A research on milk yield, milk composition and body weights of Anatolian buffaloes

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ABSTRACT

The objective of this study was to define the lactation milk yield and milk composition, and the weights at birth, at 180 and 365 days of age in Anatolian buffaloes reared in Bitlis province of Turkey. The animal material of the study consisted of 1448 Anatolian buffaloes having different ages. The lactation milk yield and lactation length were calculated from monthly milking records during the lactation period. The least squares means for lactation milk yield and lactation length in Anatolian buffaloes were 763.99±18.66 kg and 262.63±8.37 days, respectively. Dry matter, protein, fat, lactose, ash contents and pH value of the milk of Anatolian buffaloes were 16.08 ±1.54%, 3.40 ±0.67%, 7.09±1.38%, 4.57%±0.81, 0.67±0.30%, and 6.68±0.40, respectively. The weights at birth, at 180 and 365 days of age were 29.28±0.56, 97.51±1.56 and 142.16±1.50 kg, respectively. As a result, the values found for the lactation characteristics and the body weights of Anatolian buffaloes were low compared to genotypes raised in intensive production systems, but the potential of genetics of buffaloes reared in traditional production systems can be understood providing of adequate environmental conditions and planning of effective selection programs.

Keywords: Anatolian buffalo, Body weight, Lactation, Milk composition.

INTRODUCTION

The world total buffalo (Bubalus bubalis) population is mostly widespread in tropical and subtropical countries with hot and humid climate, especially South East Asian countries like India, Pakistan and China. If the other Asian countries such as Thailand, Indonesia, Philippines, Vietnam, Bangladesh, Nepal, and Sri Lanka are added to these countries, Asia has the 95 % of world buffalo population (FAO, 2014). Despite of high population of buffaloes in these countries, the buffalo breeding has a traditional breeding system and production per cow is low. In Europe, however, buffalo breeding under intensive breeding system especially draws attention in Italy in terms of mozzarella industry.

In Turkey, there are about 121,826 buffalo head in Turkey according to FAO data and these animals are reared in different parts of Turkey for different purposes such as milk, meat and draught (FAO 2014). At the same time, buffaloes of Turkey, Anatolian buffaloes, are regarded as an important genetic and cultural source in Turkey. However, population size of Anatolian buffaloes dramatically decreased between 1970 and 2008. It has been thought that we can lose this genetic source, which it is important for both the economic and cultural aspects, if we do not have any conservation program for this animal species in future (Sariözkan 2011). Like the Asian countries, buffalo breeding in Turkey has been performed by traditional methods and production per cow is low in comparison with intensive buffalo production systems, but little is known about variation of production traits. Therefore, it is important to carry out the projects on Anatolian buffaloes for both conserving as a genetic resource and increasing production characteristics. With the projects carried out by General Directorate of Agricultural Research and Policies (TAGEM), Ministry of Food, Agricultural and Livestock Ministry of Turkey, it has been foreseen providing a contribution for restoration of Anatolian buffalo breeding in long term. Recently, there are numerous studies concerning with Anatolian buffaloes to establish databases, which it serves to do projects regarding the improvement of them (Tekerli et al., 2001; Sahin and Ulutas, 2014; Sahin et al., 2014).

In this study, we aimed to determine the lactation milk yield and composition, and body weights in different periods such as at birth, at 6 months and yearling age in Anatolian buffaloes reared in traditional production conditions of Bitlis province of the Turkey.

MATERIAL AND METHODS

Animals and management: Data obtained from 1448 Anatolian buffalo raised in Güroymak and Mutki regions of Bitlis city (38° 24’ 2.048” N 42° 6’ 34.207” E). The study was financially supported by General Directorate of
Agricultural Research and Policies (TAGEM), Ministry of Food, Agricultural and Livestock Ministry of Turkey (Tekerli, 2016). In the beginning of study, the notebook for milk record and the milk weighing device were delivered to the farmers. During the study, we performed some meetings with farmers to make both the introduction of the project and to ensure the conscious of recording in farmers. Milk yield for each cow was calculated from test day milk yields which collected monthly interval during the lactation period. The first test day was started 80 days after calving and lactation milk yield of buffalo cows was estimated using Trapeze II formula (Berger and Thomas, 2016). The formula of Trapeze II method, Fleischmann method is presented as follows:

\[ X = [(k_1 A) + ((k_1+ k_2)/ 2) a_1 + \ldots + ((k_n-1 + k_n)/2) a_n + (k_n C)] \]

Where,

- \( A \): number of days from calving to 1st monthly test,
- \( k_i \): milk yield of the 1st monthly test,
- \( a_i \): number of days between monthly tests,
- \( KnC \): the milk yield taken multiplying the milk yield of last test and number of days until dry period.

Milk composition was determined for three periods; the beginning of lactation, mid-lactation and the end of lactation. Investigated characteristics of milk content were dry matter (%), protein (%), fat (%), lactose (%), ash (%) and pH. We sampled 20 buffalo cows in each village of Güroymak region in three stages of lactation. Thus, a total of 120 samples of milk could be taken in every of lactation stage for determining the milk composition. After that, the samples were taken into laboratory of Food Engineering (Faculty of Engineering and Architect, Yuzuncu Yil University, Van, Turkey) to analyze milk composition. The analyses of milk composition were performed by described Kurt and Çakmakçı (1982), AOAC (1990) and Kosikowski (1984).

The data for body weights in several periods included 983 weights at birth and 959 of 180 days of age and 903 of 365 days of age raised on pasture during spring, summer and autumn, and fed by white and alfalfa straws during winter without supplementation of Bitlis city of Turkey. The body weights of Anatolian buffaloes were recorded at birth, at 180 days of age and at 365 days of age and were calculated by interpolation.

**Data analyses and statistics:** Data analyses for milk yield, milk composition and body weights were performed using GLM procedure of SAS (2015) software, including the environmental factors such as villages, age of buffalo.

**RESULTS AND DISCUSSION**

The least squares means for the lactation milk yield and the lactation length are presented in Table 1. Averages of lactation milk yield and lactation length were 763.99±18.66 kg and 262.63±8.31 days, respectively. The effect of the age of buffalo on milk traits varied among the age groups (P<0.01 and P<0.05). The lowest lactation milk yield was in 5 years old age (662.65 kg). However, unlike the lactation milk yield, the effect of age of buffalo on lactation length was only observed at 5 ages of buffalo. As shown in Table 1, least squares mean for lactation length was shorter for 5 years of age than that of the other age groups.

At the same time, the least squares mean analyses revealed that there were significant differences among villages for lactation milk yield (Table 1). The lactation milk yields were higher in Değirmenköy and Güzelli of Güroymak region in comparison with the other villages, but these differences were statistically significant for Günkiri and Budaklı only. The lowest lactation milk yield was founded in these villages (Table 1).

**Table 1:** Least squares means and standard errors of the lactation milk yield and length in Anatolian water buffaloes

<table>
<thead>
<tr>
<th>n</th>
<th>Lactation milk yield</th>
<th>Lactation length</th>
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<tbody>
<tr>
<td>Overall</td>
<td>763.99±18.66</td>
<td>262.63±8.31</td>
</tr>
<tr>
<td>The age of dam</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>18</td>
<td>62.65±97.67</td>
</tr>
<tr>
<td>6</td>
<td>118</td>
<td>793.67±36.03</td>
</tr>
<tr>
<td>7</td>
<td>323</td>
<td>751.89±20.84</td>
</tr>
<tr>
<td>8</td>
<td>255</td>
<td>746.79±22.55</td>
</tr>
<tr>
<td>9</td>
<td>242</td>
<td>765.63±23.02</td>
</tr>
<tr>
<td>10</td>
<td>149</td>
<td>777.78±29.29</td>
</tr>
<tr>
<td>11</td>
<td>127</td>
<td>723.64±39.48</td>
</tr>
<tr>
<td>12</td>
<td>57</td>
<td>874.46±75.66</td>
</tr>
<tr>
<td>&gt;12</td>
<td>159</td>
<td>788.63±32.55</td>
</tr>
<tr>
<td>The villages</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Değirmenköy</td>
<td>347</td>
<td>758.91±26.74</td>
</tr>
<tr>
<td>Budaklı</td>
<td>191</td>
<td>704.48±58.39</td>
</tr>
<tr>
<td>Gülbaşi</td>
<td>195</td>
<td>793.37±30.62</td>
</tr>
<tr>
<td>Özakavak</td>
<td>197</td>
<td>724.86±33.63</td>
</tr>
<tr>
<td>Günüklı</td>
<td>147</td>
<td>669.09±45.54</td>
</tr>
<tr>
<td>Güzelli</td>
<td>178</td>
<td>907.84±36.25</td>
</tr>
<tr>
<td>Çitlyol</td>
<td>193</td>
<td>802.06±36.77</td>
</tr>
</tbody>
</table>

a, b, c, d: Values without a common superscript within rows (for ages and villages) differ (P<0.05 and P<0.01).
The least squares means for milk composition showed that it was significantly affected by the stages of lactation period (Table 2). The dry matter and fat of milk were significantly low in mid-lactation stage. Again, while the protein and ash matter of milk had an increase in mid-lactation stage, the lactose level of milk had a decrease in that stage, but this decrease of lactose was not statistically significant (Figure 1). The present results suggested that the fat level of milk was sensitive to stages of lactation period (P=0.05; P=0.01).

Table 3 shows that weights at birth, at 180 days of age and at 365 days of age in Anatolian water buffaloes are 29.28±0.56, 97.51±1.56, 142.16±1.50 kg, respectively. The effects of age of dam and villages on weight at birth were significant. Nevertheless, differences for the weights at 180 days of age and at 365 days of age were significant (P=0.05-P=0.01).

In our study the findings obtained for lactation milk yield and lactation length in Anatolian buffaloes raised on Bitlis province were similar to those reported by Sahin and Ulutas (2014), who reported that the mean of lactation milk yield calculated by Holland Method in Anatolian buffaloes reared in Tokat city was 734.0±16.0 kg. Nonetheless, the mean of lactation length in our study was very high compared to the lactation yield (146.55±1.79) reported by the same authors. This wide range of lactation milk yield traits was also reported by Soysal (2009), who founded that the lactation milk yield and lactation length in Istanbul buffaloes were 925 kg and 112-449 days, respectively and it was demonstrated that they varied according to effects of environmental factors. The lactation length of Anatolian buffaloes was between 220 and 224 days in previous studies (Ilaslan et al. 1983; Izgi et al. 1989). Özenç et al (2008) and Izgi and Asker (1988) found that the lactation milk yield of

<table>
<thead>
<tr>
<th>Gender</th>
<th>n</th>
<th>Weight at birth</th>
<th>n</th>
<th>Weight at 180 days of age</th>
<th>n</th>
<th>Weight at 365 days of age</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>434</td>
<td>28.95±0.26</td>
<td>549</td>
<td>29.38±0.23</td>
<td>536</td>
<td>29.60±1.53</td>
</tr>
<tr>
<td>Female</td>
<td>228</td>
<td>30.90±0.34</td>
<td>140</td>
<td>26.83±0.43</td>
<td>136</td>
<td>26.82±0.43</td>
</tr>
<tr>
<td></td>
<td>123</td>
<td>28.40±0.45</td>
<td>123</td>
<td>28.40±0.45</td>
<td>123</td>
<td>28.40±0.45</td>
</tr>
<tr>
<td></td>
<td>147</td>
<td>29.25±0.41</td>
<td>147</td>
<td>29.25±0.41</td>
<td>147</td>
<td>29.25±0.41</td>
</tr>
<tr>
<td></td>
<td>126</td>
<td>29.44±0.46</td>
<td>126</td>
<td>29.44±0.46</td>
<td>126</td>
<td>29.44±0.46</td>
</tr>
<tr>
<td></td>
<td>103</td>
<td>30.77±0.48</td>
<td>103</td>
<td>28.59±0.46</td>
<td>103</td>
<td>28.59±0.46</td>
</tr>
<tr>
<td></td>
<td>116</td>
<td>30.90±0.34</td>
<td>116</td>
<td>28.59±0.46</td>
<td>116</td>
<td>28.59±0.46</td>
</tr>
</tbody>
</table>

a, b, c, d Values without a common superscript within rows (for ages and villages) differ (P<0.05-P<0.01).
Anatolian buffaloes was between 350 and 1,580 kg; 227 and 1,443 kg, respectively. In another study, it was reported that lactation milk yield in Anatolian buffaloes was between 600 and 800 kg (Kreul and Sarican, 1993). However, Sekerden (1987) reported that lactation milk yield in Anatolian buffaloes was 1300±39.27 l, indicating that this value was higher than that of our study. Afzal et al. (2007) also reported that lactation milk yield and length of Nili-Ravi buffaloes were 1831±530.0 l and 273.3±52.8 days, respectively. In that study, it was detected high correlation coefficient between lactation milk yield and lactation length. Bufano et al. (2006) investigated the effect of calving season on milk yield characteristics of buffaloes using the data covered 23 years between 1977 and 2000. They reported that daily milk yield in winter and autumn season were 9.11 and 8.55 kg, respectively. The lactation length in winter and autumn season study were 275 and 258 days, respectively. These results clearly showed that in intensive production systems, buffaloes have higher lactation milk yield and lactation length than in traditional production systems. Degirmencioglu et al. (2015) reported that daily milk yield of Anatolian water buffaloes reared in sub-intensive and intensive production systems were 4.42 and 7.34 kg, respectively.

In the current study, the dry matter of milk, protein, fat, lactose, ash matter and pH in Anatolian water buffaloes were 16.08±1.54 %, 3.40±0.67 %, 7.10±1.38 %, 4.57±0.81 %, 0.67±0.30 %, and 6.68±0.40, respectively. The milk composition varied based on the beginning of lactation, mid-lactation and the end of the lactation. Sekerden and Avsar (2008) reported that the fat, protein and dry matter of Anatolian buffalo milk were 7.67 %, 5.28 % and 17.55 %, respectively. Likewise, Sarfarz et al. (2008) reported that fat, protein and a total of dry matter of Murrah buffaloes were 7 %, 4.35 % and 17.45 %. In another study (Sekerden, 2011) fat, protein, a total of dry matter and lactose contents of milk of Anatolian buffaloes were 6.4 %, 3.3 %, 16.0 % and 5.3 %, respectively. Bufano et al. (2006) investigating the effects of several environmental factors in the data covered 23 years found that the fat, protein and lactose contents of milk in winter and autumn seasons of Italian buffaloes were 8.98%, 4.78% and 4.83 %; 8.22 %, 4.45 % and 4.88 %, respectively. Similarly, in Anatolian buffaloes raised under sub-intensive and intensive production systems, the fat and protein percent of milk were 5.80 % and 8.03 %; 4.96 % and 4.95 %, indicating that there were statistically significant differences between the levels of milk fat for these production systems (Degirmencioglu et al., 2015). Thus it can be confirmed that the level of milk fat in buffaloes varies with different production systems, whereas the other traits of milk changes a little.

In this study, the weights at birth, at 180 days of age and at 365 days of age in Anatolian buffaloes were 29.28±0.56, 97.51±1.56, 142.16±1.50 kg, respectively. Malloda et al. (2005) reported that in Brazil buffaloes the weights at birth, at 205, 365 and 550 days of age were 39.5, 195.2, 300.7 and 433.1, respectively. The findings of that study were higher then the results obtained in our study. In another study (Ramos et al., 2007) the weights at 205, 365 and 550 days of age were 210.0, 387.6, 503.5 kg.

![Image](image-url)
The results of the present study were in accordance with the reports of the mentioned studies for traditional production system. In addition we think that databases for Anatolian buffaloes have under developed, showing that they have a wider range of data because of problems in herd management system. Especially in some seasons, buffaloes have been hold at night outside, and therefore in these regions it is difficult to develop and pursue the effective data collect processes.

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