University of Thi-Qar Journal of agricultural research

Thi-Qar Journal of agricultural research

ISSN Onlin:2708-9347, ISSN Print: 2708-9339 Volume 15, Issue 1 (2026) PP 15-20

https://jam.utq.edu.iq/index.php/main https://doi.org/10.54174/pac7wp11

Influence of Geographic Location on Milk Yield and Composition in Iraqi Buffalo (Bubalus bubalis)

Muayad Abdulwahid Jaber Al-Fayad

Department of Animal Production, Faculty of Agriculture and Marshlands, University of Thi-Qar, Thi-Qar, 64001, Iraq

Email: ***muaeid@utq.edu.iq***

Abstract

This study was conducted in Dhi Qar Governorate at two different locations, namely the north of the governorate (Al-Shatra District/Bani Zaid sub-district) and the south of the governorate (Karma Bani Saeed District/Al-Karmashiyah sub-district) during the period 1/9/2023 until 1/4/2024, in order to know the effect of location on milk production and its components in Iraqi buffalo. The study included one hundred buffalo of different ages nursing young of different sexes, with fifty buffalo for each location.The study results showed a significant effect ($p \geq 0.05$) of location on daily, monthly, and total milk production. The animal group from the northern part of the governorate (Bani Zaid) significantly outperformed the animal group from the southern part of the governorate (Al-Karmashiyah), with an average daily milk production of (0.32 ± 6.56) kg and a monthly milk production of (9.86 ± 196.5) kg. The total milk production was (259 ± 1375.5) kg at the northern location of the governorate (Bani Zaid) and the average daily milk production was (0.23 ± 3.30) kg, the monthly milk production was (7.17 ± 99) kg, and the total milk production was (85.38 ± 693) kg, respectively, at the southern location of the governorate (Al-Karmashiyah). A significant effect ($p \geq 0.05$) of location was observed in some milk components.The milk from animals in the southern part of the governorate (Al-Karmashiyah) had a higher total solids content and fat content than milk from animals in the northern part of the governorate (Tabni Zaid). The average total solids content was (0.38 ± 15.82) and the average fat content was (0.34 ± 6.95) in the milk from animals in the southern part of the governorate (Al-Karmashiyah), while the averages for these percentages in the milk from animals in the northern part of the governorate (Bani Zaid) were (1.03 ± 13.78) and (0.65 ± 5.65), respectively.No significant differences ($p \geq 0.05$) were recorded in the percentage of non-fat solids, protein percentage, lactose percentage, and ash percentage between the two sites. Rather, there was an arithmetic increase that was not significant in favor of the group of animals in the southern part of the governorate (Al-Karmashiyah).

Keywords: Location, Iraqi buffalo, milk production, milk components.

I. Introduction

Buffalo are important farm animals that constitute a source of livestock in many countries, including Iraq. The Iraqi buffalo belongs to the domesticated Asian river buffalo (Bubalus bubalis), and archaeological evidence indicates that this type of buffalo was domesticated 5000 years ago in Iraq, Iran, and the Indian subcontinent in which it was first domesticated 3000 years BC from its wild ancestors (Abdulkarim & Al-Maliki, 2022).The global buffalo population reached 208 million head (FAO, 2021). According to FAO statistics, the number of buffalo in Iraq reached 209,160 head in 2017 (FAO, 2017). Iraqi buffalo are found in all Iraqi governorates except Erbil and Dohuk, where their numbers reached 285,537 head in 2008 , the buffalo population in Thi Qar Governorate reached 49,283 head, representing 17.3% of the total buffalo population in Iraq (Ministry of Agriculture, 2008).Buffalo are an important source of high-quality animal protein, such as milk and meat, and contribute 11% to global milk production (Gerosa and Skoet, 2012). Buffalo milk is considered to have high nutritional value and energy content due to its rich composition, particularly in fat and total solids (Hamad and Baiomy, 2010).Buffalo are used for the purpose of producing

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milk, meat and work (Prasad et al., 2010), while in Iraq they are used primarily for milk production and secondarily for meat production (Baghdasar et al., 2012). The contribution of buffalo to milk production in Iraq is 5-8% and to meat production is 1.3% (Faw, 2003). Milk yield and composition are affected by several factors such as breed (Sethi, 2003), nutrition (Idris et al., 2007), season (Al-Fayad, 2023), parity and calf sex (Al-Fayad & Shareef, 2022), month of production (Abdul-Muhsin, 2010), and location (Baghdasar et al., 2010). El-Masri and Qasqous (2004) reported differences in daily milk yield between swamp buffaloes raised in northern and southern Vietnam, with averages of 3.45 kg and 1.5 kg per day, respectively. These variations were attributed to environmental and management conditions associated with location. Abdel Magid et al. (2015) also reported a significant influence of location on annual milk yield, average daily yield, and lactation length in Egyptian buffaloes. Therefore, the present study aimed to evaluate the effect of geographic location on milk yield and composition of Iraqi buffaloes reared in the northern and southern parts of Thi-Qar Governorate.

II. Materials and methods

This study was carried out in two different locations within Thi-Qar Governorate, Iraq: Northern site ,Al-Shatrah District / Bani Zaid Subdistrict and Southern site ,Al-Karma Bani Saeed District / Al-Karmashiyah Subdistrict. The experimental period extended from 1 September 2023 to 1 April 2024, aiming to assess the influence of location on milk yield and composition in Iraqi buffaloes. A total of 100 lactating buffaloes (50 per site) of various ages, each nursing calves of different sexes, were included. Feeding management varied between the two sites: Buffaloes in the northern site (Bani Zaid) were fed a mixed diet consisting of bran, ground barley, and flour as concentrates, along with green forages such as alfalfa (Medicago sativa), clover (Trifolium Alexandrium), and naturally growing riverbank weeds, in addition to straw as roughage. Buffaloes in the southern site (Al-Karmashiyah) grazed freely on marsh vegetation (mainly reeds and aquatic plants) during the day and received limited amounts of wheat bran and straw in the evening. Data on milk yield were obtained from farmers' records. Milk samples (100 mL per animal) were collected monthly from the morning milking. Samples were immediately stored in ice boxes and transported to the laboratory for chemical analysis. Milk composition was analyzed using a Lacto Flash Funke Gerber milk analyzer (Germany).Data were statistically analyzed using the SPSS (2006) software package. Mean differences were tested for significance using the Least Significant Difference (LSD) test at a 0.05 probability level.

III. Results and discussions

Milk Yield

Table 1 presents the effect of location on milk yield traits (daily, monthly, and total yield). The results revealed a significant effect ($p \leq 0.05$) of location on milk production. Buffaloes reared in the northern site (Al-Shatrah/Bani Zaid) showed significantly higher milk yields than those in the southern site (Al-Karmah Bani Saeed/Al-Karmashiyah). The mean daily, monthly, and total yields were 6.56 ± 0.32 kg, 196.5 ± 9.86 kg, and 1375.5 ± 259 kg, respectively, in the northern site, compared with 3.30 ± 0.23 kg, 99 ± 7.17 kg, and 693 ± 85 kg, respectively, in the southern site.These findings are consistent with Baghdasar et al. (2017), who reported significant differences in milk yield among buffaloes in three regions of Najaf Governorate, Iraq (Al-Mishkhab, Al-Abbasiya, and other localities). Their study recorded daily and total milk yields ranging between 4.23–8.64 kg and 831.67–1600.91 kg, respectively. Similarly, Avadesian et al. (2012) found a significant effect of location on daily milk yield in Nineveh buffaloes, where the highest production (10.53 kg) occurred in Badoush and the lowest (8.12 kg) in Bab Al-Shams.

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Table 1. Effect of location on daily, monthly, and total milk yield (Mean ± SE)

Location	Daily Milk Yield (kg)	Monthly Milk Yield (kg)	Total Milk Yield (kg)
Al-Shatrah / Bani Zaid	6.56 ± 0.32[a]	196.5 ± 9.86[a]	1375.5 ± 259[a]
Al-Karmah Bani Saeed / Al-Karmashiyah	3.30 ± 0.23[b]	99 ± 7.17[b]	693 ± 85[b]

Different superscript letters (a, b) within the same column indicate significant differences at p ≤ 0.05.

Milk Composition

Table 2 shows the impacts of location on milk composition. There was a significant difference ($p \leq 0.05$) between locations in total solids (TS%) and fat (F%) contents. Buffaloes in Al-Karmashiyah had higher mean percentages of total solids (15.82 ± 0.38%) and fat (6.95 ± 0.34%) than those in Bani Zaid (13.78 ± 1.03% and 5.65 ± 0.65%, respectively).No significant differences were found between sites for solid-not-fat (SNF%), protein (P%), lactose (L%), or ash contents, though a numerical increase was observed in favor of the southern site. These findings align with El-Masri and Qasqous (2004), who reported differences in fat and protein contents between swamp buffaloes raised in northern and southern Vietnam. Similarly, Al-Zarkani et al. (2020) observed significant effects of location on SNF, protein, and lactose, but non-significant effects on fat percentage. The observed variation in milk composition may be attributed to differences in nutrition and management practices. Buffaloes grazing on marsh vegetation rich in fiber (e.g. reeds and aquatic plants) exhibit increased acetic acid production in the rumen, which enhances milk fat synthesis. This agrees with Al-Qudsi and Elia (2010), who noted that higher roughage intake increases volatile fatty acid (especially acetic acid) concentration, thereby raising milk fat and total solids levels.

Table 2. Effect of location on milk composition (Mean ± SE)

Location	TS%	F%	SNF%	P%	L%	Ash%
Al-Shatrah / Bani Zaid	13.78 ± 1.03[b]	5.65 ± 0.65[b]	8.41 ± 0.51[a]	3.11 ± 0.18[a]	4.76 ± 0.25[a]	0.64 ± 0.03[a]
Al-Karmah Bani Saeed / Al-Karmashiyah	15.82 ± 0.38[a]	6.95 ± 0.34[a]	8.84 ± 0.29[a]	3.27 ± 0.09[a]	4.94 ± 0.16[a]	0.66 ± 0.02[a]

Different superscript letters (a, b) within the same column indicate significant differences at p ≤ 0.05.

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Table 3. Average percentages of milk components in Iraqi buffaloes according to location, as reported by previous studies

Source	Location	TS%	F%	SNF%	P%	L%	Ash%
Abbas et al. (2011)	Al-Diwaniyah	–	6.8	10.8	5.9	4.3	–
Hassan (2013)	Thi-Qar / Al-Hammar Marsh	–	7.2	9.33	4.4	3.14	4–4.5
Al-Fartosi & Al-Moussawi (2017)	Thi-Qar / Souq Al-Shuyoukh	–	4.42	10.7	3.25	4.8	0.58–0.77
Abdullah (2018)	Kirkuk	–	5.85	11.47	5.23	4.58	–
Al-Zarkani et al. (2020)	Baghdad / Al-Taji	–	6.25	8.26	3.77	4.03	–
Al-Zarkani et al. (2020)	Babylon / Al-Hashimiyah	–	5.89	9.44	4.15	4.93	–
Al-Galiby (2020)	Najaf / Al-Mishkhab	–	5.35	9.16	3.25	3.07	4.28–5.01
Al-Fayad (2022)	Thi-Qar	12.87	4.80	8.60	3.28	4.66	0.62
Al-Hassnawi (2022)	Thi-Qar / Al-Tar	16.73–18.14	6.04–7.60	10.54–10.69	3.27–3.39	4.64–5.18	0.76–0.77

TS% = total solids, F% = fat, SNF% = solid-not-fat, P% = protein, L% = lactose, Ash% = mineral content.

IV. Conclusions

The study concludes that geographic location has a significant influence on daily, monthly, and total milk yield, as well as on some milk composition parameters in Iraqi buffaloes raised in different regions of Thi-Qar Governorate. The observed variations between the northern and southern sites reflect differences in management, feeding systems, and environmental conditions. Improving these factors can enhance the productivity and milk quality of Iraqi buffaloes.Future studies are recommended to include molecular, nutritional, and physiological parameters to better understand the mechanisms through which local environments influence buffalo milk yield and composition.

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