GENETIC AND NON-GENETIC PARAMETERS FOR MILK PRODUCTION TRAITS OF DAMASCUS GOAT IN JORDAN

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ABSTRACT

This study examined the effects of genetic and some non-genetic factors on total milk yield (TMY), test-day milk yield (TDM), pre-weaning (PRMY), and post-weaning milk yield (POMY) using a total of 1167 lactation records of (Damascus) does over the years of 1998 to 2001 at Al-Walla Agricultural Research Station, Ministry of Agriculture. The General Linear Model (GLM) was employed to analyze the data. TMY, TDM, PRMY, and POMY had respective overall averages of 280.3 kg, 1.45 kg, 135.7 kg, and 144.5 kg. Age, doe weight, birth type, and year of kidding all significantly influenced the variables under study. Heritability estimates were 0.22, 0.17, 0.17 and 0.26 for TMY, TDM, PRMY and POMY, respectively. The corresponding estimates of repeatabilities were 0.44, 0.50, 0.32 and 0.33. Genetic correlation between studied traits ranged between 0.52 and 0.91.

Keywords: Selection, Goat, Lactation, Shami goat

بعض المعالم الوراثية واللاوراثية لانتاج الحليب في الماعز الشامي بالاردن

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المستخلص

أجريت الدراسة في محطة الوالا للتجارب الزراعية، وزارة الزراعة، الاردن للمدة بين 1998–2001 حيث تم استخدام 1167 سجل انتاج حليب للماعز الدمشقي وذلك بهدف دراسة المعالم الوراثية وبعض العوامل اللاوراثية المؤثرة في انتاج الحليب الكلي، الفحص اليومي وانتاج الحليب لفترتي ما قبل وبعد الفطام. بلغ المتوسط العام لانتاج الحليب الكلي، الفحص اليومي وانتاج الحليب لفترتي ما قبل الفطام وما بعد الفطام 280.3، 1.45، 135.7 و 144.5 كغم على التوالي. تبين من النتائج بأن لكل من عمر المعزة ووزنها ونوع الولادة وسنة الميلاد تأثيرا معنويا في الصفات قيد الدراسة. بلغت تقديرات المكافئ الوراثي 0.22 ، 0.17 ، 0.17 و 0.26 لكل من انتاج الحليب الكلي، الفحص اليومي وانتاج الحليب لفترتي ما قبل الفطام وما بعد الفطام، كما بلغ المعامل التكراري 0.44، 0.50 ، 0.32 و 0.33 للصفات أعلاه وبنفس الترتيب السابق. تراوح الارتباط الوراثي للصفات قيد الدراسة بين 0.52 و 0.91.

الكلمات المفتاحية: الفحص اليومي، الماعز الدمشقي، الفطام، المكافئ الوراثي.

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INTRODUCTION

A well-adapted animal to Jordan's many ecological conditions is the goat (24). In 1998, it had a population of about 650 000 and supplied 9.6 and 16.9% of the world's total milk and red meat production, respectively (12). Goat milk output can be increased by better management, feeding practices, and genetic enhancement through the adoption of genetically superior animals (23). The Damascus goat is a native breed of Syria and other Middle Eastern countries. This goat was thought to have originated near Damascus, Syria, as its name indicates (25). Following that, they are introduced to countries such as Egypt, Cyprus, Lebanon, Jordan, Algeria, and Iraq. However, the name Damascus was given to them in Cyprus, where the British brought them. It is primarily originated in Cyprus, Lebanon, and Syria. As a result, the Ministry of Agriculture in Jordan started a genetic improvement program in 1995 with the goal of improving both the local goat and the Damascus goat breeds through breeding. The degree to which a characteristic is heritable and how it is genetically related to other traits that are economically significant and to which selection pressure may be applied determine how much room there is for genetic improvement (3). To obtain more precise genetic parameters for milk production, as well as many other quantitative traits, records must be adjusted for a number of well-known fixed influences (8) and 22).This study aims to determine the effects of a number of variables, such as the age and weight of the doe, the kid's birth type, and the year of kidding, on the total, pre-weaning, post-weaning, and test-day milk yields, as well as the estimation of repeatability, heritability, genetic, and phenotypic correlations for the aforementioned parameters.

MATERIALS AND METHODS

In this study, total milk yield (TMY), test day milk (TDM), pre-weaning milk yield (PRMY), and post-weaning milk yield (POMY) were assessed using 1167 lactation records of Damascus does that were collected between 1998 and 2001 at the Al-Walla Agriculture Research Station, Ministry of Agriculture. Semi-intensive management was used to manage the flock. Animals were permitted to graze on green forage and uncultivated plants (shrubs and herbage) for seven hours each day. Throughout the final eight weeks of pregnancy, a daily dose of 0.5 kg of alfalfa and 1.5 kg of concentrate/doe was given; this amount rose to 2.0 kg during the nursing stage. Kids were raised by their mothers until weaning (3 months), with the exception of the period during which milk production was measured. Since the second week after kidding, milk output has been monitored at intervals of every two weeks in 1998 and every month from 1999 to 2001.Kids were taken away from their mother at 7:00 p.m. The next morning, all does were hand milked at 7:00 and again at 3:50, and the amount of milk collected was recorded. The Best Linear Unbiased Estimates (BLUE) for fixed effects and variance components for random effects were estimated using the General Linear Model (21) and Restricted Maximum Likelihood-REML (14), respectively. The measurements were adjusted using the following mixed model, and the estimates of random changes brought on by sire or doe were used to determine genetic parameters or repeatability for the investigated traits:

$$\mathbf{Y_{ijklm} = \mu + S_i + A_j + T_k + R_l + b_{WK} + e_{ijklm}}$$

Where:

Y_{ijklm}: measurement on the mth doe

μ: Overall constant mean associated with each doe

S_i : Random effect associated with ith sire or doe having a zero mean and variance of σ^2s or σ^2d

A_j: Effect of jth age of doe (< 2, 3, 4, 5, 6 and > 7),

T_k : Effect of kth type of birth (single, twin and triplet),

R_l : Effect of lth year of kidding (1998, 1999, 2000, 2001),

b_{WK} :Regression of each trait on weight at kidding and

e_{ijklm} :random error associated with each observation assumed to be normally and independently distributed (0, σ^2e).

For each trait, sire, error, variance, and covariance components were used to build variation-covariance (VCV) matrices, which were then assessed for positive definiteness (all eigen values must be positive). To estimate reliable estimates parameters, the non-positive definite matrices were adjusted using the "Bending" method (4).

RESULTS AND DISCUSSION

The overall means of TMY, TDM, PRMY, and POMY were, respectively, 280.3 2.68 kg, 1.45 0.01 kg, 135.7 1.64 kg, and 144.5 1.48 kg.

Factors affecting milk traits

Age of dam: All milk variables were significantly influenced by the dam's age (p 0.01) showing the overall yield to be increased increased; From 254.3 kg for 2-year-old does to 297.3 kg for 5-year-old does, It was then a progressive drop till older ages of does. This elevation in milk yield may be attributed to the maturity stage of the does and the growth of the udder's secretary tissue (9). The findings of (13, 20,18) were in agreement with these results.

Kid type of birth

Even though the levels of TMY, TDM, PRMY, and POMY tended to be higher in does nursing triplets, this impact was not statistically significant (Table 2). Additionally, several investigators discovered that the birth type had no noticeable impact on milk production (15,16,6). However, this result deviates from others who claimed that the type of birth had a substantial impact on milk production (2,10).

Year of kidding

Milk yield traits were significantly influenced by the year of kidding ($p < 0.01$) (Table 2). In 1998, does produced the most amounts of TMY (330.0 Kg), TDM (2.04 kg), and PRMY (174.5 Kg). The differences in management techniques and the accessibility of feed may be the cause of the year of kidding's major impact on milk yield. This outcome supported the claims made by (13, 10, 6).

Weight of doe at kidding

According to estimates, the regression coefficients for TMY, TDM, PRMY, and POMY on doe weight at kidding were 2.37, 2.01, 1.42, and 0.95 kg/kg ($p < 0.01$). (Tables 1 and 2). Similar to this, other researchers revealed a strong and favorable association between milk yield and doe weight at kidding (20, 6).

Genetic parameters

For TMY, TDM, PRMY, and POMY, the heritability estimates were 0.22, 0.17, 0.17, and 0.26, respectively. In general, this estimate falls within the range of earlier estimates from 0.09 in Saanen (19) to 0.46 in Damscus goat. The heritability estimate for TMY is similar to that published by (17,1,11). These predictions suggest that selection would increase goat milk production. For TMY, TDM, PR MY, and POMY, the repeatability estimates were 0.44, 0.50, 0.32, and 0.33, respectively. These projections show that selection will raise the flock's milk production in the future. The estimate of TMY (0.44) is lower than that obtained by (6) for native Iraqi goat, but higher than those reported earlier by (7) for Alpine (0.33), LaMancha (0.29), Nubian (0.35), Saanen (0.27), and Toggenburg (0.35) (0.56). Genetic correlations between any pairs of the studied traits are positive and significant ($p<0.01$) and ranged between 0.52 to 0.91 (Table 3). The high positive genetic correlations means that these traits were affected by the same direction. Also, phenotypic correlations between milk traits are summarized in Table 3. It reveals that all the correlations were positive ($p < 0.01$) The highest correlation (0.87) was between TMY and POMY. These correlations suggest that selection for one trait can lead to an indirect genetic improvement in the other trait. Such result is in agreement with the finding of other workers (11,5, 10).

Table 1. Least square means ± standard errors for factors affecting milk traits of Damascus goats

Effects	No	Milk yield (kg) Total Mean ± S.E	Test day Mean ± S.E	Pre- weaning Mean ± S.E	Post weaning Mean ± S.E
Overall mean	1167	280.30 ± 2.7	1.45 ± 0.01	135.71 ± 1.6	144.59 ± 1.5
Doe Age					
≤2	242	254.36 ± 6.3 c	1.33 ± 0.029 b	121.80 ± 3.7 c	132.56 ± 3.8 c
3	273	276.93 ± 5.8 b	1.46 ± 0.027 a	130.20 ± 3.4 b	146.72 ± 3.5 ab
4	254	289.01 ± 5.8 ab	1.49 ± 0.027 a	140.70 ± 3.4a	148.31 ± 3.5 a
5	191	297.38 ± 6.6 a	1.51 ± 0.031 a	142.36 ± 3.9 a	155.02 ± 4.0 a
6	141	284.99 ± 7.3 ab	1.47 ± 0.034 a	140.15 ± 4.3 a	144.84 ± 4.4 ab
≥7	66	279.13 ± 10.3 ab	1.46 ± 0.048 a	144.25 ± 6.0 a	134.89 ± 6.2 b
Kids type of birth					
Single	467	275.29 ± 3.8 a	1.43 ± 0.02 a	134.18 ± 2.2 a	141.12 ± 2.3 a
Twin	645	279.25 ± 3.3 a	1.45 ± 0.02 a	136.01 ± 1.9 a	143.20 ± 2.0 a
Triplet	55	286.39 ± 10.6 a	1.48 ± 0.05 a	139.54 ± 6.2 a	146.85 ± 6.4 a
Year of kidding					
1998	305	330.01 ± 5.8 a	2.05 ± 0.03 a	174.53 ± 3.4 a	155.48 ± 3.5 a
1999	262	217.19 ± 6.2 d	1.15 ± 0.03 c	106.36 ± 6.1 c	110.76 ± 3.7 b
2000	322	314.21 ± 5.4 b	1.29 ± 0.03 b	158.19 ± 3.2 b	156.02 ± 3.3 a
2001	278	259.86 ± 6.1 c	1.33 ± 0.03 b	107.23 ± 3.6 c	152.63 ± 3.7 a
The regression on doe weight at kidding	1167	2.38 ± 0.27	0.011 ± 0.001	1.42 ± 0.16	0.96 ± 0.16

Means within the same column, with the same letters are not significantly different (P<0.05).

Table 2. Analysis of variance for the factors affecting milk production in Damascus goats

Sources of Variation	D.f.	Milk production Total Mean Squares	Test day Mean Squares	Before Mean Squares	After Mean Squares
Doe age	5	37645.78**	0.749696**	1176.291**	10983.391**
Kids type of birth	2	3956.35 N.S	0.153874 N.S	902.506 N.S	1080.374 N.S
Year of kidding	3	666967.9**	38.408563**	311662.236**	109901.354**
The regression on doe weight at kidding	1	465294.34**	11.154227**	166370.47**	75207.305**
Residual	1155	5855.09	0.128651	20002.06	2144.718

N.S. non significant, ** P<0.01

Table 3 Genetic and Phenotypic parameters for milk traits of Damascus goats.

Trait*	PRMY	POMY	TMY	TDM
PRMY	0.17	0.52	0.82	0.79
POMY	0.46	0.26	0.91	0.59
TMY	0.84	0.87	0.22	0.77
TDM	0.75	0.67	0.83	0.17
Repeatability	0.32	0.33	0.44	0.50

***Total milk yield (TMY), test-day milk yield (TDM), pre-weaning (PRMY), and post-weaning milk yield (POMY), Heritabilities on the diagonal, genetic correlations listed on the above diagonal and phenotypic correlations listed below diagonal.**

CONCLUSION

The estimated genetic parameters for milk traits in Damascus goats indicated the ability to improve milk production through genetic selection that will be efficient in accumulating the favorable alleles that contributed to genetically enhance milk production. When implementing such breeding programs, the environmental consequences must be considered.

REFERENCES

1.Analla, M., I. Jimenez-Gamero, M. A. Munoz-serrand, J.M. Serradilla and A. Falagan,. 1996. Estimation of genetic parameters for milk yield and fat and protein contents of milk from Murciano-Granadina goats. J.Dairy Sci. 79:1895-1898

2.Crepaldi, P., M. Corti, and M. Cicogna,. 1999. Factors affecting milk production and prolificacy of Alpine goats in Lombardy (Italy). Small Rumin. Res. 32:83-88

3.Das, S.M., J.E.O. Rege and M. Shibre,. 1996. Phenotypic and genetic parameters of growth traits of blended goat at Malya, Tanzania. Proceeding of the third biennial conference of the African small ruminant research network. ILRI.:63-70. Nairobi, Kenya

4.Hays, J. F., and W. G. Hill. 1981. Modification of estimates of parameters in the construction of genetic selection indices "Bending" Biometrics. 37:483-493

5.Hermiz, H.N., M.K. Asofi and A.A. Al-Rawi. 1998. Some genetic and non-genetic causes of variation in milk traits of Iraqi local goat. 6th World Congress on Genetics Applied to Livestock Production. 12-16 Jan.,1998, Armidale, NSW, Australia.24:212-215

6.Hermiz, H.N., M. Singh, A.A. Al-Rawi and J.E. Alkass. 2004. Genetic and non genetic parameters for milk traits in Iraqi goat and their crosses. Dirasat.31:223-228

7.Hoeje, M.U., T.R Rounsaville, R.E. McDowell, G.R. Wiggans, and L.D. VanVleck. 1980. Age-season adjustment factors for Alpine, LaMancha, Nubian, Saanen and Toggenburg dairy goats. J.Dairy Sci. 63:1309-1316

8.Kennedy, B.W., C.M. Finley, J.E. Pollak and G.E. Bradford. 1981.Joint effects of parity, age, and season of kidding on milk and fat yields in dairy goats. J.Dairy Sci., 64:1707-1712

9.Knight, C.H. and M. Peaker. 1982. Development of the mammary gland. J. Reprod. Fert. 65:521-536

10.Kominakis, A., E. Rogdakis, C. Vasiloudis and D. Liaskos.2000. Genetic and environmental sources of variation of milk yield of Skopelos dairy goats. Small Rumin. Res. 36:1-5

11.Mavrogenis, A.P., C. Papachristoforou, P. Lysandrides and A. Roushias. 1989. Environmental and genetic effects on udder characteristics and milk productionin Damascus goats. Small Rumin. Res. 2:333-343

12.Ministry of agriculture. 1998. Annual Report. Directorate of Animal Production and Health

13.Montaldo, H., A. Juarez, J.M. Berruecos and F. Sanchez. 1995. Performance of local goats and their backcrosses with several breeds in Mexico. Small Rumin. Res. 16:97-105

14.Patterson, H.D. and R. Thompson. 1971. Recovery of interblock information when block sizes are unequal. Biometrika. 58:545-554

15.Peris ,S., G. Caja, X. such , R. Casals , A. Ferret and C. Torre. 1997. Influence of kid rearing systems on milk composition and yield of Murciano-Granadina dairy goats. J. Dairy Sci. 80:3249-3255

16.Peris, S., X. Such and G. Caja. 1996. Milkability of Murciano-Granadina dairy goat. Milk partitioning and flow rate during machine milking according to parity, prolificacy and mode of suckling. J.Dairy Res. 63:1-9

17.Prakash, C., R.M. Acharya and J.S. Dollin. 1971. Sources of variation in milk production in Beetal goats. Indian J. Anim. Sci. 41:356-360

18. Prasad, H. and O.P.S. Sengar. 2002. Milk yield and composition of the Barbari goat breed and its crosses with Jamunapari, Beetal and Black Bengal. Small Rumin. Res. 45:79-83

19. Ribeiro, A.C., S.A. Queiroz, J.F. Lui, S.D.A. Ribeiro and K.T. Resende. 1998. Genetic and phenotypic parameters estimates and genetic trend of milk yield of Saanen goats in Southeast of Brazil. 6th World Congress on Genetics Applied to Livestock Production. 12-16, Jan. Armidale, NSW Australia. 24: 234-237

20.Sangare, M. and V.S. Pandey. 2000. Food intake, milk production and growth of kids of local, multipurpose goats grazing on dry season natural Sahelian rangeland in Mali. Anim. Sci. 71:165-173

21.SAS. 2001. SAS/STAT/ User's Guide for Personal computers. Release 6.12. SAS Institute Inc, Cary, NC, USA

22.Schaeffer, L.R. and J.W. Wilton. 1981. Comparison of single and multiple trait beef sire evaluation. Can. J. Anim. Sci. 61:565-573

23.Singh, R.N. and R.M. Acharya. 1982. Genetic and environmental trends of milk production in a closed flock of Beetal goats. J.Dairy Sci. 65:2015-2017

24.Zaitoun, I.S., M.J. Tabbaa and S. Bdour. 2004. Body weight, milk production and lifetime twinning rate of the different goat breeds of Jordan. Dirasat. 31:143-149

25. Zarkawi, M., M. R., Al-Merestani, and M. F. Wardeh, 1999. Induction of synchronized oestrous in indigenous Damascus goats outside the breeding season. Small Ruminant Research, 33(2), 193–197.