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Research Article

The Environmental relations between milk production amount and some of its components in Iraqi buffalo milk

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Abstract

The study was conducted in Iraq, Dhi Qar Governorate, Al-Shatra District, Al-Sada Al-Ghawalba Village, from November 15, 2021, to July 15, 2022, to evaluate milk production effect on some components of Iraqi buffalo milk (% fat, % non-fat solids, % protein, % lactose, % ash, milk density) and to determine the relationship between milk production and these components. The study included 30 lactating buffaloes of different ages, which were divided to three groups depending on their milk production. The first group included low-yielding buffaloes, with a total milk production of 7,380 kg during the study period. The second group included medium-yielding buffaloes, with a total milk production of 13,320 kg during the study period. The third group included high-yielding buffaloes, with a total milk production of 25,020 kg during the study period. The herd was monitored from the beginning of lactation until drying off. The results of the study showed that all milk components under study were changed by milk production in a significant way ($p<0.05$). The low-yielding buffalo group (7,380 kg) had significantly ($p<0.05$) higher fat content than the medium-yielding (13,320 kg) and high-yielding (25,020 kg) groups. The medium-yielding group (13,320 kg) also had significantly ($p<0.05$) higher fat content than the high-yielding group (25,020 kg). The average percentages were 0.12±7.14, 0.11±6.07, and 0.18±5.07, respectively. In terms of non-fat solids, the low-yielding (7,380 kg) and medium-yielding (13,320 kg) groups had significantly ($p<0.05$) higher percentages than the high-yielding (25,020 kg) group. The average percentages were 0.18±9.49, 0.17±9.28, and 0.11±8.75, respectively. The low-yielding (7,380 kg) and medium-yielding (13,320 kg) groups also had significantly ($p<0.05$) higher protein percentages than the high-yielding (25,020 kg) group. The average percentages

were 0.036±3.51, 0.10±3.44, and 0.033±3.24, respectively. The high-yielding (25,020 kg) group had significantly ($p<0.05$) higher lactose percentages than the medium-yielding (13,320 kg) and low-yielding (7,380 kg) groups. The average percentages were 0.10±4.90, 0.032±5.20, and 0.12±5.38, respectively. The medium-yielding (13,320 kg) group also had significantly ($p<0.05$) higher lactose percentages than the low-yielding (7,380 kg) group. In terms of ash, the low-yielding (7,380 kg) and medium-yielding (13,320 kg) groups had significantly ($p<0.05$) higher percentages than the high-yielding (25,020 kg) group. The average percentages were 0.011±0.67, 0.0048±0.65, and 0.010±0.59, respectively. The medium-yielding (13,320 kg) group also had significantly ($p<0.05$) higher ash percentages than the high-yielding (25,020 kg) group. The low-yielding (7,380 kg) and medium-yielding (13,320 kg) groups had significantly ($p<0.05$) higher milk density than the high-yielding (25,020 kg) group. The average values were 0.32±32.25, 0.21±32.1, and 0.29±30.75, respectively. It was found that milk production was negatively and significantly correlated with fat, non-fat solids, protein, ash, and milk density.

Keywords: Iraqi Buffalo, milk quantity, percentage of fat, non-fat solids percentage

Introduction

Buffalo milk production globally is 82 billion liters per year, accounting for 12.5% of total milk production. Cow milk production is 551 billion liters per year, accounting for 84% of total milk production. This makes buffaloes the second-largest milk producer in the world after cows (O'Connor, 2007).

Iraqi buffaloes are well-adapted to the harsh environment in which they live (Dawood, 2010). They are considered to be one of the native dairy animals in Iraq and are used primarily for milk production and secondarily for meat production (Baghdassa et al., 2012). According to the Iraqi Ministry of Agriculture, Iraq's milk production in 2012 was 2927 thousand tons (Ministry of Planning, 2012). Iraqi buffaloes contribute 5-8% of Iraq's milk production and 1.3% of its meat production (Adeniran et al., 2010).

Buffalo milk is a high-value, high-energy food because it is rich in fat and total solids (Hamad & Baiomy, 2010). (Kumar et al., 2019) reported that buffalo milk has more of almost all of the important nutrients than cow milk. Milk quality is based on the proportions of its major components, including fat, protein, lactose, and non-fat solids. Therefore, the milk marketing system in developed countries is based on the content of these major milk components (Khalil et al., 2022; Ravikala et al., 2014). (Farhomand, 2001) reported an inverse relationship between milk production and fat, protein, and non-fat solids content and a positive relationship between milk production and lactose content. (Negassa et al., 2012) found that increased milk production leads

to a decrease in fat content in milk. They also reported that the relationship between milk production and fat, protein, and mineral content in milk is inverse.

The aim of this research is to find out how the amount of production affects different parts of milk, as well as the relationship between milk production and some of its components the amount of fat, protein, lactose, non-fat solids, and density in Iraqi buffalo milk reared in southern Iraq, in the Dhi Qar Governorate, Al-Shatra District, and Al-Sada Al-Ghawalba Village.

Material and methods

The study took place in southern Iraq, in the Dhi Qar Governorate, Al-Shatra District, and Al-Sada Al-Ghawalba Village, from November 15, 2021, to July 15, 2022. The study's goal was to find out how the amount of milk production affected some milk parts (% fat, % non-fat solids, % protein, % lactose, % ash, and density) in Iraqi buffalo milk.

The study included 30 lactating buffaloes of different ages and production seasons. The cows were split into three groups based on how much milk they produced. Group 1, the low-yielding group, included 10 buffaloes. Group 2, the medium-yielding group, included 10 buffaloes. Group 3, the high-yielding group, also included 10 buffaloes. The herd was monitored from the beginning of lactation until the animals dried off.

The herd was fed a diet of concentrate and roughage, as available during the season. The animals received veterinary care throughout the study period. Milk production was measured daily using a scale. The cows were milked every day, in the morning, by hand. Milk samples were collected once every 14 days at a volume of 100 ml per animal. The samples were stored in a box filled with crushed ice to prevent spoilage while they were being taken to the lab to be analysed. Milk samples were analyzed using an EKO MILK device made in Germany. The following milk components were measured using this device: fat content, non-fat solids content, protein content, lactose content, ash content, and milk density. The SPSS (Lee & Lim, 2013) statistical programme was used to do a statistical analysis of the data. The significance of the means was tested using the LSD test.

Results and discussion

Table 1 shows effect of milk production on composition of buffalo milk. The results showed a fat content was significantly affected ($p<0.05$) by milk production, with the low-yielding group (7380 kg) having significantly higher fat content than the medium-yielding (13,320 kg) and high-yielding

(25,020 kg) groups. The medium-yielding group also had significantly higher fat content than the high-yielding group. The average fat content of the three groups was as follows: (0.12±7.14, 0.11±6.07, 0.18±5.07) respectively. The decrease in milk fat content with increasing milk production can be attributed to the inverse relationship between milk production and fat content. The results are consistent with (Al-Fayad & Shareef, 2022; Khan et al., 2011; Wadhwa et al., 2020).

The solids-not-fat (SNF) content also was significantly affected ($p<0.05$) by milk production, with the low-yielding group (7380 kg) and the medium-yielding group (13,320 kg) having significantly higher SNF content than the high-yielding group (25,020 kg). The average SNF content of the three groups was as follows: (0.18±9.49, 0.17±9.28, 0.11±8.75) respectively. These results are consistent with those of (Al-Fayad & Shareef, 2022; Farhomand, 2001; Khosroshahi et al., 2011).

The process of making milk also had a big effect on the amount of protein in it ($p<0.05$), with the low-yielding group (7380 kg) and the medium-yielding group (13,320 kg) having significantly higher protein content than the high-yielding group (25,020 kg). The average protein content of the three groups was as follows: (0.11±3.51, 0.10±3.44, 0.033±3.24) respectively. These results are consistent with those of (Al-Fayad & Shareef, 2022; Farhomand, 2001; Khosroshahi et al., 2011; Wadhwa et al., 2020).

The lactose content was also significantly affected ($p<0.05$) by milk production, with the high-yielding group (25,020 kg) having significantly higher lactose content than the medium-yielding (13,320 kg) and low-yielding (7,380 kg) groups. The medium-yielding group also had significantly higher lactose content than the low-yielding group. The average lactose content of the three groups was as follows: (0.10±4.90, 0.032±5.20, 0.12±5.38) respectively. This is because the amount of lactose in milk goes up a little as more milk is made and then slowly goes down as the milk production season ends (Friggens et al., 2007). These results are consistent with those of (Al-Muhaimid et al., 2021; Patbandha et al., 2015; Ravikala et al., 2014).

The ash content significantly affected ($p<0.05$) by milk production, with the low-yielding group (7,380 kg) having significantly higher ash content than the medium-yielding (13,320 kg) and high-yielding (25,020 kg) groups. The medium-yielding group also had significantly higher ash content than the high-yielding group. The average ash content of the three groups was as follows: (0.011±0.67, 0.0048±0.65, 0.010±0.59) respectively. These results are consistent with those of (Negassa et al., 2012).

Production of milk also had a big effect on milk density ($p<0.05$), with the low-yielding group (7,380 kg) and the medium-yielding group (13,320 kg) having significantly higher milk density than the high-yielding group (25,020 kg). The average milk density of the three groups was as follows: (0.35±32.25, 0.21±32.1, 0.29±30.75) respectively. These results consistent with (Al-Fayad & Shareef, 2022; Al-Zarkan et al., 2020; Hassan, 2013).

Table 1. Average (±standard error) effect of the amount of milk produced on some milk components.

Quantity of milk produced/kg	Fat%	Non-fatty solids%	Protein%	Lactose%	ash%	Density
7380	7.1±0.124a	9.49±0.18a	3.51±0.11a	4.90±0.10c	0.67 ±0.011a	32.25±0.35a
13320	6.0±0.117b	9.28±0.17a	3.44±0.10a	5.20±0.032b	0.65±0.0048b	32.1±0.21a
25020	5.0±0.187c	8.75±0.11b	3.24±0.033b	5.38±0.12a	0.59±0.010c	30.75±0.29b

Different letters within one column , which means that the changes are important at the 0.05 level of probability.

Table 2 shows a relationship between milk production and some milk components. The table shows a significant negative correlation ($p<0.05$) between milk production and fat content in milk. This result is consistent with those of (Al-Muhaimid et al., 2021; Farhomand, 2001; Khosroshahi et al., 2011; Wadhwa et al., 2020). There is a significant negative correlation ($p<0.05$) between milk production and non-fat solids content. This result is also consistent with those of (Al-Muhaimid et al., 2021; Farhomand, 2001; Khosroshahi et al., 2011) . There was also a negative and significant ($p<0.05$) link between milk output and protein content. It agrees with what (Al-Muhaimid et al., 2021; Farhomand, 2001; Wadhwa et al., 2020) found. However, there was a positive and significant ($p<0.05$) link between milk output and lactose content. It agrees with what (Farhomand, 2001; Khosroshahi et al., 2011; Patbandha et al., 2015) found.

The table also shows a significant negative correlation ($p<0.05$) between milk production and ash content. This result is consistent with those of (Al-Muhaimid et al., 2021; Negassa et al., 2012). In the case of milk density, the correlation with milk production was also negative and significant at ($p<0.05$). This outcome is the same as those of (Al-Fayad & Shareef, 2022; Al-Muhaimid et al., 2021; Al-Zarkan et al., 2020; Hassan, 2013).

Table 2. The relationship between the amount of milk produced and some of its components in Iraqi buffalo milk

Associated traits	Fat%	Non-fatty solids%	Protein%	Lactose%	ash%	Density
amount of milk produced						
Correlation coefficient	-0.962	-0.824	-0.867	0.861	-0.901	-0.914
Significantly level	*	*	*	*	*	*

*p<0.05) significant, Ns not significant

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