J. Animal and Poultry Prod.., Mansoura Univ., Vol. 8 (2): 21 -25 , 2017

Estimation of Genetic Parameters for Some Production and Reproduction Traits Using Different Animal Models in Egyptian Buffaloes

Mostafa, M. A.[1]; S. A. Darwish[2] and M. S Abd El-Fatah [1]

[1]Animal Production Dept., Fac. of Agric., Mansoura University

[2]Animal Production Research Institute, Agriculture Research Center, Ministry of Agriculture, Egypt.

ABSTRACT

Estimates of (co)variance component and genetic parameters using multi-traits animal model, traits studied were lactation period (LP), total lactation milk yield (TMY), and days open (DO). In all lactations based on 4745 records of Egyptian buffaloes calved during the period from 1980 to 2014 at Mehallet Mousa Experimental farms of Animal Production Research Institute (APRI), Ministry of Agriculture. The six mixed model used in the analysis included the non genetic effects of month and year of calving, parity, and the random effects of additive direct genetics, maternal effect, maternal permanent environmental and residual. Means for LP, TMY and Do were 220.632 d, 1445.26 kg and 184.34 d, respectively. The estimates of heritability in six models for LP, TMY and Do were ranged from (0.026±0.56 to 0.047±0.16), (0.15±0.57 to 0.021±0.15) and (0.02±0.020 to 0.020±0.13), respectively. While Estimates of maternal heritability was very low in six models for LP, TMY and DO and ranged from 0.055±0.026 to 0.18E-09±0.79E-05: 0.081±0.029 to 0.52E-09±0.13E-04; 0.053±0.01 to 0.83E-09±0.12E-04, respectively. The estimates of genetic correlations between LP and TMY in six models ranged from (0.53 to 0.84). Estimates of genetic correlation between DO and TMY in six models ranged from (-0.15 to 0.58).While the estimates of genetic correlation between LP and DO in six models ranged from (0.30 to 0.94). Corresponding estimates of phenotypic correlation among same traits fluctuated (0.17 to76). Thus, the influence of the maternal genetic effect for traits studied was lowest thereby no relative efficiency of improvement. Vice-versa, direct heritabilities for TMY and LP were efficiency, therefore considerable rate of genetic improvement these traits under investigation. Genetic betterment for LP following up improve each TMY and DO. The estimates of heritabilities were low for DO indicated that the major part of the variation in this trait was environmental and selection may not prove effective in bringing about genetic improvement. Therefore, preferable improving management can play a major role in this trait.

Keywords: Lactation period, total Milk yield, Days open, maternal heritability, direct additive heritability and Egyptian buffaloes.

INTRODUCTION

It is well known that the buffalo in Egypt is a major source for the production of milk and red meat in Egypt, contributes to buffalo about 47% of the total milk production the National (Mostafa *et al.,* 2012). The total numbers of buffaloes nearly 3.95 million buffalo (Marl., 2016). Milk production and Reproductive traits are the most important traits that influence profitability of dairy production (Mark *et al.,* 2002, Haile-Mariam *et al.,* 2003 and Zafar et al ., 2008), revealing the production potential of a particular animal. However, stage of lactation and parity of animal and season of calving are some other main factors, which influence milk production and its composition in cattle buffalo and goat. (Ibeawuchi and Dangut 1996; Ekerden Ozel 1999 and Akingbade *et al.,* 2003). Nevertheless, genetic improvement of productivity and reproductive traits is almost non-existent in Egypt. Even some improvement programs for increasing dairy yield have been implemented, they have not survived due to the lack of financial resources, (García *et al.,* 2002; Grajales *et al.,* 2006). The objectives of this study were to determine the genetic, phenotypic parameters for Lactation period (LP), total Milk Yield (TMY) and Days open (DO) using different model of animal model in Egyptian buffalo.

MATERIALS AND METHODS

Data collected from Egyptian buffaloes kept at maintained at Mehallet Mousa Experimental farms of Animal Production Research Institute (APRI), Ministry of Agriculture Egypt. The data of 1428 buffaloes having 4745 normal lactation records from one to nine lactations over a period of 35 years from 1980 to 2014 were included in this investigation. The numbers of sires and dam were 255 and 1300, respectively. Buffaloes records were included sires and dams identification, month and year of calving, farm, parity, lactation period (LP), total milk yield (TMY) and days open (DO). Buffaloes were naturally mated until 2002 and artificially insemination after that. Assignment of sires to buffaloes was at random. Heifers were served for the first time when they reached 24 month or 350 kg of weight. Traits studied were total lactation milk yield (TMY), lactation period (LP) and days open (DO).

Management of the herds

Animals were kept under Semi- open asbestos sheds. Lactating buffaloes were milked by hand or machine twice daily at 7.00 a. m and 4.00p.m throughout the lactation period and milk production was recorded daily. Buffaloes were kept under the routine feeding with according to level of production and managerial system in mahallet mousa experimental farms. The Animals were grazed on Egyptian clover (Trifolium alexandrinum) during December to May with concentrate mixture and rice. While during June to November, animals were fed on concentrate mixture, rice straw and limited amount of clover hay or (silage). Animals were feed according to their live weight, milk production and reproductive status. The concentrate feed mixture was given twice daily before milking, while rice straw was offered once daily at 9.00 a. m, whereas clover hay or (silage) in summer was offered at 11.00 a. m, animals were allowed to drink water three times a day or free from water troughs. Multi mineral licking blocks were available for animals in the stalls.

Data analyses

Data analyzed using multi-traits animal model of VCE6 computer package (Groeneveld *et al.,* 2010) for estimate variance components for direct, maternal and environmental effects by Restricted Maximum Likelihood procedures (REML) and fitting six different animal models.

The model 1: included additive direct effect

$$Y = Xb + Za + e$$

The model 2: included additive direct effect and the maternal permanent environmental effect.

$$Y = Xb + Za + Wpe + e$$

The model, 3: included a additive direct effect and additive maternal effect

$$Y = Xb + Za + Zm + e \quad \text{with} \quad Cov\ (a, m) = 0$$

The model 4: was the same as Model 3, but allowed for a direct maternal covariance ((Cov (a,m))

$$Y = Xb + Za + Zm + e \quad \text{with} \quad Cov\ (a, m) = 0$$

The model 5: included additive direct effect, additive maternal and maternal permanent environmental effects, ignoring the direct-maternal covariance.

$$Y = Xb + Za + Zm + Wpe + e \quad \text{with}\ Cov\,(a, m) = 0$$

The model 6: included additive direct effect, additive maternal and maternal permanent environmental effects, with fitting direct - maternal covariance.

$$Y = Xb + Za + Zm + Wpe + e \quad \text{with} \quad Cov\ (a, m) = 0$$

Where, Y = is the vector of traits studies. b = is the vector of available fixed effects (i.e. year of calving, month of calving and parity). a = is the vector of breeding value, m = is the random vector of direct maternal effects, pe = is the random vector of maternal permanent environmental effects, X, Za, and Zm = are the incidence matrices relating records to examined fixed, animal additive maternal effect and random maternal permanent environmental effects, respectively, and, e = is the unknown vector of residual effects.

RESULTS AND DISCUSSION

The overall means and their standard deviations (SD) and coefficient variabilities (C.V) for different studied traits are presented in Table 1. The overall means for LP, TMY and Do were 220.63 d, 1445.26 kg, 184.34 d, respectively. The present estimated of LP was higher than obtained by Mourad and Khattab, (2009) in Egyptian buffaloes (184 days). However, lower than estimated by Bashir *et al.,* (2015) was 278.3 days and Barros *et al.,* (2016) was 269.57 day in buffalo. Mean of total milk yield (TMY) was lower than found by Mostafa *et al.,* (2012) (1943) and Bashir *et al.,* (2015) in Pakistan (1840±08 kg) working on buffaloes. The present mean of DO is higher than that found by Damarany *et al.,* (2013) (141.8d) and Marai *et al.,* (2009) (91.8±1.3d) for Egyptian buffaloes. This study revealed that high coefficients of variation (ranged from 37.20 to 70.46%). Such large coefficients of variation are good opportunities for breeders to improve in these traits.

Table 1.The estimated of overall means, standard deviations (SD) and coefficient variabilities (C.V) for lactation period (LP), Total milk yield (TMY) and day open (DO).

Traits	Records	Mean	SD	C.V%
LP (day)	4745	220.63	82.07	37.20
TMY (kg)	4745	1445.26	629.69	43.57
DO (day)	3499	184.34	129.89	70.46

Estimates of (co)variances components and heritabilities for different traits studied are presented in Table (2). The estimates of direct heritability for LP in six models ranged from 0.16±0.047 to 0.56±0.026, the higher value of estimates in model 4, while the lowest value are recorded in model 2. The present estimate of direct heritability of similar estimated by El-Arian *et al.,* (2012) (0.41+0.06) on Egyptian buffaloes, while our findings are higher than estimated by Mourad and Khattab (2009) (0.134) and El-Bramony, (2014) (0.06) in Egyptian buffaloes. The estimates of present direct heritability of TMY round from 0.15±0.021 to 0.57±0.15, similar estimates were reported by Mourad and Khattab (2009) 0.172 on Egyptian buffaloes and Barros *et al.,* (2016) (0.24) on Murrah Buffaloes .The direct heritability of DO higher than estimate by Birhanu et al (2015) was 0.119±0.0335 on Holstein Friesian and that of Aziz *et al.,* (2001) 0.08 on Egyptian buffalo, which ranged from 0.13±0.020 to 0.20±0.02 in present results. Estimates of maternal heritability was very low in six models for LP, TMY and DO and ranged from 0.18E-09±0.79E-05 to 0.055±0.026; 0.52E-09±0.13E-04 and 0.081±0.029 and from 0.83E-09±0.12E-04 to 0.053±0.01, respectively. These results agree with Khattab *et al.* (2005) and Mostafa *et al.,* (2013) suggested that maternal effects are not important for milk traits in dairy cattle.

The estimates herein for maternal heritability similar those obtained by Khattab *et al.,* (2005) for (305dMY) on Holstein Friesian in two models were 0.01, 0.02, respectively. Lee *et al.,* (2004) estimated for 305dMY and DO (0.045 and 0.005, respectively) on Korean Holstein cows and Berry *et al.,* (2008) for TMY on Holstein Friesian 0.01.

Correlations

Direct genetic correlations and maternal genetic correlations of studied traits in Egyptian buffaloes are given in Table 3.

Estimates of direct genetic correlations between LP and TMY for six model ranged from 0.53 to 0.84. These results agree with genetic correlation estimated between LP and TMY in Egyptian buffalo by Mostafa *et al.,* (2012) was (0.75), El-Arian *et al.,* (2012) (0.75) and Khattab *et al.,* (2003) (0.76). The genetic correlations estimates between TMY and DO in six models ranged from (-0.15 to 0.58). While the estimate obtained by Hammoud *et al.,* (2013) on Egyptian Holstein cows was negative (-0.31).

Table 2. Estimates of direct and maternal heritabilities, ratios of permanent variance and covariance between direct and maternal genetic effect for different studied traits in Egyptian buffalo.

Trait/Estimates	Model	σ^2_a	σ^2_c	σ^2_m	σ_{am}	σ^2_e	σ^2_p	$h^2_a \pm SE$	$c^2 \pm SE$	$h^2_m \pm SE$	$r_{am} \pm SE$
LP	1	2598				3987	6585	0.39±0.021			
	2	1024.8	1236.0			3889	6150	0.16±0.047	0.20±0.077		
	3	2187		318.2		3971	6476	0.34±0.031		0.049±0.028	
	4	3127		313	-827	3941	5727	0.56±0.026		0.055±0.026	-0.84±0.19
	5	1106.4	1167.9	0.1077E-05		3905	6179	0.18±0.024	0.19±0.23	0.18E-09±0.79E-05	
	6	1215.9	1183.0	41.1	-167.5	3886	5991	0.21±0.04	0.19±0.03	0.01±0.008	-0.75±0.25
TMY	1	145644				216981	362624	0.41±0.018			
	2	494292.5	79244.0			211026	339700	0.15±0.035	0.24±0.054		
	3	112368		27107.5		215476	354952	0.32±0.031		0.076±0.028	
	4	176603		24786	-54555	213653	305932	0.57±0.03		0.081±0.029	-0.83±0.16
	5	52862.9	76238.7	0.1769E-03		211572	340674	0.15±0.021	0.23±0.02	0.52E-09±0.13E-04	
	6	58492.6	74705.4	1721.6	-5622.9	210969	334642	0.17±0.03	0.22±0.02	0.01±0.005	-0.56±0.47
DO	1	1797				11310	13107	0.14±0.019			
	2	1655.9	81.6			1655.9	13043	0.13±0.026	0.04±0.03		
	3	1750		21.3		11313	13084	0.14±0.033		0.01±00	
	4	2389		636	-1074	11163	12041	0.20±0.02		0.053±0.01	-0.87±0.69
	5	1664.0	75.3	0.1081E-04		113085	13048	0.13±0.020	0.01±0.02	0.83E-09±0.12E-04	
	6	2207.4	150.8	617.4	-1064	11184	11996	0.18±0.02	0.01±0.07	0.05±0.02	-0.91±0.06

LP = lactation period; TMY = total milk yield; DO =Days open; σ^2_a = direct additive genetic variance; σ^2_c= permanent environmental variance; σ^2_m = maternal additive genetic variance; σ^2_{am}= direct and maternal additive genetic covariance; σ^2_e = residual variance; σ^2_p = phenotypic variance;c2 = permanent environmental variance as a proportion of phenotypic variance.; h^2_a = direct heritability; h^2_m = maternal heritability; r_{am}= correlation between direct and maternal additive genetic effect.

Genetic correlations between LP and DO in six models was positive (0.30 to 0.94) and higher than obtained by Aziz *et al.,* (2001) (0.07) on Egyptian buffaloes. The estimates of maternal genetic correlations between (LP and TMY), (TMY and DO) and (LP and DO) in six models ranged from (0.66 to 0.99), (-0.87 to 0.52) and (-0.85 to 0.61) respectively.

Phenotypic correlations of studied traits in Egyptian buffaloes are given in Table 4.

The estimates of phenotypic correlations between LP and TMY in six models were high, positive from (0.74 to 0.76), and similar to that estimated by Marai *et al.,* (2009) (0.77) on Egyptian buffaloes. Phenotypic correlation between (TMY and DO) and (LP and DO) ranged from (0.17 to 0.21) and from (0.27 to 0.29), respectively. These results agree with that of Dematawewa and Berger (1998), found the Estimates of phenotypic correlation between TMY and DO was 0.27 on Holstein cows. However the phenotypic correlations between LP and DO was lower than that reported by Aziz *et al.,* (2001) (0.47) on Egyptian buffalos.

Table 3. Estimates of direct genetic correlations and maternal genetic correlations of studied traits for six models in Egyptian buffaloes.

Traits	Model 1	Model 2	Model 3		Model 4		Model 5		Model 6	
	r_G	r_G	r_G	r_{mg}	r_G	r_{mg}	r_G	r_{mg}	r_G	r_{mg}
LP x TMY	0.82	0.53	0.78	0.99	0.84	0.96	0.56	0.95	0.57	0.66
TMY x DO	0.26	0.58	0.23	0.12	0.16	0.52	0.097	-0.87	-0.15	-0.15
LP x DO	0.94	0.46	0.47	0.12	0.41	0.31	0.45	-0.85	0.30	0.61

r_G = direct genetic correlations; r_{mg}= Maternal genetic correlations

Table 4. Estimates of phenotypic correlations of studied traits for six models in Egyptian buffaloes.

Traits	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
	r_p	r_p	r_p	r_p	r_p	r_p
LP x TMY	0.76	0.75	0.76	0.74	0.75	0.75
TMY x DO	0.18	0.17	0.18	0.21	0.17	0.20
LP x DO	0.28	0.28	0.29	0.28	0.27	0.27

r_p= phenotypic correlations

Our results showed that the estimates of traits under investigation in unconditioned range with other studies in Egyptian buffaloes. The influence of the maternal genetic effect for traits studied was lowest thereby no relative efficiency of improvement. Vice-versa, direct heritabilities for TMY and LP were efficiency, therefore considerable rate of genetic improvement these traits under investigation. Genetic betterment for LP following up improve each TMY and DO. The estimates of heritability was low for DO indicated that the major part of the variation in this trait was environmental and selection may not prove effective in bringing about genetic improvement. Therefore, preferable improving management can play a major role in this trait.

REFERENCES

Akingbade, A. A; Nsahlai, I .V and Morris, C. D. (2003). Composition of colostrums and milk of South African indigenous Nguni goats grazing natural pasture and supplemented with concentrate. J. of Animal Sci., 20: 47–51.

Aziz, M. A; Schoeman, S. J.; Jordaan, G. F.; El-Chafie, O. M. and Mahdy, A.T. (2001). Genetic and phenotypic variation of some reproductive traits in Egyptian buffalo. South African J. of Animal Sci., 31: 195-199.

Barros, C.; Rusbel, R. S.; Fraga, B. A.; Tonhat, I. H. (2016). Genetic parameter estimates for production and reproduction traits in dairy buffaloes, Scientific Information System Network of Scientific J,Am, the Caribbean, Spain and Portugal, ISSN. 1983-2125. http://www.redalyc.org/articulo.oa?id=237144625025

Bashir, M. K; Khan, M. S.; Lateef, M. and Iqbal, M. (2015). Environmental factors affecting productive traits and their trends in NiliRavi Buffaloes. Pak. j. life Soc. Sci., 13: 137-144.

Berry, D. P; Lonergan, P.; Butler, S. T.; Cromie, A. R.; Fair, T., Mossa, F. and Evans, A. C. O. (2008). Negative influence of high maternal milk production before and after conception on offspring survival and milk production in dairy cattle. J. Dairy Sci Vol. 91: 329–337.

Birhanu, T.; Mohammed, T.; Kebede, K.; Tadesse, M. (2015). Heritability, genetic and phenotypic correlations of milk production and reproduction traits of Ethiopian boran cattle with different levels of Holstein Friesian inheritance, J. R. Infertility, 6: 79-83.

Damarany, A. I.; Ali, M. A. E. and Ammar R. M. (2013). Reproductive characteristics of the Baladi cows and buffaloes under traditional management conditions in Upper Egypt, the 4th scientific conference of Animal Production Research Institute, 442-449.

Dematawewa, C. M. B. and Berger, P. J. (1998). Genetic and phenotypic parameters for 305-day yield, fertility and survival in Holsteins. J. Dairy Sci., 81: 2700-2709.

Ekerden, Ozel. (1999). Factors affecting milk composition and changes in milk composition with lactation stage in Anatolian buffaloes.Turkish J,Vet.Sci.,23:505–10. http://journals.tubitak.gov.tr/veterinary/issues/vet-99-23–6/vet-23-6–1–96125.pdf.

El-Arian, M. N.; Shalaby, N. A. ; Khattab, A. S.; Darwish, S. A.; Abou-Gamous, R. H. (2012). Phenotypic and genetic trends for some milk yield traits of Egyptian buffaloes. J. Anim. Prod., 3: 353 – 364.

El-Bramony, M. (2014). Genetic and phenotypic parameters of milk yield and reproductive performance in the first three lactations of Egyptian buffalo. Egyptian J. Anim. Prod., 48: 1-10.

García, G. A.; Cárdenas, C. A.; Monterrosa, V.; Valencia, L. and Maldonado, J. G. (2002). Characterization productive y reproductive de lase xplotaciones ganaderas del bajo Cauca y el litoral Atlántico antioqueños. Haciendas la Leyenda y la Candelaria. Revista Colombiana de Ciencias Pecuarias 15:293-301.

Grajales, H.; Hernández, A and Prieto, E. (2006). Edad y peso a la pubertad y su relación con la eficiencia reproductiva de grupos raciales bovinos en el trópico colombiano. Livestock Research for Rural Development 18(10).

Groeneveld, E.; Kovac, M. and Mielenz, N. (2010). VCE User's Guide and Reference Manual Version 6.0.ft p://ft p.tzv.fal.de/pub/vce6/doc/ vce6-manual-3.1-A4.pdf.

Haile-Mariam. M.; Bowman, P. J. and Goddard, M. E. (2003). Genetic and environmental relationship among caving interval, survival, persistency of milk yield and somatic cell count in dairy cattle. J. Dairy Sci., 80: 189-200.

Hammoud, M. H. (2013). Genetic aspects of some first lactation traits of Holstein cows in Egypt, Alex. J. Agric. Res., Vol. 58.295-300.

Ibeawuchi, J. A. and Dangut, A. (1996). Influence of stage of lactation on milk constituents of Bunaji (Zebu) cattle in a hot humid tropical environment. Discovery and Innovation 8: 249–56.

Khattab, A. S., Hulya, A. and Lila, B. (2005). Variances of direct and maternal genetic effects for milk yield and age at first calving in a herd of Friesian cattle in Egypt. Arch. Tierz., Dummerstorf. 48: 24-31.

Khattab, A. S.; El-Awady, H. G.; El-Arian, M.N. and Kawther. A. Mourad. (2003). Genetic analysis of some performance traits using an animal model in a herd of Egyptian Buffaloes. Egyptian. J. Anim. Prod., 40: 15-26.

Lee, D. H. and Han, K. J. (2004). Genetic relationship between milk production, calving ease and days open at first parity in Holstein cows, Asian-Aust. J. Anim. Sci., 17: 153-158.

Marai, I. F. M.; Daader, A. H.; Soliman, A. M. and El-Menshawy, S. M. S. (2009). Non-genetic factors affecting growth and reproduction traits of buffaloes under dry management housing (in sub-tropical environment) in Egypt. Livestock Research for Rural Development. Volume 21, Article #30.

Mark, T.; Fikse, W. F.; Emanuelson, U. and Philipsson, J. (2002). International genetic evaluations of Holstein sires for milk somatic cell and clinical mastitis. J. Dairy Sci., 85:2384–2392.

Marl, (2016). Ministry of Agriculture and land reclamation

Mourad, M. A. and Khattab, A. S. (2009). A comparison between different selection indices for some productive traits on Egyptian buffaloes. Archiv Tierzuchi. 52: 476 - 484.

Mostafa, M. A.; Khattab, A. S.; Set El-Habaeib. Awad; Tızsér, J. (2012). Genetic parameters for buffalo milk yield and milk quality traits using animal model. Aweth. Animal welfare, ethology and housing systems 8: 175-181.

Mostafa, M. A.; Enas .A. Bader.; Khattab, A. S. (2013). Variances of direct and maternal genetic effects for milk yield and its composition in a herd of Friesian cows in Egypt. J. Anim. Prod., 4 : 493-499.

Zafar, M. A. and Rehman A. H. S. U. (2008). study of some performance traits in sahiwal cows during different periods, Pakistan Vet. J, 28: 84-88.

تقدير المعالم الوراثية باستخدام نماذج مختلفة من نموذج الحيوان لبعض الصفات الإنتاجية والتناسلية في الجاموس المصري

محمد عبد الرحمن مصطفى[١] ، سامي أنور درويش[٢] و محمد سامي عبد الفتاح[١]

[١] قسم إنتاج الحيوان – كلية الزراعة – جامعة المنصورة – مصر

[٢] معهد بحوث الإنتاج الحيوان وزارة الزراعة مصر

كان الهدف من هذه الدراسة تقدير مكونات التباين الوراثية والأموية والبيئية والمظهرية والمعالم الوراثية باستخدام نموذج الحيوان المتعدد الصفات وهى طول موسم الحليب ، وكمية الحليب ، وفترة الأيام المفتوحة، استخدم في هذه الدراسة ٤٧٤٥ موسم ولادة لحيوان الجاموس المصري خلال الفترة من 1980 إلى 2014 في مزارع محلة موسى التجريبية التابعة بمعهد بحوث الإنتاج الحيواني–وزارة الزراعة مصر. استخدم في التحليل ستة نماذج مختلطة فشملت تأثير على شهر وسنة الولادة والموسم (ترتيب الولادة) كتأثيرات ثابتة أما التأثيرات العشوائية فشملت التأثيرات الوراثية المباشرة والأمية والبيئية. حيث بلغت المتوسطات لصفات طول موسم الحليب وإنتاج اللبن الكلى وطول فترة الأيام المفتوحة 184.34d ,1445.26 kg, 220.632d على التوالي. وكان تقديرات المكافئ الوراثي في الستة نماذج لصفات طول موسم الحليب و إنتاج اللبن الكلى وطول فترة الأيام المفتوحة تتراوح مابين 0.026 ±0.56 إلى 0.16±0.047، 0.57±0.15 إلى 0.021 ±0.15 ، 0.02± 0.20 إلى 0.020 ± 0.13 على التوالي. بينما كانت تقديرات المكافئ الوراثي الاموى منخفضة جدا في الستة نماذج لصفات المدروسة حيث تراوحت مابين 0.056±0.026 إلى 0.18E-09±0.79E-05 : 0.081±0.029 إلى 0.13E-04±0.52E-09 : 0.053±0.01 إلى 0.83E-09± 0.12E-04 على التوالي . وكان الارتباط الوراثي بين طول موسم الحليب وإنتاج اللبن الكلى في الستة نماذج يتراوح مابين (0.54 إلى 0.84). وكان الارتباط الوراثي بين طول فترة الأيام المفتوحة وإنتاج اللبن الكلى فى الستة نماذج يتراوح مابين(0.15- إلى0.58). بينما كان الارتباط الوراثى بين طول موسم الحليب وطول فترة الايام المفتوحة فى الستة نماذج يتراوح مابين (30 الى 0.94) وكانت التقديرات المماثلة من الارتباط المظهري لنفس الصفات تتراوح ما بين 0.17 إلى0.76. وهكذا فان التأثير الوراثي الاموى عن الصفات المدروسة منخفض جدا وبالتالي ليس له فاعلية في التحسين والوراثي والعكس بالعكس للمكافئ الوراثي المباشر لصفات طول موسم الحليب وإنتاج اللبن الكلى. التحسين الوراثي في طول موسم الحليب يتبعه تحسين وراثي في إنتاج اللبن الكلى وطول فترة الأيام المفتوحة. وكان تقديرات المكافئ الوراثي لطول فترة الأيام المفتوحة منخفض لذلك هناك جزء كبير من التباين لهذه الصفة يرجع إلى البيئة والانتخاب قد لا يكون فعالا في إحداث تحسين وراثي في هذه الصفة لذلك يمكن أن تقوم الرعاية بدورا رئيسيا لتحسين الوراثي في هذه الصفة .