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Effect of Environmental Factors on Lactation Milk Yield, Lactation Length and Calving Interval of Anatolian Buffalo in Istanbul

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ABSTRACT

In this study, 3843 lactation yield records of Anatolian Buffaloes within "Anatolian Water Buffalo Breeding Project" and reared in Istanbul province and district were used. The aim of study was to investigate the effects of environmental factors on the lactation milk yield (LMY), lactation length (LL) and calving interval (CI) of the Anatolian buffalo. For this propose 2034 Anatolian buffalos' pedigrees in Istanbul between 2012 to 2017 were used. The overall mean and standard error of the LMY, LL and CI were determined as 1223.9 ± 6.83 kg, 230.99 ± 0.89 kg and 417.51 ± 1.73 days respectively. The effects of the province, calving year, lactation number, season and calving age on these characteristics were determined. Also effects of the province, calving year, lactation number, season and calving age on LMY, effect of province, calving year and season on LL and calving year, lactation number and calving age on CI were statistically significant ($p<0.01$), Phenotypic correlation were calculated between LMY, LL and CI also.

İstanbul'da Yetiştirilen Anadolu Mandalarının Laktasyon Süt Verimi, Laktasyon Uzunluğu ve Buzağılama Aralığı Üzerine Çevresel Faktörlerin Etkisi

MAKALE BİLGİSİ

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ÖZET

Çalışmada İstanbul ili Anadolu Manda Islahı Porjesinde yer alan Anadolu Mandasına ait 3843 süt verim kaydı kullanılmıştır. Çalışmanın amacı, Anadolu Mandalarında Laktasyon Süt Verimi (LSV), Laktasyon Süresi (LS) ve Buzağıalama Aralığına (BA) etki eden çevresel faktörlerin belirlenmesidir. Bu amaçla İstanbul'da yetiştirilen 2034 Anadolu Mandasının 2012-2017 yılları arasındaki pedigri kayıtları kullanılmıştır. LSV, LS ve BA ilişkin ortalama ve standart hatalar sırası ile 1223.9 ± 6.83 kg, 230.99 ± 0.89 kg ve 417.51

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Anahtar Kelimeler

Anadolu Mandası
Çevresel faktörler
Süt verimi
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± 1.73 gün olarak tespit edilmiştir. Bu özellikler üzerine bölge, buzağılama yılı, laktasyon sırası, mevsim ve buzağılama yaşının etkisi araştırılmıştır. Çalışmada LSV üzerine bölge, buzağılama yılı, laktasyon sırası, mevsim ve buzağılama yaşının, LS üzerine bölge, buzağılama yılı, ve mevsim ve BA üzerine buzağılama yılı, laktasyon sırası ve buzağılama yaşının etkisi istatistik olarak önemli bulunmuştur (P<0,01). Ayrıca LSV, LS ve BA arasındaki fenotipik korelasyonlar da hesaplanmıştır.

Introduction

While the number of buffaloes in the world, was 173 million in 2005, it was reported that the number was increased to 200 million in 2013. The population of buffaloes has increased by 87% between 2005-2013. In Turkey, the number of buffaloes was 103000 in 2005, and it was 107000 in 2013. (Anonymous, 2014a). In 2014, due to the Project of Nationwide Improvement of Buffalo Breeding in Farm Condition, the number of buffaloes in Turkey, has increased to 107435. The buffaloes being raised in Turkey, are originated from the Mediterranean buffaloes, which is a subgroup of river buffaloes, and they are named as Anatolian Water Buffaloes (Soysal, 2009). In Turkey, by the year of 2014, 300 tons meat and 50000 tons milk were produced from buffaloes (Anonymous, 2014b).

Anatolian water buffaloes are generally bred in Samsun and Sinop in the seashores of Northern Anatolia; in Çorum, Amasya and Tokat in Middle and Inner North Anatolia; in Afyon and Balıkesir in Inner West Anatolia; in İstanbul in Marmara; in Sivas and Muş in East Anatolia; and in Diyarbakır in Southeast Anatolia (Şekerden,2001). Moreover, in Anatolian water buffaloes, it is reported that lactation duration is ranging between 180 and 280 days and 305-day yield is ranging between 800 and 1100 kg (Anonymous, 2004). Buffalo breeding in Turkey is made for milk (lüle kaymağı, yoghurt, cheese, and ice cream) and meat (sucuk, salami, and pastırma) production (Soysal, 2009). However, buffalo breeding is usually practiced by family-run small-scale (83%) and medium-scale (17%) enterprises (Sarıcan, 1993). Importance of the buffalo, stems from milk and meat yield, resistance to many infectious diseases, low breeding costs, and being an appropriate livestock for low-income growers. In addition to this, the studies conducted, have indicated that buffalo meat contained 40% less cholesterol, 12% less fat, 55% less calorie, and 11% more protein and mineral than beef (Sarıözkan, 2011; Borghese *et al.*, 2010). Therefore, buffalo meat is reported to be a good choice of red meat for people with heart and circulatory system diseases (Küçükkebapçı, 2005).

The aim of study was to investigate the effects of environmental factors on the lactation milk yield (LMY), lactation length (LL) and calving interval (CI) of the Anatolian buffalo. For this propose 2034 Anatolian

buffalos' pedigrees in Istanbul between 2012 to 2017 were used.

Materials and methods

Material of this study consisted of 3843 milk yield records from buffaloes that reared in 4 different provinces of İstanbul in the framework of Project of Nationwide Improvement of Buffalo Breeding in Farm Condition. On the other hand milking is carried on twice daily, in the morning and evening. Milk controls of buffaloes are collected monthly with a weighing scale with a precision of 10 g/50kg.

In this study, the effects of the province, calving year, lactation number, season and age on these characteristics were determined. Also, effects of the province, calving year, lactation number, season and age on LMY, LL and CI. were analyzed by Variance Analysis Technique (ANOVA; Least Squares Method). Minitab version 14 was used for statistical analyses and, subsequently, factors that reveal significant effects were compared in Tukey's multiple-range test (Tukey, 1953; Sheskin, 2004). The mathematical model that will be used to determine the effect of environmental factors, is given Model:

$$Y_{ijklmn}=\mu+a_i+b_j+c_k+d_l+f_m+e_{ijklmn}$$

Definitions of symbols are as follows:

Y_{ijklmn} : observation value of the investigated trait (lactation milk yield, lactation length and calving interval of 1. cow, that in i. province, in j. calving year, in k. lactation number, in l. season and in m. calving age)

μ : population average,

a_i : i. amount of effect of province,

b_j : j. amount of effect of calving year,

c_k : k. amount of effect of lactation number

d_l : l. amount of effect of season

f_m : m. amount of effect of calving age

e_{ijklmn} : error

Results and Discussion

The overall mean and standard error of the LMY, LL and CI were determined as 1223.9 ± 6.83 kg, 230.99 ± 0.89 kg and 417.51 ± 1.73 days respectively. The effects of the province, calving year, lactation number, season and calving age on these characteristics were determined. Also effects of the province, calving year, lactation number, season and calving age on LMY, effect of province, calving year and season on LL and calving year, lactation number and calving age on CI were statistically significant ($P<0.01$), Phenotypic correlation were calculated between LMY, LL and CI also.

Table 1. Characteristics of Anatolian water buffalo that determined in Istanbul

Parameters	n	Min	Max	$\overline{X} \pm S_{\overline{X}}$
Lactation Lenght, day	3843	120	397	230.99 ± 0.89
Lactation Milk Yield, kg	3843	402	3155	1223 ± 6.83
Calving Interval, day	2239	300	700	417 ± 1.73

Table 2. Descriptive statistics and significance test results for values of lactation milk yield (LMY), lactation length (LL) and calving interval (CI) according to the province, calving year, lactation number, season and calving age.

		LMY			LL			CI	
Province	n	$\overline{X}$	$S_{\overline{X}}$	n	$\overline{X}$	$S_{\overline{X}}$	n	$\overline{X}$	$S_{\overline{X}}$
Arnavutköy	1207	1193.3^{b}	12.3	1207	236.42	1.51^{a}	661	421.77	3.39
Çatalca	1481	1194.2^{b}	10.9	1481	227.79	1.45^{b}	987	403.87	2.34
Eyüp	781	1321.5^{a}	13.7	781	234.05	1.96^{b}	409	431.32	4.04
Silivri	374	1236.8^{ab}	24.2	374	219.69	3.04^{c}	182	444.48	6.79
P		**			**			ns	
Calving year									
2012	420	1125.9^{b}	12.6	420	213.72^{c}	1.59	308	407.37^{a}	4.24
2013	542	1277.2^{a}	17.7	542	244.49^{ab}	2.42	351	414.32^{ab}	4.29
2014	591	1279.1^{ab}	16.3	591	235.64^{b}	2.12	341	419.14^{c}	4.33
2015	631	1227.0^{ab}	16.8	631	232.60^{b}	2.30	358	422.75^{c}	3.93
2016	980	1281.3^{a}	15.3	980	244.19^{a}	1.85	522	428.08^{bc}	4.01
2017	679	1108.3^{c}	16.1	679	206.28^{c}	1.94	359	406.94^{c}	4.28
P		**			**			**	
Lactation number									
1th	1516	1155.9^{b}	9.89	1516	229.27	1.42	1107	388.78^{b}	2.14
2nd	1029	1270.3^{a}	13.1	1029	234.20	1.75	636	421.81^{a}	2.96
3rd	625	1258.1^{a}	17.7	625	233.13	2.12	325	454.71^{ab}	4.06
4th	422	1287.8^{a}	22.4	422	232.91	2.65	137	504.95^{a}	6.49
5th	251	1251.8^{a}	30.9	251	219.59	3.52	34	562.1^{ab}	13.4
P		**			ns			**	
Season									
Winter	1332	1316.7^{a}	11.4	1332	244.82^{b}	1.34	775	414.58	2.83
Spring	1587	1163.0^{b}	10.0	1587	220.65^{c}	1.32	921	422.89	2.74
Summer	589	1128.9^{c}	17.3	589	215.80^{d}	2.44	336	418.96	4.60
Autumn	335	1310.6^{a}	25.9	335	251.65^{a}	3.53	207	401.78	5.63
P		**			**			ns	

Calving age									
4	827	1115.2^{c}	13.4	827	231.60	1.98	827	350.15^{e}	0.588
5	426	1210.1^{bc}	18.7	426	236.21	2.65	426	387.04^{d}	0.401
6	465	1230.1^{ab}	18.1	465	232.01	2.51	465	426.15^{c}	0.734
7	405	1257.3^{ab}	22.6	405	228.77	2.63	405	511.75b	2.10
8	407	1234.8^{bc}	20.1	407	228.68	2.65	116	645.21^{a}	2.53
9	348	1252.7^{ab}	24.4	348	230.81	3.01			
10	276	1309.8^{ab}	27.5	276	225.65	3.27			
11	204	1357.1^{a}	31.7	204	231.69	3.90			
12	485	1252.9^{ab}	20.1	485	231.00	2.55			
p		**			ns			**	

$^{a-e}$: The difference between the averages indicated by different letters in the same column are statistically significant. **: P<0.01, ns: non-significant

It is determined that the effects of the province, calving year, lactation number, season and calving age on LMY (1223 kg) were significant (P≤0.01). This value is less than the lactation milk yield reported by other studies (Caddy et al., 1983; Babar et al., 1996; Vasconcellos and Tonhati, 1998; Rosati and Van Vleck, 2002; Malhado et al., 2013) for Nili-Ravi (1702-2064 kg), Brazil Murrah (1493.3-1631.5 kg) and Italian buffaloes (2286.8 kg). This result can be attributed to the differences in breed, feeding and management conditions. In addition, the lactation milk yield obtained in this study is higher than the values reported by some other studies (Tekerli et al., 2001; Tekerli et al., 2016; Uğurlu et al., 2016) for Anatolian buffalo (894.3, 925.4 and 1000.7 kg, respectively) in Afyonkarahisar and Giresun provinces of Turkey. This may be due to advances in feeding and management conditions and the effect of selection in the National Anatolian Water Buffalo Improvement Program.

From another hand it is reported that, mean lactation period of Anatolian water buffaloes was 232 days (112-449 days) and depending on various factors as race, care-nutrition, age, lactation, and length of the dry period, lactation milk yield reported to be 925 kg (Soysal, 2009). Similarly to the results of this study, it was reported (Vasconcellos and Tonhati, 1998; Hussain et al., 2006; Marai et al., 2009) that the year, season and age have significant effects on the lactation length. The mean of the lactation length determined in this study is shorter than those reported in other studies (Babar et al.,1996; Rosati and Van Vleck, 2002; Malhado et al., 2013) involving Nili-Ravi (327.9 days), Murrah (269.4 days), and Italian water buffaloes (270 days) but longer than those reported by some other studies (Tekerli et al., 2016; Uğurlu et al., 2016) for Anatolian buffaloes (229.4 days and 231.9 days).

Generally, in buffaloes, it is stated that the highest milk yield can be seen between the ages of 6 and 7, namely during the 3rd lactation (İzgi and Asker, 1988; Metin, 1999). Özenç et al. (2008) have determined that lactation milk yield was changing in the range of 350-1580 kg and that the mean lactation milk yield was 943.2. It is reported that the 1st lactation milk yields of buffaloes reared in Buffalos Research Institute of Afyon, were ranging between 227 and 1443 kg with an average milk yield of 813 kg (İzgi and Asker, 1988). It was noted by Kreul and Sarıcan (1993) that lactation milk yield of buffaloes range from 600 to 800 kg in Turkey, although this value was determined as 1200 kg in Europe. The LL average, which is closely related to lactation milk yield, was determined to be 220 days for indigenous water buffaloes, and 225 days for hybrid buffaloes, in Buffalos Research Institute of Afyon. İlaslan et al. (1983) have defined the mean lactation length as 224 days. In a study conducted in Tokat, according to Vogel method, the highest milk yield was 761.4±16.4 kg; according to Trapez method, the lowest milk yield was 657.7±13.7 kg. In the same study, LL and dMY were 146.55±1.79 days and 5.21±0.096 kg, respectively (Şahin ve Ulutaş 2013). In a study on Anatolian water buffaloes that carried out in Afyon Kocatepe Agricultural Research Institute, average values of 305dMY and LL were determined to be 1070.5±279,9 kg, and 221±44.19 days, respectively (Şekerden, 1999). Garcia et al. (2013) have used 2575 lactation records which belong to 1377 buffaloes, to estimate genetic parameters for the milk yield and LL of buffaloes. Accordingly, they noted the 244-day average milk yield and lactation length as 864 kg and 240 days, respectively. It is reported that Nili Ravi buffaloes that reared in Pakistan, had a mean lactation period of 317 days and a mean lactation milk yield of 2219 kg.

In the study, during winter and autumn, LMY was highest in comparison to values from summer and spring, on the other hand, during summer, LMY was lower in comparison to spring, summer and autumn. In this case, being at the onset of lactation and good condition of pastures in this season, might have been effective. The lowest milk yield was attained during winter (December to February). Accordingly, this case can be explained by the end of the lactation of animals and pasture effect (Şekerden et al., 1999). It is seen from results that buffaloes which calve in winter and autumn had a higher milk yield than buffaloes which calve in summer and spring. In order to explain that how buffaloes which calve in winter had higher milk yields in comparison to other seasons, it is possible to think that influence of critical temperatures resulting from seasons, feeding inside, and longer milking durations. So, for the buffaloes consistently grown under intensive conditions in the winter, attention is paid to care and nutrition. In addition to this, longer lactation lengths were seen in buffaloes which calve in winter and autumn than those which calve in summer and spring, respectively. This has been effective in the high milk yield in winter and autumn seasons (Şekerden et al., 1999).

Conclusion

It was concluded that the factors affecting milk production and reproduction must be considered in a selection program. Also, after corrections according to factors deemed significant in terms of milk yield and composition, buffaloes could be selected based on the first lactation milk yield.

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