The effect of some environmental factors that affecting daily milk yield of Iraqi buffaloes in Ninewah

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Accepted 3/4/2012

Summary

This study was carried out on the local buffalo in Ninewah, data were collected from154 buffalo in two herds during the period 1/7/2010 until 18/7/2010 in which milk collected daily in sequence (1st day , 5th day , 9th day , 13th day and 17th day) and recording maximum and minimum temperature .Data were analyzed using general linear model (GLM) within SAS program to study the fixed effects (parity , herd , stage of lactation and test day) , and regression coefficient with heritability . Overall average daily milk yield was 9.69 ± 0.12 kg and it appeared that parity , herd and stage of lactation has a highly significant effects in daily milk yield , while test day recorded no significant effect in the above . Minimum temperatures ranged (23.5 – 27.5 °C) and maximum was (41.8 – 45.6 °C). Regression coefficient for daily milk yield on maximum temperature was -0.259 kg / °C on ($P < 0.01$) and for minimum was 0.0325 kg / °C and this was non - significant, while the prediction equation (ŷ) was:

Y^ (max) = 21.121 – 0.259 (X1)

Y^ (min) = 8.863 + 0.0325 (X2)

The heritability estimate for daily milk yield was ranged between (0.17 – 0.21) for the test day (recording day) , it was concluded that from this a number of fixed effects , and yield was decreased significantly with rising in ambient temperature and the estimates of heritability for daily milk yield belonged to test day was rather low.

Keywords: buffaloes, Ninewah, milk yield, environmental factor.

دراسة بعض العوامل ودرجات الحرارة المؤثرة في إنتاج الحليب اليومي لدى الجاموس المحلي في نينوى

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الخلاصـــــة

أجريت هذه الدراسة في نينوى على الجاموس المحلي، إذ جمعت البيانات عن 154 جاموسة في حقلين مختلفين في المحافظة لدراسة إنتاج الحليب اليومي وذلك للمدة من 1/7/2010 ولغاية 18/7/2010 ولخمسة أيام متوالية (اليوم الأول والخامس والتاسع والثالث عشر واليوم السابع عشر) مع تسجيل درجات الحرارة الصغرى والعظمى. تم تحليل البيانات باستعمال طريقة الأنموذج الخطي العام (General linear model-GLM) ضمن البرنامج SAS لدراسة تأثيرات العوامل الثابتة (تسلسل الولادة ومرحلة أنتاج الحليب فضلا عن يوم الفحص أي يوم الاختبار) ومعامل الانحدار وتقدير المكافئ الوراثي. بلغ المتوسط العام لإنتاج الحليب اليومي 9.69 ± 0.12 كغم وظهر أن لتسلسل الولادة والحقل (الموقع) ومرحلة إنتاج الحليب تأثيرات عالية المعنوية (أ < 0.01) في أنتاج الحليب اليومي، بينما لم يكن أي تأثير معنوي ليوم أخذ القياس (التسجيل) في هذه الصفة. تراوحت درجات الحرارة الصغرى (23.5 الى 27.5 درجة مئوية) والحرارة العظمى (41.8 الى 45.6 درجة مئوية). بلغ معامل انحدار أنتاج الحليب اليومي على درجة الحرارة العظمى -0.259 كغم حليب / درجة (أ<0.01) ودرجة الحرارة الصغرى (0.0325 كغم/ درجة) والأخير كان غير معنوي، في حين كانت معادلتي التوقع (Y^) وعلى التوالي:

Y^ (Min) = 8.863 + 0.0325 (X2) , Y^ (Max) = 21.121 – 0.259 (X1)

كما تم تقدير المكافئ الوراثي لمعدل أنتاج الحليب اليومي والذي تراوح من 0.17 الى 0.21 لمدد اخذ القياس أو التسجيل المختلفة. يستنتج من هذا البحث أن أنتاج الحليب اليومي يتأثر بعدد من العوامل الثابتة، كما أنه ينخفض معنويا مع ارتفاع دراجات حرارة المحيط، وان تقديرات المكافئ الوراثي لإنتاج الحليب وحسب أيام الاختباركانت منخفضة نوعا ما.

الكلمات المفتاحية: حليب الجاموس , تاثير الحرارة, انتاج الحليب.

Introduction

The average of daily milk yield was important traits that determines the amount of milk which produced by cows across their production season , and this was dividing the total production of milk in the lactation period , and therefore reliance on total production only dose not gives clear picture from the nature of production ability of the animal , so that the comparison between buffalo is better to rely on the average milk yield an additional measures to determine the efficiency of animal production (1). Although, more than 12% of the world milk production comes from buffalo, India alone produces 60% of the world's buffalo milk and their production was 100 million tons and buffalo milk contributes to more than 50% of the total milk produced in India, Prasad *et al.,* (2) and Cockrill, (3) stated that the buffalo of the most neglected animals in the world. In Iraq, the participation rate of buffalo milk is about 8% of the total milk produced (4) in the country. Nigm, (5) found on the Egyptian buffalo, that daily milk yield in the research station ranged between (5.7 – 6.9) kg/day, while in small farms breeders will be up to 7.2 kg/day. Since the buffalo less tolerant of than native cattle because of their dark skinned color and thickness and have a little sweat gland (6) which cause decrease the intake of forage materials by animal (7) and thus reduces milk production (8).To overcome the effect of high temperatures requires the provision of an adequate drinking water with shades (for cows) and allow for swimming or diving in rivers and marshes (for buffaloes) , or using fans to reduce heat stress on the herds so that keep milk production less affected by heat (9 and 10). Singh and Yada, (11) found 1823 Indian Murrah buffalo about the data collected during 42 years (1940 – 1981) from (6) farms , that daily milk yield in first three lactation seasons were (5.13 ± 0.31 , 5.27 ± 0.36 and 5.14 ± 0.29) kg respectively , while heritability estimates for the same season was (0.069 , 0.073 and 0.070) respectively . (12) the pronounced reduction in average daily milk yield for Holstein Friesian cows within 3 years (1999 – 2001) from spring months (Feb – March – Apr.) by (18.25 – 11.45) kg/day for summer month (June – July _ Aug.) . Results of several studies indicated that milk production drops at various rates ranged between (13 – 40 %) when air temperature rises for 30°C (6, 13 and 14). In Iraq AL- Rawi and Avadessian, (15) recorded that the average daily milk yield of Friesian cows decreased highly significantly ($p < 0.01$) from (7.50 - 10.68) kg when air temperature increased from less than 10°C to more than 35 °C . In USA (16) noted that Holstein Friesian cows which exposed to temperature 30 °C reduces daily milk yield (2.6 – 11.9) kg when increase in relative humidity (20 – 80%) respectively .The present study aimed to investigate the role of environmental factors and temperatures in the summer season on daily milk yield for Iraqi buffalo rearing under Ninewah conditions.

Materials and Methods

An experiment was conducted in Ninewah in two husbandry farms , 1st in Bab Shams (58 buffalo) and 2nd in Badosh (96 buffalo) for the period from 1/7/2010 until 18/7/2010 , daily milk yield was recorded for five consecutive periods which was (1st , 5th , 9th , 13th and 17 day) also milk registration is yet to be brought buffalo calf for stimulation to such one teat of the milk let down and three others for milk yield in morning and evening milking is completed , so they do the following modification for daily milk yield according to the following equation :

$$\text{Corrected milk yield (Kg)} = \frac{the\ amount\ of\ milk\ yield\ from\ 3\ teats}{3} \times 4$$

Max. And min. temperatures were taken at Ninevah governorate on time of daily recording from General Authority of Meteorological and Seismological Centre of Jadiryah / Baghdad, temperatures were given as follows:

Table1. Minimum and maximum temperatures (°C) in Mosul c during this study)

Days	Min. temp.	Max. temp.
1st day	25.5	41.8
5th day	23.5	43.8
9th day	27.5	45.6
13th day	26.3	44.3
17th day	25.5	43.4

Good feed was provided to animals for both herds such as green forages during agricultural season twice a day, which was calculated on basis of 10% of body weight beside concentrate feeds during milking time with mineral salts in the form of blocks placed in animal barns, it is remarkable to consider that both farmers has a piece of agrarian land which provides forages continuously to animals. So, the availability of veterinary clinics and health centers for animals gives the impression of safety animals and their product, besides to increased interest of (farmers) in this important resource to the country.

Data were collected from two buffalo herds in Ninewah and statistical analysis were done using General Linear Model (GLM) within the (17) program for estimation effect of parameters (parity, herd, stage of lactation and test day milk yield) according to statistical model the following:

$Y_{ijklm} = \mu + P_i + H_j + S_k + D_l + e_{ijklm}$

As:

Y_{ijklm}: Observed value m, represent daily milk yield belonged l test day, k stage of lactation, j herd and i parity (sequence of birth).

μ: Overall means for studied trait.

P_i: effect of parity i (i: 1^{st} to 5^{th})

H_j: effect of herd j(j: 1=Bab Shams, 2= Badosh)

S_k: effect of stage of lactation k (k: 1=one month to 3 months 2= 3.1 month to 5 month 3= 5.1 month to 7 month and 4= 7.l month and above)

D_l : effect of test day (l: 1^{st} , 5^{th} , 9^{th} , 13^{th} and 17^{th} day)

e_{ijklm} : value of experimental error and which is supposed to be normally distributed with means equal to zero and variance of σ^2 e. By using (18) for test to compare the significant differences between means for studied factors and the level of probability 5% and 1% , also estimation of heritability (h^2) for daily milk yield by component of paternal variance (PHS) as stated by (19).

$$h^2 = \frac{4\sigma^2 s}{\sigma^2 s + \sigma^2 e}$$

As:

h^2: the estimated value for heritability of the studied trait

$\sigma^2 s$: Sire variance (half-sib)

$\sigma^2 e$: Error variance

It was also estimated variance components for random effect between half-sib after removing the fixed effects assuming a mathematical model for estimation of heritability for daily milk yield by the following equation:

$Y_{ijklmn} = \mu + P_i + H_j + S_k + D_l + R_m + e_{ijklmn}$

As the symbols is the same in first mathematical model with the exception to add Rm , which represent the effect of sire (no: of sires is 14).They also estimated regression coefficient (b) for daily milk yield on minimum and maximum and both together temperatures (^{0}C).

Results and Discussion

Overall means ± SE for daily milk yield in Iraqi buffalo which was rearing in Ninevah governorate was 9.69 ± 0.19 kg/day, that production was higher than study of (20) which indicated that the average daily milk yield ranged between (6.22 ± 1.53 and 6.25 ± 1.01) kg and highest production established by dairy buffalo in the winter (6.42 kg) compared to summer season (5.62 kg) in Al- Fidhlya in Baghdad. Results of previous studies which performed on the local buffalo over the past 5 decades, daily milk yield has ranged between (5 - 6) kg (21 و 22 و 23 and 24).

Further study (25) explained that daily milk yield in the White Gold village ranged from (6-10) kg/day.

Table (2) appears that there are an observed increase in average of daily yield from 1st to 3rd parity 9.57 and 10.59 kg respectively, and then production decreased to 8.74 kg in 5th parity, table (3) illustrate the existence of highly significant ($p<0.01$) effect of parity in daily milk yield, this is in similar with finding of results in previous studies (26 و 27و 28 and 29) To explain the increase in milk yield with advancing age of animal (or parity) could be also recorded due to the increase in size and weight of animal and its ability to consume more quantity of forage and enlargement of their udder (28).

Table 2. Study factors affecting on daily buffaloes milk yield (kg) (mean ± SE)

Factors	No. observe	Daily milk ± SE
Over all mean	770	9.69 ± 0.12
Parity		
1st	25	9.57 ± 0.82 bc
2nd	170	9.67 ± 0.28 b
3rd	245	10.56 ± 0.23 a
4th	145	9.50 ± 0.20 bc
5th	185	8.74 ± 0.17 c
Herd		
H(1)	290	8.32 ± 0.14 b
H(2)	480	10.53 ± 0.15 a
Stage of lactation		
G1	274	10.50 ± 0.15 a
G2	315	10.52 ± 0.20 a
G3	161	6.99 ± 0.17 b
G4	20	7.30 ± 0.16 b
Test day		
1st .day	154	9.74 ± 0.26 a
5th .day	154	9.77 ± 0.26 a
9th .day	154	9.77 ± 0.25 a
13th .day	154	9.64 ± 0.26 a
17th .day	154	9.53 ± 0.25 a

Means with different subscripts differs significantly ($p < 0.01$).

Daily milk yield was highly significant ($p< 0.01$) influenced by hard (location of conducting this study) for local buffalo was given in table (3). Were daily yield was high in Badosh herd (10.53 ± 0.15 kg) as compared with Bab Shams herd (8.32 ± 0.14 kg) as shown in table 2, can be attributed to more efforts done by farmer in Badosh. Herd affered to their animals and there are number of younger animals that produce high milk than the second herd, although there is much interest in both herds regarded with feeding and farm management. The effects of herd or place has been not studied by previous researches which has been conducted on the Iraqi buffaloes, were Al- Samare (27) in mason was contained

buffalo from different origins from of Iraq, and origin have a highly significant ($p< 0.01$) effect on total milk yield and partial production at 30, 60 and 90 days.

The differences in average daily milk yield which belonging to stage of lactation effect was highly significant a given in (table3) , higher production was in group 1 (10.50 kg) and group 2 (10.52 kg) as compared 3th and 4^{th} groups (6.99 and 7.30 kg/day) respectively as shown in (table2) , this in production was a normal in the animal , while production is rising 10 to 12 weeks then begging to decline gradually.

According to Al-jamass (29) among to his study on Iraqi buffalo at Ninewah that a maximum production the animal was reached in fourth month of lactation season (13.53 kg) and lowest in the tenth month (6.80 kg).

Table3. Analysis of variance for affecting factors in daily buffaloes milk yield

Source of variations	Degree of freedom	Mean squares
Parity	4	73.173 **
Herd (location)	1	1131.440 **
Stage of lactation	3	516.880 **
Test day	4	1.675 ns
Exp. Error	769	6.728

**** (P<0.01), ns: not significance**

Test day had no significant effect on daily milk yield of any studies sample as indicated in (table 3) which appears that there were very slight differences in daily yield , which ranged (9.53 – 9.77) kg as reveled in (table 2).

Regression coefficient represents the dependent variable (such as Y) while independent variable (such as X) one unit , and its expressed as equation of a significant line assigned a determination factor (R^2) this explains the proportion clarified by the independent variable of the dependent variable and the appropriate statistical model of data , these concepts are important when developing plans for improvement , particularly the indirect selection in the different herds for farm animals (30). Table (4) appears the results of regression of daily milk yield on maximum and minimum temperature and both together, as the decline in milk yield to maximum temperature negatively and highly significant ($p < 0.01$) and amounted (- 0.259) kg/°C , this mean that , average daily milk yield decrease amount 0.25 kg when there are an increase in maximum temperature (1) °C , and the coefficient of determination facilities off set the straight line from this relationship is (0.79) this is the maximum temperature explains 79% of the daily milk yield in buffalo , and the equation of straight line is :

$Y^ = 21.121 – 0.259 (X1)$

Regression of daily milk yield on minimum temperature was not significant and their coefficient was (0.0325) kg milk/°C and low determination factor was (0.20) , this results was really expected that the minimum temperature measured at the early morning , therefore there is no problem of heat stress. Results of regression analysis for daily milk yield of buffalo was significantly affected ($p < 0.05$) for temperatures minimum and maximum their coefficient was (-0.371) kg for one degree Celsius, which means that the relationship were inversely between milk yield (dependent variable) and environment temperatures (independent variable) and coefficient of determination for this relationship it was (0.41) the straight line equation as follows:

$Y^ = + 21.186 – 0.371 (X1) + 0.189 (X2)$

What came out of the regression results indicated that the need to provide appropriate temperatures (to reduce heat stress, especially when the ray of the sun vertical) That the production of milk to be within the required level , maximizing the economic return from the buffalo breeding projects.

Table 4. Regression daily buffaloes milk yield on minimum and maximum Temperatures

Regression daily milk yield on temperature	Reg. coefficient (b)	Prediction Equation (Y^)	Signi. level	Coefficient deter. (R^2)
Maximum environment temperature	- 0.259 kg/^{0}C	Y^=21.121 – 0.259 X1	**	0.79
Minimum environment temperature	0.0325 kg/^{0}C	Y^=8.863 + 0.0325 X2	ns	0.20
Max. and Min. environment temperature	- 0.371 kg/^{0}C & + 0.189	Y^=21.186 – 0.371 X1 + 0.189 X2	*	0.41

* (P<0.05), ** (P<0.01) , ns: not significance .

Estimation of heritability for daily milk yield in testing days were shown in table (5) the amounts studied was (0.17 , 0.18 , 0.17 , 0.19 and 0.21) for 5 days testing , these estimates within the limits which indicated by many previous studies(12و 28 and 31). The decline in these estimates refers to the need for improvement environmental conditions in both locations to show a real genetic ability for animals to increase their daily milk yield and to maximize economic return from buffalo breeding projects.

Table 5. heritability estimates for daily buffaloes milk yield (test days)

	Test days				
Heritability (h^2)	1st day 0.17	4th day 0.18	9th day 0.17	13th day 0.19	17th day 0.21

References

1. Rao, AS. and Patro, BN. (1984). Inheritance of average daily milk yield, lactation length and dry period in different lactations of Red Sindhi cattle. Indian Vet. J., 61: 132-136.
2. Prasad, RM., Sudhakar, K., Raghava Rao, E. Gaupta, BR. and Mahender, M. (2010). Studied on the udder and teat morphology and their relationship with milk yield in Murrah buffaloes. Livestock Research for Rural Development, 22 (1): 1-7.
3. Cockrill, WR. (1974). The Husbandary and Health of the Domestic Buffaloes. FAO, Rome.
4. FAO. (1988). FAO/Production Year book, Vol. 42. Rome.
5. Nigm, AA. (1996). Characterization of the Egyptian buffalo resources and production system. Cairo, Egypt.
6. McDowell, RE. (1972). The Improvement of Livestock in Warm Climates. W. H. Freeman and Company, San Francisco.
7. Wilson, WO. (1967). Environmental temperature and feed regulation mechanisms in Ground Level Climatology. R.H. Shaw (ed). Amer. Ass. Adv. Sci. Pub., 86: 247-264.
8. McDowell, RE. (1966).The role of physiology in animal production for tropical and sub-tropical areas. Wld. Rev. Anim. Prod., 2(1): 39-46.
9. Kelov, D. and Kolesov, N. 1974. Summer housing of cows in hot climates. Dairy Sci. Abstr., 36: 498.
10. Thatcher, WW. (1974). Effect of season, climate and temperature on reproductive and lactation. J. Dairy Sci., 57: 360-368.
11. Singh, CV. and Yadav, MC. (1987). Non-genetic factors effecting daily milk yield in Murrah buffaloes. Indian J. Anim. Sci., 57: 56-58.

12. Al-Doori , TS. (2002). The effect of heat stress and coat colour (Black and Red) on some performance traits of Holstein Friesian cows in Iraq. PhD. Thesis, College of Agriculture. University of Baghdad (Arabic).
13. Johanson, EH. (1977). Effect of heat stress on heat regulation in lactating cows. Thesis. Tetchiness University Berlin. German Republic Anim. Breed. Abstr., 47: 4131.
14. Feng, K.Y. (1982). Study on breeding tropical dairy cattle. Chiness J. Anim. Sci., 1: 24-25 Dairy Sci. Abstr., 45: 6759.
15. Al-Rawi, AA. and Avadessian, GA. (1991). Some physiological and production response of Friesian cattle in central Iraq. Iraqi J. Agric. Sci. 22: 95-101.
16. Fox, DG. and Tyluthi, TP. (1998). Accounting for the effects of environment on the nutrient requirements of dairy cattle. J. Dairy Sci., 81: 3085-3095.
17. SAS. (2004) SAS / STAT Users Guide for Personal Computers. Release 6.12. SAS Institute Inc., Cary, NC., USA. (SAS = Statistical Analysis System).
18. Duncan, BD. (1955). Multiple ranges and multiple F test. Biometrics, 11: 1-42.
19. Lush, J.L. (1949). Heritability of quantitative characters in animals. Heredities supple. 356.Proc. 8th. Cong. Genetics.
20. Idrees, SM.; Al- Saaidy, Jk.; Abbas, SF.; Hameed , Sl.; Zuayer , JM. and Mustafa, IQ. (2009) . Studying the effect of some non-genetic factors on daily milk yield of Iraqi buffaloes. Iraqi J. Agric. (Special Issue), 14(1): 1-7.
21. Williamson, G. (1949). Iraq Livestock. Emp. J. Exp. Agric., 17: 48-59 cited by Cockrill, 1974.
22. Juma, KH., Farhan, SM. and Faraj, M. (1972). Food lot performance of native cow and buffalo calves in Iraq. Indian J. Anim. Sci., 24 (3): 406-411.
23. El-Dessouky, FI. (1987). The buffalo in Iraq. Reginald project for production and animal health in Middle East and Far East. FAO/ UN.
24. Juma, KH. (1997). Present status of buffalo production in Iraq. Buffalo J., 2: 103-113.
25. El-Dessouky. FI. (1972). Survey on buffalo management in Whitle Gold village. Ministry of Agriculture. Iraq.
26. Khanna, RS. and Bhat, PN. (1972). Genetic and non-genetic factors associated with the first five lactations yields of Sahiwal Friesian crosses. Indian J. Anim. Sci., 41: 643-647.
27. Al-Samarai, WM. (1984). Some productive and reproductive performance in Iraq buffalo. M.Sc. thesis. College of Agriculture. University of Baghdad (Arabic).
28. Baghdasar, GA. (1990). Some productive and reproductive traits, their genetic parameters and body dimension in Iraq buffaloes. PhD. Thesis, College of Agriculture. University of Baghdad (Arabic).
29. Al-Jamass, RK. (1997). The fixation of some morphological and production characters for Iraq buffalo in Badosh. PhD. Thesis, College of Agriculture and Forestry. Mousl University (Arabic).
30. Przemyslaw, S., Stanislaw, M. and Salwomir, Z. (2008). Yield and composition of milk and blood biochemical component ewes nursing a single lamb or twins. Dept. of Clinical Sci. Internal Disease Unit, Reproduction Unit, Faculty of Veterinary Medicine, Unvi. of Warmia and Mazury in Olszyn, 10:957.
31. Al-Ani, LM. (1980). Estimation of some genetics parameters on dairy cattle in central of Iraq. M.Sc. thesis, College of Agriculture, University of Baghdad (Arabic).