian Water Buffalo is a local dairy animal in Turkey, contributing approximately 0.27% of the total milk produced in the country (Anonymous, 2014). In Turkey, the environmental conditions in some regions are suitable for buffalo breeding. However, it

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is an almost ignored animal production branch in Turkey so it appears quite feasible to increase buffalo production and productivity in the context of overall animal production.

In order to enhance the productivity of a dairy animal, it is necessary to understand the factors affecting production. Calf birth weight and milk yield of the water buffalo are very important for productivity. Calf birth weight is closed related to survival rate and growth performance. Calf birth weight, which is an indicator for growth in the prenatal period, is affected by genetic and environmental factors such as maternal age and calf sex (Akçapınar and Özbeyaz, 1999; Akdağ et al., 2011). Since there are morbidity and mortality risks for calves of low birth weight, higher birth weights contribute to higher survival rates (Nardone et al., 1997).

Lactation length is the period between birth and the dry period in the dam. Lactation milk yield is the most important trait for selection and improvement of dams and for maintenance of the herd (Tekerli et al., 2001; Şahin and Ulutaş, 2014). Lactation milk yield and lactation period vary among breeds and herds. This variation is influenced by genetic and environmental factors and the second group of factors is more important. Lactation milk yield and lactation length are affected by environmental factors such as dam age and season of calving (Akçapınar and Özbeyaz, 1999).

The objective of the present study was to evaluate the effects of dam age and sex on calf birth weight and the effects of dam age and season of birth on milk yield and lactation length and calf weight in Giresun Province in Turkey.

Materials and Methods

This study was conducted by using birth weight, total milk yields and lactation length data provided by the Anatolian Water Buffalo Breeding Association in Giresun Province.

Birth weight records of water buffalo calves (472 male and 534 female) born in 2013 and 2014 in Giresun Province were used. The birth weights were determined 24 h postnatal with electronic scales (precision: 100 g).

The lactation records of 470 Anatolian Water Buffalo dams which gave birth in 2013 were also used. Measurement of milking was initiated on the 30th day after the date of calving and continued in 30 days intervals until the dam was dried off. The farmers do not use supplementary feeding during the pasture period, but used hay, alfalfa and silage in winter. In Giresun Province, water buffaloes are released to the pastures after the morning milking, when the seasonal conditions allow.

The effects of calving season, age at calving and lactation length on birth weight and total milk yield were assessed. Based on the geo-climatic conditions prevailing in Turkey, four calving seasons were established; winter (December, January and February), spring (March, April and May), summer (June, July and August) and fall (September, October and November). Age was divided into three groups: (1) 3-4 yrs, (2) 5-6 yrs and (3) 7 yrs and older. Lactation length was divided into five groups (1) 101-150 days, (2) 151-200 days, (3) 201-250 days, (4) 251-300 days and (5) 301-350 days. Least square analyses were used to examine the effects of calf sex, age at calving and season of calving on calf birth weight and total milk yield (SPSS 21). Statistical significances among subgroups were determined with the Tukey Multiple Range Test.

Results

The mean Anatolian water buffalo calf birth weights for maternal age and gender were presented in Table 1. The overall mean of calf birth weight was 26.95 kg in the present study (Table 1). Maternal age ($P < 0.001$) and gender ($P < 0.05$) had a significant effect on calf birth weight. In terms of gender, birth weights of males were higher than for females. In the current study, the lowest birth weight was for 3 year old dams. However, calf birth weight increased with increasing dam age in this study (Table 1).

The data for milk yield and lactation length for parity are presented in Table 2. Total milk production and lactation length in the 3rd and 4th years of age were lower than those for other ages in the present study. However, milk yield for lactation length and dam age were not significantly related

Table 1
Effects of maternal age and gender on Anatolian Water Buffalo calf

Environmental factors	Calf weight	
	n	$\bar{X} \pm S_x$
Maternal age		***
3	175	24.74±0.55^{b}
4	215	26.95±0.49^{a}
5	202	27.56±0.58^{a}
6	168	28.56±0.63^{a}
7	107	26.85±0.76^{a}
8+	139	27.48±0.61^{a}
Sex		*
Male	472	27.49±0.25
Female	534	26.29±0.24
Overall mean	**1006**	**26.95±0.25**

* $P < 0.05$; *** $P < 0.001$
^{a,b} Means within a column in a subgroup with different letters differ significantly ($P < 0.05$)

Table 2

Effects of Anatolian Water Buffalo parity and season of calf birth on milk yield and lactation length

Enviromental factors	Milk yield		Lactation length
	n	$\bar{X} \pm S_x$	$\bar{X} \pm S_x$
Age of dam	-	-	-
3-4	202	878.37±29.40	225.53±1.66
5-6	152	951.32±28.10	234.79±1.59
7+	116	951.84±40.24	236.05±2.28
Season of calf birth		**	***
Winter-Spring	163	1001.66±31.99	241.93±1.81
Summer-Autumn	307	859.89±21.97	223.18±1.24
Overall mean	470	925.43±18.95	231.89±1.07

** P < 0.01; *** P < 0.001; - : non-significant

(P>0.05). In addition, there was a trend of decreasing milk yield in dams aged seven or more, with the highest total milk yield in the third and fourth lactations.

The effect of calving season on total milk yield (P < 0.01) and lactation lenght (P < 0.001) were significant (Table 2). The milk yield and lactation length of buffaloes calving in winter-spring were higher than in summer-autumn.

In present study, the overall mean of lactation length was 231.89 days (Table 2) and it ranged from 101 to 350 days (Table 3). The longest lactation lengths were in 7+ year old dams. In this study, there was significant relationship between age and lactation length (P < 0.001). Also, there was a trend to increasing milk yield with increase in lactation length (Table 3).

Table 3 Effects of lactation length of Anatolian Water Buffalo on milk yield

Environmental factors	Milk yield		
	n	%	$\bar{X} \pm S_x$
Lactation length			***
101-150	44	9.36	634.59±39.52[a]
151-200	131	27.87	765.50±18.58[b]
201-250	174	37.02	937.73±17.00[c]
251-300	106	22.55	1074.70±30.10[d]
301-350	15	3.19	1069.35±59.41[d]

***: P < 0.001

[a,b,c,d]: Means within a column in a subgroup with different letters differ significantly (P < 0.05)

Discussion

Calf birth weight is one of the important factors in a successful animal breeding program due to its strong influence on survival rate and growth performance. The overall mean of calf birth weight was 26.95 kg in the present study (Table 1). Mean birth weight of buffalo calves was 28 kg for females and 32 kg for males for Anatolian Water Buffaloes (MARA, 2009). Birth weight of calves in Giresun Province was therefore slightly below the mean for Turkey. In the current study, the lowest birth weight was for 3 year old dams. However, calf birth weight increased with increasing dam age in this study (Table 1). Rate of increase in birth weight based on 3 year old dams ranged as 8.94%, 11.40%, 15.45%, 8.53% and 11.08% for 4, 5, 6, 7 and 8+ ages respectively. Calves born to mature dams are usually heavier than first-born calves (Akçapınar and Özbeyaz 1999). This could be due to mature dams being capable of providing better physiological support for the foetus. In this study, the birth weight of male calves was 4.57% higher than that of females. This result agrees with that of Reynolds et al. (1980).

Total milk yield is an important factor in breeding selection for milking animals. The means for Anatolian Water Buffalo lactation milk yield in Turkey were reported as 894.3 kg (Tekerli et. al., 2001), 943.2 kg (Özenç et al., 2008) and in the range of 654.7-761.4 kg (Şahin and Ulutaş, 2014). In the present study, the mean for lactation milk yield was 925.4 kg (Table 2). This was similar to the reported findings for Anatolian Water Buffalo in Turkey. However, the means for total milk yield were 2031 kg in Pakistan (Chaudhry, 1992), 1200 kg in Romania and 2175 kg in Italy for water buffaloes (Bordhese and Mazzi, 2005). These production levels were substantially higher than for Anatolian Water Buffalo in Turkey. The differences could be due to the traits of the breeds of water buffalo or to different feeding regimes. Additionally, total milk yield is affected by genetic and environmental factors such as age of buffalo, lactation length and season of calving (Akçapınar and Özbeyaz, 1999). Total milk yields in the 3rd and 4th years were lower than those for other ages in the present study. In addition, there was a trend of decreasing milk yield in dams aged seven or more, with the highest total milk yield in the third and fourth lactations. It was reported that the third lactation produced the highest milk yield in Anatolian Water Buffalo (İzgi and Asker, 1988) which decreased after 5-6 years (Tekerli et al., 2001).

The effect of calving season on total milk yield was significant (P < 0.001) (Table 2). The milk yield of dams calving in winter-spring was higher than in summer-autumn. This agreed with the findings of Chaudhry (1992) for Nili-Ravi buffaloes. That result may be due to suitable ambient temperatures in winter-spring and the supply of good quality green fodder in pasture during spring and summer. The number of buffaloes calving in winter-spring was higher than in summer-autumn (Table 2). The lactation length of buffaloes calving in winter-spring was longer than in summer-autumn

(Table 2). In the present study, mean lactation milk yield and lactation length were 1001.7 kg and 241.9 days for buffaloes calving in winter-spring, and 859.9 kg and 223.2 days for buffaloes calving in summer-autumn (Table 2). The differences may be due to different management and feeding programs.

In present study, the overall mean of lactation length was 231.89 days (Table 2) and it ranged from 101 to 350 days (Table 3). The mean lactation length was 200-250 days for Anatolian Water Buffalo (MARA, 2009). Also, there was a trend to increasing milk yield with increase in lactation length (Table 3).

Conclusion

Calf birth weight in Giresun Province is at a satisfactory level for Turkish conditions. The births of buffalo calves should be planned for winter due to buffaloes calving in winter-spring having the highest total milk yield.

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