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GENETIC AND PHENOTYPIC TRENDS FOR GROWTH AND MILK TRAITS OF INDIGENOUS AND EXOTIC BREEDS OF GOATS AND THEIR CROSSES IN IRAQ

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ABSTRACT

Animal model approach was applied to evaluate 309 does and 998 kids for milk yield and body weight, respectively. The does belonging to four genetic groups: Local (L), Damascus (D), Damascus X Local (DL) and Saanen X Local (SL) were evaluated over four milking seasons (1995, 1997, 1998 and 2000). The kids were L and D purebreds and 2- and 3-way crossbreds between Local (L), Damascus (D) and Saanen (S). All kids were born at the Agargouf Goat Breeding Station between 1994 and 2000.

Heritability (h2) and repeatability (r) were estimated by REML after adjusting records for the fixed effects. An Animal Model program was used to predict breeding values for animals and their parents. Genetic and phenotypic trends of the traits studied were estimated by regression of breeding and phenotypic values on birth years, respectively.

Genetic trends of total, test day and post weaning milk yield were 1.060 ($P<0.01$), –0.003 ($P<0.05$) and –0.105 kg/year, respectively. The phenotypic trends of the same traits were –9.275, -0.031 and –7.303 kg/year ($P<0.01$), respectively. Genetic trends of body weights at 6, 12 and 18 months of age were 0.166, 0.415 and 0.310 kg/year ($P<0.01$), respectively, while, the phenotypic trends were 0.161 ($P<0.05$), 0.751 ($P<0.01$) and 1.106 kg/year ($P<0.01$), respectively for the three ages.

It was concluded that the breeds studied lack effective directional selection and thus a breeding program should be activated to increase goat productivity.

Keywords: *Genetic and Phenotypic Trend, Goat, Milk, Growth*

INTRODUCTION

Genetic trend is the change in the mean breeding values of a population over time. As suggested by **Henderson (1949)** and **Henderson *et al.* (1959)**, genetic and phenotypic trends can be estimated by grouping the animals according to their year of birth and estimating year effects using the Maximum Likelihood method. **Singh and Acharya (1982)** stated that genetic progress should be estimated by adjustment for deviation from random mating. On the other hand, **Wiggans (1984)** reported that doe indexes by year of birth provide a measure of genetic change. However, the different estimates of genetic trends could be attributed to effective breeding plans, artificial insemination used in nucleus flocks, progeny test and selection intensity **(Barillet, 1997)**, and may be due to different methods used in estimating variance-covariance components and evaluation of animals **(Gengler *et al.*, 1999)**.

This study aimed to estimate genetic and phenotypic trends of milk traits and kid body weights in Iraqi local goats and their crosses with Damascus and Saanen breeds.

MATERIALS AND METHODS

The data of this study include 309 records of total (TMY) and test day milk yield (TDM), and 261 records of post weaning milk yield (PWM) in four milking seasons (1995, 1997, 1998 and 2000). The data represent the four genetic groups of does nominated Local (L), Damascus (D), Damascus X Local (DL), and Saanen X Local (SL) kept at Agargouf Goat Breeding Station, Baghdad were used. Also, 998, 693 and 505 records of body weights of kids at 6 (WT6), 12 (WT12) and 18 (WT18) months of age, respectively, born between 1994 and 2000 were investigated. The kids belonged to different genetic groups namely L and D purebreds and 2- and 3-way crossbreds among L, D and S. Heritability (h^2) and repeatability (r) were estimated by Restricted Maximum Likelihood **(Patterson and Thompson, 1971)**. The fixed main effects included in the model for does milk traits were; genetic group, age, year and season of kidding, sex by litter size of kid, and regression on doe weight. Body weights of kids were adjusted for genetic group, age of dam, year and season of birth, sex of kid, type of birth and doe weight at kidding as a covariate.

The Animal model program **(Meyer, 1991)** was used to predict the breeding values (PBV) for the animals and their relatives depending on the traits studied. Genetic trends were calculated by regression of the predicted breeding values on years of birth **(Blair and Pollak, 1984)**. Phenotypic trends were calculated by regression of the phenotypic values on years of birth **(Van der Werf, 2000)**.

RESULTS AND DISCUSSION

Milk traits:

A highly significant positive genetic trend of TMY was found, indicating that the selection was effective in releasing improvement in milk production of 1.060 kg per doe per year (Table 1). Genetic improvement in L (1.973 kg/year) was faster ($P<0.05$) than in D (-1.474 kg/year). This result could be attributed to the adaptation of local does to the prevailing harsh condition in Iraq. On the other hand, the average genetic trend of TDM was negative (-0.003 kg/year) ($P<0.05$) and ranged between –0.002 in crossbred does (SL) and 0.001 kg/year for the other genetic groups (L, D and DL). Although the average genetic trend of PWM was negative (-0.105 kg/year), the 2-way crossbred does (DL and

SL) showed a positive genetic progress in their milk yield after weaning, which were 0.116 and 0.098 kg/year respectively. This result indicates that selection program applied in the station affects positively the genetic improvement of total milk yield. Genetic trends for the first lactation and test day milk yield of Beetal goat were estimated by **Singh and Acharya (1982)** to be 1.62 and 0.009 kg/year, respectively. Alpine, LaMancha, Nubian, Saanen and Toggenburg goats were evaluated by **Wiggans (1984)**, and the regression coefficients of their predicted breeding values for total milk yield on year of birth were 0.54, 0.84, 0.94, 1.37 and 0.52 kg/year, respectively. Another study by **Wiggans *et al.* (1988)** revealed that the regression coefficients were 1.17, -1.18, 0.20, 4.02 and 2.01 kg/year for the same breeds, respectively. **Mingfeng *et al.* (1988)** evaluated 58 Saanen bucks using 675 milk records of their daughters over the period from 1960 to 1985, and reported that the average genetic trend was 7.2 kg/year (P<0.01). **Ribeiro *et al.* (1998)** calculated the genetic trend of total milk yield for 60 Saanen does by the regression of their predicted breeding values on year of birth (1982-1994) and the annual genetic trend was 0.731 kg/year.

Table 1. Genetic trends (kg/year) for milk traits of the different genetic groups.

Genetic groups	N	TMY	TDM	PWM
Pooled	611	1.060 **	-0.003 *	-0.105
Local (L)	395	1.973 *	0.001	-0.570
Damascus (D)	37	-1.474	0.001	-2.363 *
D x L	110	0.316	0.001	0.116
Saanen x L	69	0.423	-0.002	0.098

TMY= Total Milk Yield, TDM= Test Day Milk, PWM= Post Weaning Milk
** P<0.01 * P<0.05

Table 2. Phenotypic trends (kg/year) for milk traits of the different genetic groups.

Genetic groups	TMY		TDM		PWM	
	N	Phenotypic Trend	N	Phenotypic Trend	N	Phenotypic Trend
Pooled	309	-9.275 **	309	-0.031 **	261	-7.303 **
Local (L)	221	-10.760 **	221	-0.047 **	195	-7.936
Damascus(D)	24	-15.680 **	24	-0.089 *	21	-3.361
D x L	39	-6.723	39	-0.033	27	-1.788
Saanen x L	25	-17.210 **	25	-0.134 **	18	-4.332

TMY= Total Milk Yield, TDM= Test Day Milk, PWM= Post Weaning Milk
** P<0.01 * P<0.05

The average phenotypic trend in different genetic groups for TMY was negative (-9.275 kg/year) (P<0.01), and ranged between –17.21 (P<0.01) and –6.723 kg/year for SL and DL crosses, respectively (Table 2). For the pooled data as well as for the different genetic groups, there was no positive phenotypic progress of TDM and PWM, the phenotypic trends being –0.031 and –7.303 kg/year (P<0.01), respectively. The negative phenotypic trends for the studied traits may be due to adverse environmental effects including feeding practices.

Body weights:

Results of this study showed that overall WT6 has a positive (P<0.01) genetic trend (0.166 kg/year) (Table 3). However, genetic trends for this trait in each genetic group of male kids were not significant and ranged between –0.219 for Damascus and 0.773 kg/year for crossbred (DL X L) males. Genetic trends in some genetic groups of female kids were positive and significant, being 0.324, 0.157, 0.414 and 1.635 kg/year for L, DL, SL and DL X L, respectively (Table 3). The genetic trend of pooled data for WT12 in this study was 0.415 kg/year (P<0.01).

Table 3. Genetic trends (kg/year) for growth traits for the different genetic groups.

Genetic groups	N	WT6	WT12	WT18
Pooled	998	0.166 **	0.415 **	0.310 **
Male				
Local (L)	126	-0.073	-0.063	0.202
Damascus (D)	31	-0.219	-0.323	-0.346
D x L	144	-0.077	0.388	0.309
Saanen (S) x L	94	0.223	0.519	0.385
DL X L	21	0.773	1.615	2.819 *
S X SL	10	-0.142	0.633	-0.460
SL X L	17	0.381	0.889	3.723
SL X DL	22	0.157	-0.095	-0.099
DL X SL	24	0.157	-0.545	0.758
Female				
Local (L)	121	0.324 **	-0.016	-0.824 **
Damascus (D)	30	0.417	0.603	1.784
D x L	167	0.157 *	0.245	-0.132
Saanen (S) x L	83	0.414 **	0.496 *	-0.207
DL X L	11	1.635 *	5.525 **	4.809 *
S X SL	8	0.151	0.681	-0.826
SL X L	17	-0.422	-0.405	-1.192
SL X DL	25	-0.018	1.617 *	1.605 *
DL X SL	15	-0.175	-0.944	-2.232

Wt6, wt12 and wt18= body weight at 6, 12 and 18 months of age, respectively.
** P<0.01 * P<0.05

Maximum (1.615 kg/year) and minimum (-0.545 kg/year) genetic trends were recorded for DL X L and DL X SL crossbred male kids. Similarly, trends in female kids of the same genetic groups were 5.525 and –0.944 kg/year, respectively. Genetic trend for pooled data for WT18 was positive and highly significant (0.310 kg/year). Crossbred males (SL X L) had the highest (3.723 kg/year) and (S X SL) had the lowest (-0.460 kg/year) genetic trend, while in crossbred females DL X SL had the lowest (–2.232 kg/year) and DL X L had the highest (4.809 kg/year) (P<0.05) genetic trends.

Table 4. Phenotypic trends (kg/year) for growth traits for different genetic groups.

Genetic groups	WT6		WT12		WT18	
	N	Phenotypic trend	N	Phenotypic trend	N	Phenotypic trend
Pooled	998	0.161 *	693	0.751 **	505	1.106 **
Male						
L	126	-0.085	81	0.192	21	-0.300
D	31	-2.364 **	18	0.537	12	0.912
DL	144	0.056	93	0.674 *	50	0.509
SL	94	0.603 *	64	1.460 **	40	1.112 *
DL X L	21	-1.165	14	-0.150	6	-1.500
S X SL	10	-4.667 **	8	-2.533	3	0.0
SL X L	17	2.449	8	1.043	3	6.0
SL X DL	22	0.248	18	0.872	15	-4.655 *
DL X SL	24	-2.375	13	-3.682	9	0.0
Female						
L	121	0.102	83	0.620 *	79	0.991 **
D	30	-0.818	20	-0.935	16	-0.750
DL	167	0.124	133	0.555 *	122	1.447 **
SL	83	0.470 *	69	1.231 **	64	2.267 **
DL X L	11	0.259	8	1.625	7	2.263
S X SL	8	-2.905 *	7	-5.300	7	-1.300
SL X L	17	-2.176 *	13	-2.868	12	-6.229 *
SL X DL	25	-0.850	16	-0.320	15	-1.700
DL X SL	15	-3.578 **	12	-0.514	12	0.229

Wt6, wt12 and wt18= body weight at 6, 12 and 18 months of age, respectively.
** P<0.01 * P<0.05

Regression of PBV for WT6, WT12 and WT18 on year of birth for male and female kids, showed that there was a significant positive genetic progress of 0.166, 0.415 and 0.310 kg/year/kid, respectively, which indicates that culling of some kids previously from the flock depending on a preliminary results affect positively genetic trend. In sheep, **Erasmus (1990) and Saatci *et al.* (1998)** found positive and significant (P<0.01) genetic trends for body weight at 18 and at 12-13 months of age.

Table 4 shows that the average phenotypic trends for WT6, WT12 and WT18 were 0.161 (P<0.05), 0.751 (P<0.01) and 1.106 kg/year (P<0.01) respectively. These results indicate that there was a phenotypic improvement in these traits. Phenotypic trend for WT6 ranged between –4.667 and 2.449 kg/year for (S X SL) and (SL X L) male kids, respectively, and between –3.578 and 0.470 kg/year for (DL X SL) and (SL) female kids, respectively. Highest (1.460 kg/year) and lowest (-3.682 kg/year) phenotypic trends for WT12 were found for (SL) and (DL X SL) male kids respectively, whereas for female kids, the highest (1.625 kg/year) and lowest (-5.300 kg/year) phenotypic trends were found in the (DL X L) and (S X SL) groups, respectively. Maximum and minimum values of phenotypic trends for WT18 were 6.000 and –4.655 kg/year for the (SL X L) and (SL X DL) male groups, respectively, and 2.267 and –6.229 kg/year for (SL) and (SL X L) female groups respectively.

CONCLUSION

Results showed low genetic improvement in the studied traits during the period of the study. The possible reason for ineffective selection might be unavailability of efficient techniques for the evaluation of animals and incorrect performing recording. In general, it could recommend to; 1) yearly evaluation of animals and prediction of their breeding values in order to determine which individuals or genetic groups are more suitable to be selected as parents of the next generations. 2) Select a high proportion of young animals in order to increase genetic gains.

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الاتجاهات الوراثية والمظهرية لصفات النمو والحليب للماعز المحلي وخلطانها في العراق

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الملخص العربي

استخدم برنامج نموذج الحيوان (Animal Model) لتقييم ٣٠٩ اناث ماعز و ٩٩٨ جدي لصفات إنتاج الحليب وأوزان الجسم على التوالي. وقد قيمت العنزات المنتمية لأربعة مجموعات وراثية (المحلي، الدمشقي، الدمشقي×المحلي والسانين×المحلي) عبر أربعة مواسم حليب (١٩٩٥,١٩٩٧, ١٩٩٨ , ٢٠٠٠). وتضمنت الدراسة ايضا الجديان المحلية والدمشقية والناتجة من خلط سلالتين أو ثلاث سلالات (محلي، دمشقي وسانين). ولدت جميع الجديان في محطة تربية الماعز في عكركوف بين سنة ١٩٩٤ و ٢٠٠٠. تم تقدير المكافئ الوراثي والمعامل التكراري باستخدام طريقة (REML) بعد تصحيح السجلات للعوامل الثابتة. استخدم برنامج نموذج الحيوان للتنبؤ بالقيم التربوية للحيوانات وآبائها وقدرت الاتجاهات الوراثية والمظهرية للصفات المدروسة بواسطة حساب معامل اعتماد القيم التربوية والمظهرية على سنوات الميلاد على التوالي.

كانت الاتجاهات الوراثية لصفات انتاج الحليب الكلي واليومي وبعد الفطام ١,٠٦٠ (أ<٠,٠١) ، -٠,٠٠٣ (أ<٠,٠٥) و –٠,١٠٥ كغم/سنة على التوالي. وكانت الاتجاهات المظهرية لنفس الصفات –٩,٢٧٥، -٠,٠٣١ و –٧,٣٠٣ كغم/سنة (أ<٠,٠١) على التوالي. كانت الاتجاهات الوراثية موجبة ومعنوية (أ<٠,٠١) لأوزان الجسم عند عمر ٦، ١٢ و ١٨ شهر إذ بلغت ٠,١٦٦ ، ٠,٤١٥ و ٠,٣١٠ كغم/سنة على التوالي، بينما كانت الاتجاهات المظهرية لأوزان الجديان عند الأعمار الثلاثة ٠,١٦١ (أ<٠,٠٥)، ٠,٧٥١ (أ<٠,٠١) و١,١٠٦ (أ<٠,٠١) كغم/سنة على التوالي.

نستخلص من هذه النتائج أنه يجب تفعيل برنامج التربية لزيادة انتاجية الماعز.