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GENETIC PARAMETERS FOR GROWTH PERFORMANCE TRAITS OF EGYPTIAN BARKI LAMBS USING RANDOM REGRESSION MODEL

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ABSTRACT

Variance components and genetic parameters for growth traits were estimated for Barki lambs using the average information REMLF90 (AIREMLF90). A total of 3205 Barki lambs' records over the period from 1984 to 2017 from experimental Borg Al-Arab station belonging to Animal Production Research Institute (APRI) were analyzed by fitting Random Regression Model (RRM) with Legendre polynomials (LPs) for body weight traits from birth up to 480 days. Gender, type of birth, year, season and age of dam were considered as fixed effects in addition to the fixed regression on Legendre polynomials, while random regression of additive genetic and permanent environmental effects were considered as random factors in the model. The results showed that all fixed factors and some interactions were significant for all studied traits (P<0.05). Quadratic equation was the best description for growth curve. Additive genetic and permanent environment variances ranged from 0.88 to 6.08 and from 0.88 to 15.33 for birth and thirteen months weights, respectively. Additive genetic and permanent environment covariances ranged from 0.05 to 16.06 and from 0.08 to 9.20 for birth with six months weights and for weaning with ten months weights, respectively. Direct and total heritabilities ranged from 0.05 to 0.41 and from 0.08 to 0.74 for four months and birth weights, respectively. Additive, genetic and phenotypic correlation coefficients were the lowest between birth weight with other studied traits and the highest between ten months weight with other studied traits. Phenotypic variances were oscillated between 2.27 for birth weight to 22.56 for seven months weight, while, residual variances were oscillated between 0.06 for birth weight to 14.05 for four months weight. Therefore, ten months of age recommended to be the best criterion for selecting Egyptian Barki lambs for meat production.

Keywords: Barki sheep, growth performance, genetic and non-genetic factors, Random regression model.

INTRODUCTION

Lamb's growth performance is an important economic trait in sheep production. The first step to design effective breeding strategies for genetic improvement is estimating the genetic parameters (**Gowane et al 2015**) taking into account the relative importance of additive genetic and permanent environment for growth in this breeding strategy (**Talebi et al 2007**). Egyptian sheep are widely distributed in rural areas and considered as an important source of income for smallholder. More than five million heads from three main indigenous sheep breeds are raised in Egypt (**FAOSTAT, 2016**). Barki sheep is one of the most important types of sheep that originated in the Libyan city of Burka and were raised along the northern coast (**Fahmy et al 1969**) with population size of half million heads (**Salwa El-Wakil et al 2008**). It is one of fat-tailed sheep breeds with low growth potential compared with other indigenous breeds and is mostly adapted to the arid range conditions **(Fahmy et al 1969).** However, most of the studies on Barki sheep have so far concentrated on evaluating the breed based on phenotypic parameters. Few studies estimated the genetic merits for economically traits under certain assumptions that were made to facilitate the analysis. Most of them ignored the (co)variance structure of the traits when analyzed simultaneously considering the genetic and non-genetic factors under more realistic assumptions.

With the beginning of the 21st century, random regression model (RRM), as one of the covariance functions, became a common methodology for estimating genetic parameters from longitudinal data **(Schaeffer, 2004).** The first investigation of covariance function was in 1990 for mice growth **(Kirkpatrick et al 1990),** but now there are many articles which investigated the possibility of applying RRM in a wide variety of time-dependent traits **(Fischer et al 2004, Oliveira et al 2010 and Zamani et al 2016).** In Egyptian sheep and goats, **Mekkawy (2000) and Mousa et al (2006)** used RRM with second order of Legendre polynomials for Zaraibi goats and Farafra sheep' genetic studies, respectively. Most models such as repeatability model assumes the homogeneity of variance and this gave genetic correlation equal to unity between repeated measures (**Mansour et al 1981**). Multivariate analysis takes into account the heterogenetic variances and covariances in repeated measurements but its mathematical is difficult and its computation needs long time, in addition to estimate large number of parameters (**Mekkawy, 2000)**. All these models assume the covariance structure is discontinuous (**Van der Werf and Schaeffer, 1997). Meyer (1998)** used covariance function as a continuous function and **Schaeffer and Jamrozik (2008)** suggested random regression model as an alternative methodology to estimate the (co)variance of longitudinal data or records with repeated measurement.

The use of measurements whatever the variability of the ages at taken the weights, reduced number of estimated parameters compared with multivariate analysis and lower estimate for stander error compared with univariate analysis are additional features of the random regression model **(Fischer et al 2004).** Furthermore, The RRM can take into account the environmental effects of the measurement time and can also accommodate genetic differences in the shape of each animal's growth curve (**Schaeffer, 2004 and Meyer, 2004**). Legendre polynomials are suitable, flexible and don't rely on predefined structures when describe the change of covariance over time in addition to their ease of calculation **(Kirkpatrick et al 1990).** This study aimed to: 1) Investigate the effect of non-genetic factors on all body weight traits. 2) Estimate (co)variance components such as additive genetic, permanent environment, phenotypic and residual variances. 3) Estimate genetic parameters using random regression model with second order Legendre polynomials by AIREMLF90.

MATERIALS AND METHODS

Data description

Data comprised 60895 weight records related to 1563 Barki males and 1642 females progeny of 142 sires and 968 dams. The data collected at monthly intervals up to 480 days over the period from 1984 through 2017 from experimental Borg Al-Arab station belonging to APRI were utilized to estimate (co)variance components and genetic parameters for all body weights. Also, the effects of gender, type of birth, season, year and age of dam at lambing on all body weight traits were studied. The most important economic traits were Bwt=birth weight, Wwt=weaning weight (60 days), 6wt= weight at 180 days, 10wt=weight at 300 days, 12wt=weight at yearling and 16wt=weight at 480 days.

Management

An accelerated lambing system of a crop every eight months was practiced. Mating seasons were January, May and September and therefore, lambs were dropped in June, October and February. Only weight not less than 35 kg was permitted for ewe to join the first time to enter the mating. Ewes were randomly divided into mating groups of 20 to 25 ewes. Each group was exposed to a fertile ram, about 540 days of age, in a separate mating pen for a period of 35 to 45 days. Ram should be replaced by another, in case of failing to mate the ewes after one week. Lambs were kept with their dams in nursery facility all the time up to weaning at eight weeks of age. Lambs were weighed monthly until 540 days of age.

In the morning, lambs were fed ad libitum on wheat straw or rice stubbles, which available, in addition to a concentrate mixture consisting of (24% yellow corn, 38% cotton-seed meal, 34% wheat bran, 3% Molasses and 1% salt). During

November to May the lambs were allowed to graze Egyptian clover pasture (*Trifolium alexandrinum)*. In the rest of the year, they graze crop stubbles and green fodder, if available, while clover hay or silage may be offered. Extra supplement of concentrate feed of 250g per head a day was offered one week before and after the beginning of the mating season for flushing ewes and also during the last two to four weeks of pregnancy and through the first four weeks of lactation. Sheep were allowed to drink fresh tap water twice or thrice daily. Animals were sheared twice a year in March and August.

Statistical analysis

Using Average Information REMLF90 (AIREMLF90) software to estimate variance components and genetic parameters by Random regression model with Legendre polynomials (**Misztal et al 2016**). "Orthopolynom" package in R software used to estimate Legendre polynomials in different times **(R Core Team, 2015).** The best model fit using TableCurve 2D v5.01 software (Quadratic function) to estimate mean of monthly weights, the linear and quadratic regression coefficients for each animal. Coefficients were used to estimate covariance matrices, including estimates of genetic parameters. Fixed model was performed to adjust the effect of fixed factors using R program software. The fixed main effects on body weights assumed in this study were gender (male or female), type of birth (single or twin), season of birth (1=lambs born from January to April, 2=born from May to August and 3=born from September to December), year of birth (34 years from 1984 up to 2017) and age of dam (1=ewes with age from 13-28 months, 2=29-38 months, 3=39-50 months, 4=51-69 months and 5=ewes with age more than 69 months of age). Mean separation test of Duncan was used to compare between means. The main model used to estimate fixed factors was as follows.

$$Y_{ijklmn} = \mu + G_i + T_j + S_k + Y_l + D_m + e_{ijklmn}$$

where,

- Y_{ijklmn} is the weight of the n^{th} lamb in the i^{th} gender, j^{th} type of birth, k^{th} season of birth, l^{th} year of birth and m^{th} age of dam;
- μ is the overall mean;
- G_i is the effect of the i^{th} gender, i= 1 (male) and 2 (female);
- T_j is the effect of the j^{th} type of birth, j= 1 (single) and 2 (twin);
- S_k is the effect of the k^{th} season, k= 1, 2 and 3;
- Y_l is the effect of the l^{th} year, l= 1 to 34;
- D_m is the effect of the m^{th} age of dam, m= 1 to 5; and
- e_{ijklmn} is the effect of random residual associated with the individual, assumed to be independent and normally distributed with (0, σ^2_e).

The fixed model was fitted for every trait due to some significant interactions.

The general Random regression model fitted Legendre polynomials of age at recording (in days) as independent variables for the analysis was:

$$Y = Xb + Z_{1a} + Z_{1p} + Z_{2e} + \varepsilon;$$

where,

- Y the observation vector of weight of lamb;
- b the vector of fixed effects including fixed regressions;
- a the vector of animal additive genetic effects for random regression;
- p the vector of permanent environmental effects for random regression;
- e the vector of residual effects for random regressions;
- X the incidence matrix for fixed effects;
- Z_{1a} the incidence matrix for animal additive genetic effects;
- Z_{1p} the incidence matrix for permanent environmental effects;
- Z_{2e} the matrix of covariates for each observation; and
- ε the vector of random residual effect for the overall regression model, assumed to be independent and normally distributed with (0, $I\sigma^2_e$).

RESULTS AND DISCUSSION

Descriptive statistics

Least squares means and their standard errors (LSM±SE), coefficients of determination (R^2) and coefficients of variation (CV%) for body weights (kg) are presented in **Table 1**. The least squares mean were 3.11, 13.11, 24.34, 32.36, 35.15 and 40.26 kg for males and 2.95, 12.90, 22.61, 28.53, 30.88 and 35.31 kg for females for Bwt, Wwt, 6wt, 10wt, 12wt and 16wt, respectively. Coefficients of variation ranged between 11.5 to 22.3% and determination coefficients ranged between 51 to 81.

Table 1. Least Squares Means and their Stander Errors (LSM±SE), Coefficients of Determination (R^2) and Coefficients of Variation (CV%) for body weights (kg) of Barki lambs at different ages.

Classification	Body weights (kg)					
	Bwt	**Wwt**	**6wt**	**10wt**	**12wt**	**16wt**
Overall mean	3.08±0.01	13.01±0.08	23.32±0.12	30.13±0.16	32.43±0.17	37.24±0.45
Gender						
Male	3.11^{a}±0.02	13.11^{a}±0.11	24.34^{a}±0.18	32.36^{a}±0.24	35.15^{a}±0.27	40.26^{a}±0.82
Female	2.95^{b}±0.01	12.90^{b}±0.12	22.61^{b}±0.16	28.53^{b}±0.19	30.88^{b}±0.20	35.31^{b}±0.50
Type of Birth						
Single	3.04^{a}±0.01	13.07^{a}±0.08	23.45^{a}±0.12	30.17^{a}±0.16	32.63^{a}±0.17	37.46^{a}±0.47
Twin	2.90^{b}±0.03	12.20^{b}±0.26	23.02^{b}±0.45	29.60^{b}±0.61	31.89^{b}±0.69	37.21^{a}±1.50
Season[a]						
1	3.07^{a}±0.02	12.54^{c}±0.12	23.83^{a}±0.18	29.50^{b}±0.22	31.50^{c}±0.24	36.20^{c}±0.75
2	2.95^{c}±0.02	13.85^{a}±0.17	22.53^{b}±0.21	29.83^{b}±0.27	32.88^{b}±0.29	37.15^{b}±0.83
3	3.03^{b}±0.02	13.06^{b}±0.12	23.49^{a}±0.22	31.61^{a}±0.34	34.41^{a}±0.37	39.55^{a}±0.78
Age of Dam[b]						
1	3.05^{c}±0.03	13.03^{bc}±0.18	23.13^{a}±0.31	29.57^{a}±0.40	31.85^{a}±0.42	37.33^{a}±1.34
2	3.08^{bc}±0.03	13.21^{ab}±0.19	22.92^{a}±0.30	29.69^{a}±0.36	32.08^{a}±0.40	37.19^{a}±0.92
3	3.12^{b}±0.03	13.41^{a}±0.19	23.50^{a}±0.32	29.91^{a}±0.40	32.35^{a}±0.45	36.74^{a}±1.11
4	3.12^{b}±0.03	12.73^{c}±0.19	23.15^{a}±0.31	29.48^{a}±0.38	31.94^{a}±0.40	36.93^{a}±1.06
5	3.18^{a}±0.03	12.80^{c}±0.20	22.98^{a}±0.32	29.62^{a}±0.41	32.43^{a}±0.45	37.81^{a}±1.11
CV%	11.64	22.31	17.68	17.32	14.40	11.52
R^2	0.73	0.56	0.64	0.51	0.70	0.81

a: season: 1=lambs born at the period from January to April, 2=lambs born from May to August and 3=lambs born from September to December and b:(1=ewes with age from 13 to 28 months, 2=29 to 38, 3=39-50, 4=51-69 and 5=ewes with age more than 69 months). P values <0.05 and the means with the same letter are not significantly different.

The overall average of body weights for Barki sheep at birth and yearling were intermediate between those reported before for the same breed whereas the values were 3.4, 3.59, 2.92, 3.45 and 3.46 kg at birth weight and 33.4, 31.92, 28.7, 32.7 and 23.82 at yearling weight, the values were lower than those reported before at weaning weight 18.2, 18.0, 14.1, 19.9 and 14.46 (**Fahmy et al 1969, Mokhtar et al 1991, Ahmed et al 1992, Bedier et al 1995 and Salwa El-Wakil et al 2009),** respectively. Lowing weaning weight attributed to the fact that lambs were weaned at 60 days in this flock.

Non-genetic factors

The results revealed that fixed effects (gender, type of birth, season, year and age of dam) and some of the first and second order interactions were generally significant on all studied traits ($P<0.05$). The effect of gender on body weights at different ages was highly significant ($P<0.001$). Males weights were significantly higher than females from birth till the end of trajectory. Type of birth was significant ($P<0.05$) and the lambs born single had higher weights than those born twins from birth till yearling and differences weren't significant after yearling. Season for birth was also significant ($P<0.05$), lambs born from January to April had higher values at birth, lambs born from May to August had higher values at weaning and lambs born from September to December had higher values after weaning till the end of the trajectory. The effect of lambing season phenom could be due to the better environmental condition from November to May specially the availability of Egyptian clover. Lambing season from September to December was the best season for Barki sheep. Year of birth was the main significant effect on all body weight traits (($P<0.0001$), this significant difference is attributed to the differences in subsequence managements and environmental conditions. Age of dam at lambing had slight significant effect (P<0.05) on all traits. However, Duncan comparisons showed that elder ewes gave highest birth weight for their lambs, ewes with moderate age (39-50 months) gave the highest weaning weight, while after weaning the differences were not significant. The results confirm what has been reported by other authors **(Salwa El-Wakil et al 2009, El-Awady, 2011, Faid-Allah et al 2016, Hammoud & Salem, 2017 and Naderi, 2018)**

Variance components

Additive genetic variances (σ^2_a) for growth performance traits showed a tendency to increase with age till 13wt (6.08±0.09) and subsequently decreased up to the end of the trajectory (1.36±0.03) **(Fig. 1B).** This trend is similar to that obtained by **Wang et al (2012)** who used different models to estimate genetic parameters for growth traits of Qinghai fine-wool sheep in China and **Naderi (2018)** who used RRM for genetic evaluation and genetic trend of Makouei sheep growth. Whereas the trend reduced over time in Arabian sheep (**Shokrollahi and Baneh, 2012**) and Indian Malpura (**Gowanea et al 2015**). The highest estimate of σ^2_a was reported by **Nemutandani et al (2015)** when used RRM to estimate heritabilities and variance components for body weights from birth to six years of age in Merino sheep. **El-Awady (2011)** reported approximately the same values in the present study at Bwt, 4wt, 6wt and 12wt in Barki sheep. **Figure 2** shows the additive genetic covariance (σ^2_{aco}) estimates which were very low between the most of traits except between 10wt with 2wt, 6wt, 12wt, 13wt and 14wt and these high estimates may be explain the reason of increase of h^2_a in 10wt. Observed variation in the lamb's growth performance at these ages could have been caused by direct genetic effect.

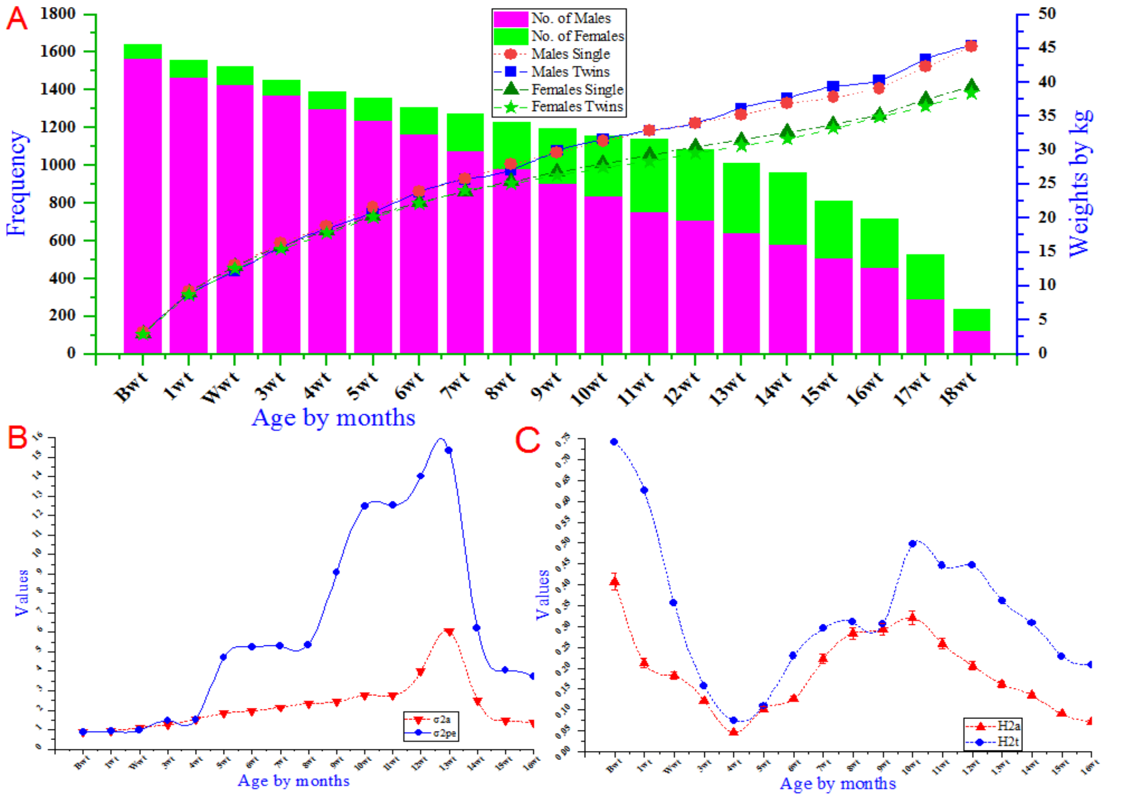

Fig. 1. A) Barki lambs growth curve for different gender with different type of birth which increase with lag of age and the number of male and female which decrease with lag of age in every body weight traits. **B)** Additive genetic (σ^2_a) and permanent environment (σ^2_{pe}) variances which increased by lag of age till 13wt and decreased after that to the end of trajectory. **C)** Additive genetic (h^2_a) and total (h^2_t) heritabilities which have three stages:1) decrease from Bwt to 4wt, 2) increase from 4wt to 10wt and 3) decrease again to the end of trajectory.

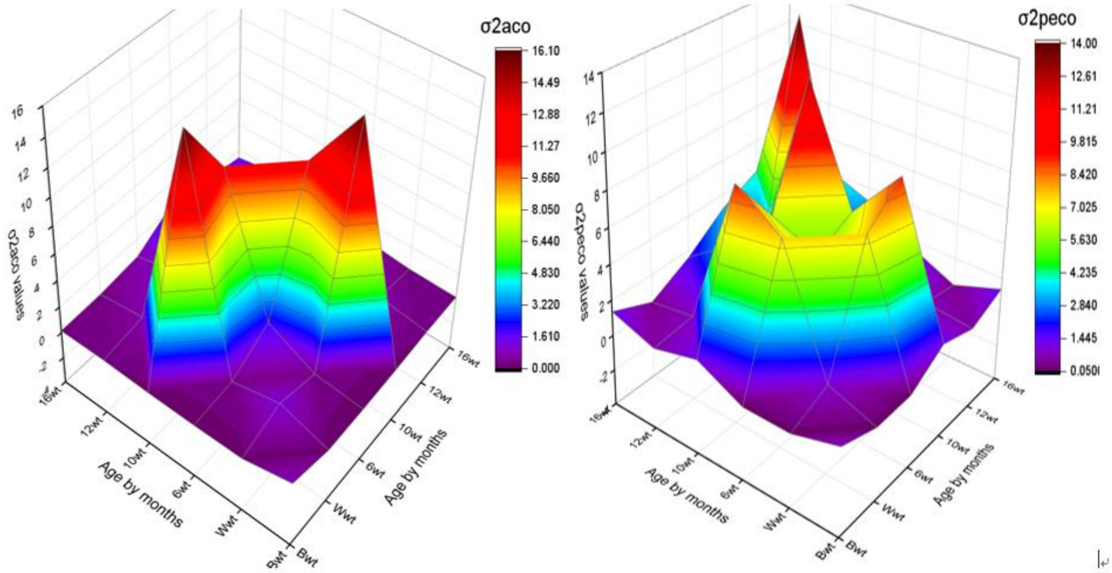

Fig. 2. Additive genetic (σ^2_{aco}) and permanent environment (σ^2_{peco}) covariances for the most important economic growth performance traits which increased till 10wt followed by decreased rate to the end of trajectory.

The trend of Permanent environment variances (σ^2_{pe}) took the same as σ^2_a, but σ^2_{pe} had faster growth more than σ^2_a **(Fig. 1B).** The σ^2_{pe} values were estimated in the range from 0.88 to 15.32 with slightly increase till 4wt (1.52) followed by sharp increase till 13wt (15.32) and a general decrease to the end of trajectory afterward (3.72). The observed trend of σ^2_{pe} in the present study was similar to those reported in several breeds such as Moghani sheep in Iran **(**Najafi et al, 2011 **and Zamani et al 2016),** Sardi sheep in Morocco (**Jannoune et al 2015**) and Makouei sheep in Iran (**Naderi, 2018**). On the other hand, **Fischer et al (2004)** found general decreasing pattern for σ^2_{pe} from 100 to 500 days of age in Australian and New Zealand Poll Dorset sheep. **Figure 2** shows the permanent environment covariance (σ^2_{peco}) estimates which were low between the most studied traits, but higher than those of σ^2_{aco}, except between 6wt with 2wt and 10wt, also between 11wt with 12wt and 13wt with 14wt.

Although, phenotypic variance (σ^2_p) fluctuated between 2.27 and 22.56 for all body weight traits from Bwt to 16wt (**Fig. 3D),** for the most important economic attributes the trend was upward whereas the values were 2.27, 6.15, 15.61, 17.89 and 21.17 for Bwt, Wwt, 6wt, 10wt and 12wt, respectively. Similar estimates were reported for different populations such as Bharat Merino sheep in India (**Gowane et al 2010**), Qinghai fine-wool sheep in China **(Wang et al 2012),** Sardi sheep in Morocco (**Jannoune et al 2015**), Makouei sheep in Iran (**Naderi, 2018**) and Barki sheep in Egypt (**El-Awady, 2011**).

The residual variance (σ^2_e) estimated for all body weights took the same σ^2_p oscillated trend **(Fig. 3D),** while the trend increased with most important economic traits over age. The values were 0.06, 1.28, 1.97, 2.12 and 5.46 for Bwt, Wwt, 6wt, 10wt and 12wt, respectively. Previous published papers reported that residual variance trend increased steadily with age advanced (**Gowane et al 2010, El-Awady, 2011 and Wang et al 2012).**

Genetic parameters

According to RRM, direct heritability (h^2_a) trend took three stages in the present study: in the beginning, h^2_a values had a sharp decline from 0.41±0.02 at Bwt to 0.05±0.00 at 4wt followed by a gradual increase to 0.32±0.01 at 10wt and eventually decreased again to 0.07±0.00 at 16wt **(Fig. 1C).** Low additive genetic values led to decline of h^2_a values in the first four months. As the values of σ^2_a improved from the fifth month, the values of the h^2_a increased, even though the increase wasn't high due to the faster increase of permanent environment values more than additive genetic values. The low values in preweaning period may be attributed to the low nutritional level whether from ewe milk or from nutrition supply and differences in management practices at the farm, creating a lee

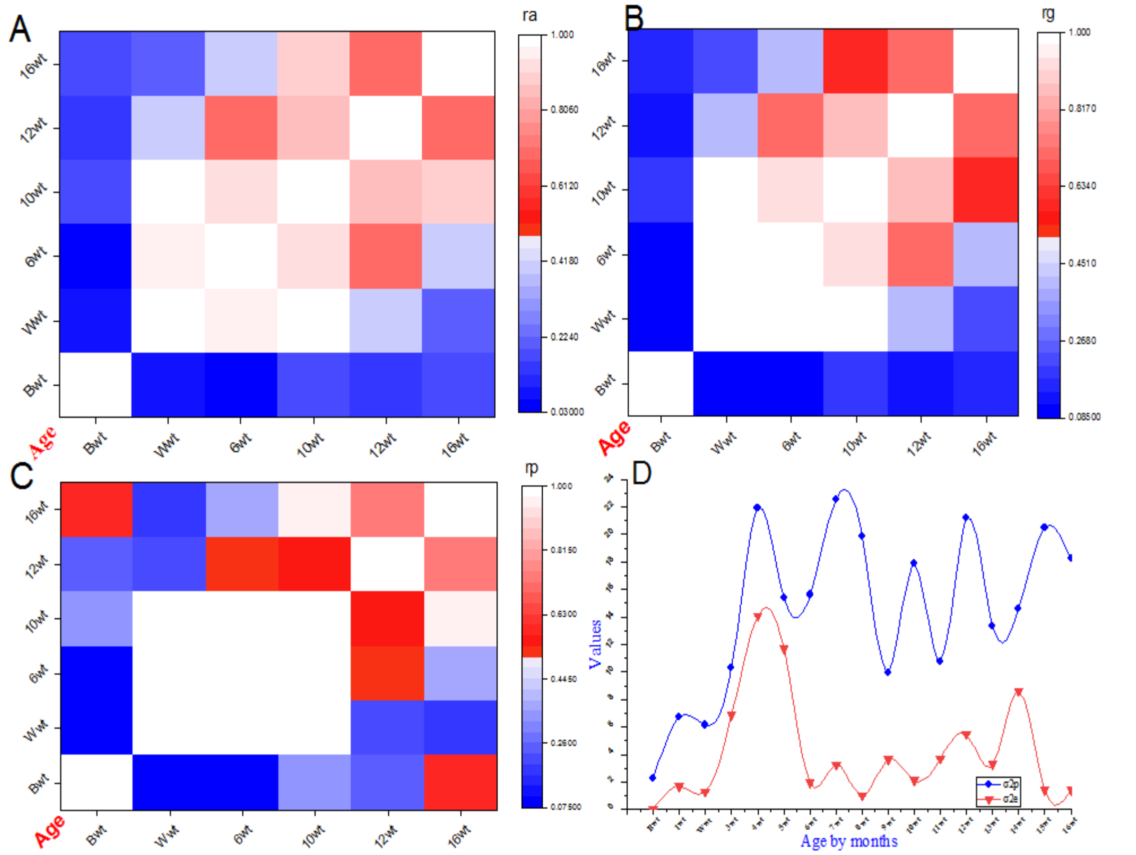

Fig. 3. A, B and C) Heat map for Additive (r_a), genetic (r_g) and phenotypic (r_p) correlations which close to unity between Wwt, 6wt and 10wt. **D)** phenotypic (σ^2_p) and residual (σ^2_e) variances which were oscillated between months.

way for large environmental variations. Improved nutrition may be the main reason to increase the values gradually. Several researchers reported similar h^2_a trend in different populations such as New Zealand and Australian Poll Dorset sheep **(Fischer et al 2004),** Sardi sheep in Morocco (**Jannoune et al 2015**) and Iranian Moghani sheep **(Zamani et al 2016).** On the other hand, some researchers established that h^2_a increased steadily with advancing age **(Lewis and Brotherstone, 2002, Kariuki et al 2010 and Jannoune et al 2015**). **Hammoud and Salem (2017)** estimated h^2_a of preweaning growth traits of Barki lambs and reported that values were 0.161-0.353 and 0.100-0.171 for Bwt and Wwt while **El-Awady (2011)** established that h^2_a for body weights showed a tendency to decrease over the time. Furthermore, **Salwa El-Wakil et al (2009**) estimated higher h^2_a value for Wwt (0.41) than Bwt (0.32) and 12wt (0.30).

Total heritability (h^2_t) had a similar trend, but higher, to the h^2_a. In the beginning, h^2_t values had a sharp slipping from 0.74±0.01 at Bwt to 0.08±0.02 at 4wt followed by gradual growing to 0.50±0.01 at 10wt and eventually decreased again to 0.21±0.01 at 16wt **(Fig. 1C). El-Awady** (**2011**) used different animal models for estimating genetic parameters of Barki sheep and reported a lower estimate for h^2_t in all studied traits except Wwt. While **Hammoud and Salem (2017)** estimated the same values obtained in this study for Wwt but lower for Bwt. On the other hand, very low h^2_t were estimated in other populations (**Ekiz et al 2004 and Gowane et al 2010**). Generally, this wide range of h^2 estimates could be due to the differences in populations maintained at different locations, method of estimation, statistical models, initial matrices and selection criteria. The high heritability obtained during the time from 10wt to 13wt indicates a significant contribution of the σ^2_a to the phenotypic variation.

Consequently, genetic improvement is possible for growth traits at this time by selection.

Additive (r_a), genetic (r_g) and phenotypic (r_p) correlation coefficients estimated by RRM in Barki lambs from Bwt to 16wt had the same trend. Generally, the coefficients ranged from medium to unity, except for Bwt and 1wt, so selection for lambs' body weight at any age will improve weights at other ages. As shown in **Figure 3A, B and C,** the coefficients for r_a between Bwt with all body weight traits ranged from low (0.03 with 6wt) to moderate (0.28 with 13wt), for r_g ranged from low (0.08 with 6wt) to moderate (0.29 with 13wt) and from low (0.015 with 5wt) to high (0.60 with 16wt) for r_p. The lowest r_g between Bwt and 1wt with other body weights indicates that body weights in younger ages are different from those at older ages. Such a result is fact of that different weights are controlled by different genes and this must be noticed in designing animal breeding strategies (**Fischer et al 2004 and Kariuki et al 2010**). The same results were given by **Jannoune et al (2015)** for Sardi sheep and **Naderi (2018)** for Makouei sheep using RRM. On contrast, **El-Awady (2011)** reported high r_a 0.83, 0.89 and 0.67 between Bwt with Wwt, 6wt and 12wt, respectively, for the same breed using different animal models. The slight to moderate r_p between younger and older ages is a sign of the efficiency of Barki lambs is extremely related to the ability to endure the production conditions like produce under the harsh conditions. Coefficients of r_a, r_g and r_p were high, close to unity, between Wwt (60 days) with 6wt and 10wt, while were moderate with 12wt and 16wt. **El-Awady (2011)** estimated high coefficients between Wwt with 6wt and 12wt. The coefficient ranged from moderate to high (0.36 to 0.98) between 6wt and other body weights traits. The highest correlation coefficients were found between 10wt and other traits (0.56 to 0.98). An adjacent body weights had higher correlation estimates than nonadjacent ones. These results emphasis the results given in many populations such as Zaraibi goats in Egypt (**Mekkawy, 2000**) and Moghani sheep in Iran **(Zamani et al 2016).** Only negative phenotypic correlation coefficients were estimated for some Bwt and 1wt traits. Negative r_p was reported before in Santa Inês breed in Brazil **(Oliveira et al 2010).** However, **Ghafouri-Kesbi et al (2008) and Kariuki et al (2010)** didn't estimate any negative correlations. Anyway, correlations coefficients among longitudinal data or repeated measures depends mainly on genetic properties of the population and analysis methods.

CONCLUSION

Under the conditions of this study, the methodology based on RRM with Legendre Polynomials can be recommended for genetic evaluation of body weights from birth to 480 days in Barki sheep. The highest direct and total heritability for body weight traits after birth was at ten months of age and the highest additive and genetic correlation was between body weight at the same age with other body weight traits. Therefore, weight at ten months of age is considered the best criterion to give highest selection response for traits related to growth performance in Barki sheep breed. Different functions must be evaluated with different orders of fit, both in the fixed as in random regression because the behavior of the trajectory may be different for each data set.

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تقدير المعالم الوراثية لصفات النمو في أغنام البرقي المصرية بإستخدام نموذج الإنحدار العشوائي

[36]

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الموجـــــــز

أجريت هذه الدراسه لتقدير مكونات التباين والمعالم الوراثية لصفات النمو لحملان البرقى باستخدام برنامج AIREMLF90. جمعت سجلات 3205 حمل برقي خلال الفترة من 1984 وحتى 2017 من محطة بحوث برج العرب التابعة لمعهد بحوث الانتاج الحيوانى، حللت البيانات باستخدام نموذج الإنحدار العشوائى (RRM) مع دالة متعددة الحدود (LPs) باستخدام طريقة التشابة العظمى المحددة (REML) لتقدير مكونات التباين والمعالم الوراثية لصفات وزن الجسم من الميلاد وحتى عمر 480 يوما.

اعتبر كل من الجنس، نوع الميلاد، السنة، الموسم، وعمر الأم كتأثيرات ثابتة بالأضافة إلى الإنحدار الثابت لدالة LPs، فى حين تم اعتبار الإنحدار العشوائى للتأثير الوراثى التجمعى والتأثير البيئى الدائم كعوامل عشوائية فى هذا النموذج.

أظهرت النتائج أن كل العوامل الثابتة مع بعض التداخلات ذات تأثير معنوى على جميع الصفات المدروسة (كانت قيم المعنوية P<0.05). أختيرت معادلة من الدرجة الثانية كأفضل معادلة لوصف منحنى النمو. تراوحت قيم التباين الوراثى التجمعى والتباين البيئى الدائم بين 0.88 إلى 6.08 وبين 0.88 إلى 15.33 لاوزان الجسم عند الميلاد وثلاثة عشر شهرا، على الترتيب. تراوحت قيم التباين المشترك للتأثير الوراثى التجمعى والتأثير البيئى الدائم بين 0.05 إلى 16.06 وبين 0.08 إلى 9.20 للوزن عند الميلاد مع الوزن عند عمر ستة اشهر والوزن عند الفطام مع الوزن عند عمر عشرة اشهر، على الترتيب.

تراوحت قيم المكافئات الوراثية المباشرة والإجمالية بين 0.05 إلى 0.41 وبين 0.08 إلى 0.74 للوزن عند عمر أربعة اشهر والوزن عند الميلاد، على الترتيب. كانت معاملات الارتباط التجمعى، الوراثى، والمظهرى أقل ما يمكن بين وزن الميلاد مع باقى الأوزان الأخرى وأعلى ما يمكن بين الوزن عند عمر عشرة اشهر مع باقى الصفات المدروسة الأخرى. تأرجحت قيم التباينات المظهرية من 2.27 للوزن عند الميلاد إلى 22.56 للوزن عند عمر سبعة اشهر، فى حين تأرجحت قيم تباينات المتبقى من 0.06 للوزن عند الميلاد إلى 14.05 للوزن عند عمر أربعة اشهر. بنأء على ما سبق، يمكن أعتبار الوزن عند عمر عشرة اشهر أفضل مقياس لانتخاب حملان البرقى المصرية لإنتاج اللحم.

الكلمات الدالة: أغنام البرقي، أداء النمو، العوامل الوراثية وغير الوراثية، نموذج الإنحدار العشوائي

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