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GENETIC PARAMETERS, SIRE EVALUATION AND GENETIC TREND FOR PREWEANING GROWTH TRAITS IN FRIESIAN CALVES IN EGYPT

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ABSTRACT

Records of birth weight (BWT) and weaning weight (WWT) of 1184 Friesian calves (593 males and 591 females) progeny of 49 sires and 489 dams born during the period from 1990 to 2000 were used in the present study. The average number of calves per sire was 18.3 . Data were statistically analyzed using the least squares mixed model and maximum likelihood (LSMLMW) computer program of Harvey (1990). The effects of sire (random effect), year and season of birth, sex of calf (fixed effects) and dam weight at calving (DWC) (covariate) for analysing BWT, WWT and average daily gain (ADG) from birth to weaning were studied. Both BWT and age of calf at weaning (suckling period) (SP) were included in the model as linear covariates when analyzing WWT and ADG. The least squares means (± SE) of BWT, WWT and ADG were 31.3±0.33, 97.0±0.75 kg and 624±0.72 g/d, respectively. Sire, year of calving, sex of calf, DWC and BWT had highly significant ($P<0.001$) effects on traits studied. Season of birth showed highly significant ($P<0.01$) effect only on BWT. Birth weight and WWT increased by 0.021 and 0.018 kg/kg increase in DWC, respectively. Weaning weight of calves increased by 0.36 kg per each kg increase in BWT. Meanwhile, ADG decreased by -6.16 g/d per each kg increase in BWT. Calves born in spring were the heavier BWT and those born in autumn were the lower BWT (32.0 vs. 30.6 kg). The proportions of sire variance components (δ^2s) for BWT, WWT and ADG were 6.03, 6.96 and 7.04%, respectively. Heritability estimates were 0.241, 0.279 and 0.281, respectively. The genetic, phenotypic and environmental correlation coefficients among studied traits generally were low and positive except the correlations between WWT and ADG were strong (0.907, 0.892 and 0.886, respectively) and between BWT and ADG were moderate and negative (-0.285, -0.278 and -0.277, respectively). Estimates of sire-transmitting ability (ETA's) as deviations from the overall means using Best Linear Unbiased Prediction (BLUP) method ranged from -0.856 to +2.24 kg for BWT, from -3.86 to +4.46 kg for WWT and from -36.4 to +42.3 g/d for ADG. Percentages of sires that had positive ETA estimates for studied traits ranged from 43.24 to 48.65%. Spearman rank correlation coefficients among ETA's of BWT and both WWT and ADG were low and negative (-0.17 and -0.17, respectively), while the corresponding correlation between WWT and ADG was high and positive (0.998). The annual phenotypic and genetic trends in BWT were positive and significant (0.149 and 0.503 kg/year, respectively). Meanwhile, the phenotypic trends in both WWT and ADG were negative and significant (-0.268 kg/year and -2.55 g/d/year in the two traits, respectively) and the genetic trends in the same two traits were negative also (-0.060 kg/year and -0.615 . g/d/year, respectively) but not significant. From this study, it could be concluded that the economic importance must be given to growth traits in breeding programs.

Keywords: Friesian calves, growth traits, sire evaluation, genetic trend, Egypt

INTRODUCTION

In Egypt, Friesian cattle were imported for milk production and meat production as well. Friesian cattle are used as purebred or for crossing with Egyptian native cattle. It is known that cattle contribute about 60% of red meat production in Egypt (Oudah, 2001). Zahed *et al.* (2001) reported that sexual maturity of heifers depends more on body weight than on age. Thus, growth rate influences age at puberty and ultimately age at first calving for females as well as marketing date for males.

Birth weight (BWT), weaning weight (WWT) and average daily gain (ADG) of calves, during suckling period, are affected by several genetic and environmental factors. Estimates of heritabilities and genetic and phenotypic correlations are needed for the genetic evaluation of animals and the design of breeding programmes (Lobo *et al.*, 2000). Numerous studies on preweaning growth found that sire was significant source of variation for preweaning growth performance of calves (e.g. Abassa *et al*, 1993; Colborn *et al.*, 1997; Oudah and Mehrez, 2000; Lengyel *et al.*, 2001 and Pogdanovic and Djurdjevic, 2001). Applying sire evaluation results will identify those sires having high genetic potential and will lead to reseanable genetic progress. The genetic trends provide a basis for assessing the impact of selection programs followed on genetic improvement.

Limited information are available on performance and genetic potential of preweaning growth traits in Friesian calves in Egypt (e.g. Ragab and Abdel-Aziz, 1961; Afifi and Soliman, 1971; Afifi *et al*, 1975, Al-Amin, 1979, Badran and El-Barbary, 1986, Maarof *et al*, 1988 Abdel-Moes, 1996 and Oudah, 2001). Especially, in the recent years the main interest and concern of researchers was to study different milk traits of Friesian cattle. The present study aimed to investigate some genetic and environmental factors affecting BWT, and WWT and ADG from birth to weaning of Friesian calves. Estimates of genetic parameters, sire evaluation, and phenotypic and genetic trends in the same traits were also studied.

MATERIALS AND METHODS

Records of birth and weaning weights of 1184 Friesian calves (593 males and 591 females) progeny of 49 sires and 489 dams collected during the period from 1990 to 2000 were used in the present investigation. The average number of calves per sire (k) was 18.3 . The calves were maintained at Sakha Research Station, Kafr El-Sheikh Governorate belonging to Animal Production Research Institute, Ministry of Agriculture. The farm located at the northern middle part of the Delta (about 160 km from Cairo), Egypt. Dams of these calves were locally born Dutch Friesian cows produced from a herd imported into Egypt from Holland in 1960.

Management: The calves were allowed to suckle colostrum for the first three days after birth. Thereafter, they were artificially reared on natural milk twice daily on the age basis till weaning. An amount of 437.5 kg of natural milk was available for each calf during the suckling period. Beside milk, green fodder was given to the calves *ad libitum* according to the schedule applied under the feeding and management system of Animal Production Research Institute (APRI), Egypt. Green fodder in winter was Berseem (*Trifolium alexandrinum*) while green maize or elephant grass were offered in summer. The concentrates (calf meal) and hay were offered to calves according to their age from the beginning of the third or fourth week of age. About 113, 91, and 17 kg of calf meal, hay and yellow maize, respectively were offered for each calf during the suckling period (15 weeks). The calf meal consisted of 48% yellow maize, 17% cotton-seed cake, 10% wheat bran, 10% rice starch residue, 10% linseed meal, 2% molasses 1% limestone, 1% bone meal and 1% salt.

The calves were loosely housed at day time while they were housed in individual pens at the time of suckling and overnight. After morning suckling the calves were grouped according to their ages in shades stables with open yards. Birth weight of calves was recorded to the nearest kg within 24 hours from birth. The calf was weaned at the end of the 15^{th} week of age if it reached to 85 kg live body weight. Suckling period was prolonged for calves with less than 85 kg at 15^{th} week of age until they reach this weight. Average daily gain of a calf was calculated according to the following formula: ADG = (actual weight at 15^{th} week of age - actual BWT) / 105 days. Dam weight at calving (DWC) was recorded within 1 – 3 days from calving.

Statistical analysis: Three traits were studied: birth weight (BWT), weaning weight (WWT) and average daily gain (ADG) from birth to the end of the 15^{th} week of age. Data were statistically analyzed utilizing the linear mixed model least squares and maximum likelihood (LSMLMW) computer program of Harvey (1990). The fixed effects (beside the sire of the calf as random effect) fitted included year of birth (11 years from 1990 to 2000), season of birth (winter, spring, summer and autumn) and sex of calf (male and female). Dam weight at calving (DWC) was included in the mixed model as linear covariate. Both BWT and age of calf at weaning (suckling period) (SP) were included in the model as linear covariates when analyzing WWT and ADG. The linear mixed model mentioned above could be described as follows:

$Y_{ijklm} = \mu + S_i + Yr_j + M_k + Se_l + b(x - \bar{x}) + e_{ijklm}$ (Model 1), where:

Y_{ijklm} = the measured trait (BWT, WWT or ADG);

μ = the overall mean;

S_i = the random effect of the i^{th} sire, I = 1, 2, 3 ..... 49;

Yr_j = the fixed effect of the j^{th} year of birth j = 1990, 91, 92, ...2000;

M_k = the fixed effect of the k^{th} season of birth, k = 1, 2, 3 and 4 (1 = winter, 2 = spring, 3 = summer and 4 = autumn), winter (from December to February), spring (from March to May), summer (from June to August) and Autumn (from September to November);

Se_l = the fixed effect of the l^{th} sex of calf, l = 1 and 2 (1 = male and 2 = female);

b = partial linear regression of the BWT (kg) on DWC (kg),

$(x - \bar{x})$ = x is the DWC and $\bar{x}$ is the average of DWC of the herd; and

e_{ijklm} = random error.

The same model was used in the analyses of WWT and ADG, but both BWT and (SP) were taken as covariates with linear regression coefficients as follows:

$Y_{ijklm}=\mu+S_i+Yr_j+M_k+Se_l+b_1(x_1-\bar{x}_1)+b_2(x_2-\bar{x}_2)+b_3(x_3-\bar{x}_3)+e_{ijklm}$ (Model 2) where: b_1, b_2 and b_3 are the partial linear regression coefficients of WWT (kg) or ADG (g/d) on DWC, BWT (kg) and SP (d), respectively. The SP was added to the model to remove its effect on WWT and preweaning ADG. Preliminary analyses showed that cow within sire (as random effect) as well as first-order interactions were not significant (P>0.05) for traits studied, and were excluded from the models of the final statistical analyses. Heritability estimates (h^2) were computed by the paternal half-sibs method according the formula: $h^2 = 4\,\delta^2 s/(\delta^2 s + \delta^2 e)$. Estimates of h^2 and genetic (with standard errors), phenotypic and environmental correlations among traits were computed according to Model I of statistical analysis using the LSMLMW program of Harvey (1990).

Estimation of sire transmitting ability (ETA's): Transmitting abilities were estimated for sires with at least five daughters. The total number of sires used in estimation of ETA's was only 37 sires. Sire-transmitting ability for different traits studied was estimated by Best Linear Unbiased Predictor method (BLUP). One set of cross-classified non-interacting random effect (sire) is absorbed according to Harvey (1990) where BLUP estimates for random sire effects absorbed by maximum likelihood were obtained. Rank correlation coefficients among sire transmitting abilities for traits were estimated using the Spearman formula (Snedecor, 1956).

Estimation of phenotypic and genetic trends: Annual phenotypic changes for different traits studied were computed as the regression coefficients of trait values on the year of birth after adjusting the records for the fixed effects. Genetic Trends in studied traits were estimated by regression of ETA's for each year on year of birth.

RESULTS AND DISCUSSIN

Overall means: Actual means, standard deviations (SD) and coefficients of variation (CV%) of BWT, WWT (kg) and ADG (g/d) of 1184 Friesian male and female calves are presented in Table 1. Means of BWT (31.5 kg) and WWT (96.6kg) fall generally within the range of estimates reported in most studies carried out on the Friesian calves under Egyptian conditions. Birth weight ranged between 25.9 to 37.3 kg as reported by many authors (Ragab and Abdel-Aziz, 1961 (32.5 kg); Afifi and Soliman, 1971 (30.9 kg); Afifi *et al.*, 1975 (31.5 kg); Alim and Taher, 1979 (25.9 Kg); and Abdel-Moes, 1996 (37.3 kg)). Weight at weaning ranged between 76.2 to 98.0 kg (Ragab and Abdel-Aziz, 1961 (98.0 kg); Alim and Taher, 1979 (96.9 Kg); Afifi *et al.*, 1975 (93.0 kg) and El-Gaffarawy, 1979 (76.2 kg). The present means of ADG (620 g/d) (Table 1) is higher than the results of Ragab and Abdel-Aziz (1961) working on 218 Friesian calves who found that the overall mean of ADG for the period from birth to four months of age was 550 g/d. Kabuga and Agyemang (1985) in Ghana reported that BWT, WWT and ADG averaged 35.6, 104.6 and 0.5 kg, respectively in 97 imported Holstein-Friesian calves. The differences between our estimates and those of other investigators may be related to genetic differences between genotypes, managerial practices and/or system of feeding that would affect live body weights and growth rates.

Table 1: Unadjusted means, standard deviations (SD) and coefficients of variation (CV %) of BWT, WWT and preweaning ADG.

Trait	Abbreviation	Mean	SD	CV %
Birth weight (kg)	BWT	31.5	4.46	14.2
Weaning weight (kg)	WWT	96.6	9.25	9.58
Average daily gain (g/d)	ADG	620	89.5	14.4

Effect of non-genetic factors:

The least squares means of growth traits along with level of significance are presented in Tables 2.

Effect of year of birth: Least squares analysis of variance showed highly significant (P<0.001) effect for year of birth on BWT and WWT (Table 2). The same significant effect of year of birth on BWT or WWT was reported also by several studies (e.g. Shibata and Kumazaki, 1984; Kabuga and Agyemang, 1985; Reyes *et al,* 1992 and Duc *et al.,* 1993; Oudah and Mehrez, 2000). The differences in weights among years might be due to differences in management and climatic conditions. Least squares analysis of variance showed highly significant (P<0.001) effect of year of birth on ADG (Table 2). Similar results were found by Sakhare and Ingale (1984) who found that growth from birth to weaning was significantly affected by year of birth. Kabuga and Agyemang (1985) working on 97 Friesian calves in Ghana stated that year of birth influenced significantly WWT and ADG. DeNise *et al* (1988) stated that year of birth was a significant source of variation in all environments for all preweaning daily gain traits. Reyes *et al* (1992) also came to the same conclusion. The differences in ADG among years might be due to differences in management and climatic conditions.

Effect of season of birth: Season of birth had significant (P<0.01) effect on BWT only (Table 2), indicating that season birth plays an important role in determining calf birth weight. Calves born in spring were heavier and those born in autumn were the lighter (32.0 *vs.* 30.6 kg, respectively). Most of the studies carried out on the effect of season or month of birth on BWT confirmed the presence of such significant effect, e.g. Afifi and Soliman (1971) in Egypt, who reported irregular variation in BWT from one month of birth to another. They attributed the seasonal fluctuations in BWT to the differences in condition of the cows during gestation period. The differences in system of feeding and management, which are practiced at different seasons, are logical sources of variation in pregnant cow's conditions. The same significant effect of season (or month) of birth on BWT was reported

Table 2: least squares means of BWT, WWT and ADG as affected by different factors along with level of significance.

Classification	No. of obs.	Least squares means (± SE) BWT (kg)	WWT (kg)	ADG (g/d)
Overall mean	1184	31.3±0.33	97.0±0.75	624±0.72
Sire	49	***	***	***
Year of birth:		***	***	***
1990	83	30.1±1.03	99.9±2.15	651±2.06
1991	98	29.7±0.87	99.1±1.83	644±1.76
1992	105	31.8±0.77	99.8±1.63	649±1.56
1993	98	33.1±0.75	101.7±1.58	669±1.51
1994	130	32.6±0.82	101.0±1.72	661±1.64
1995	121	32.3±0.64	93.3±1.37	588±1.30
1996	62	30.3±0.79	96.4±1.68	618±1.61
1997	138	31.2±0.74	94.0±1.58	595±1.50
1998	136	33.0±0.77	89.3±1.64	551±1.56
1999	168	30.1±0.68	95.8±1.44	612±1.37
2000	45	30.0±0.98	96.9±2.05	621±1.96
Season of birth:		**	N.S	N.S
Winter	377	31.4±0.39	97.8±0.86	631±0.82
Spring	356	32.0±0.39	96.1±0.87	615±0.83
Summer	210	31.2±0.44	97.0±0.97	623±0.92
Autumn	241	30.6±0.43	97.2±0.94	625±0.90
Sex:		***	***	***
Male	593	31.9±0.36	98.1±0.80	634±0.76
Female	591	30.7±0.36	95.9±0.80	613±0.76
Regression of trait on:		***	***	***
Dam wt. at calving (kg)		0.021±0.002	0.018±0.005	0.17±0.04
Birth weight (kg)		------	0.36±0.063	-6.16±0.60
Suckling period (day)		------	-0.16±0.04	-1.46±0.39

** P<0.01 and *** P<0.001 .

also in several studies (Al-Amin, 1979; Morsy *et al*, 1984 and Badran and El-Barbary, 1986). The insignificant effect for season of birth on WWT and ADG reported here was confirmed also by Afifi and Soliman (1971) and Maroof and Arafat (1985) on Friesian cattle in Egypt who found that WWT and preweaning ADG were not significantly affected by season of birth.

Effect of sex: Table 2 shows highly significant (P<0.001) effect for sex of calf on BWT, WWT and ADG. In this study, males were significantly heavier than females by 1.2 and 2.2 kg in BWT and WWT, respectively and grew faster from birth to the 15th week by 21 g/d (Table 2). Many studies showed such significant effect (e.g. Afifi and Soliman, 1971; Shibata and Kumazaki, 1984; and Kabuga and Agyemang, 1985). Abassa *et al.* (1993) also working on Zebu cattle in Cameroon found that sex had highly significant effect on BWT and WWT of calves.

Effect of dam weight at calving (DWC): The effect of DWC on BWT, WWT and ADG of the calf was highly significant (P<0.001) (Table 2). Birth weight increased by 0.021 kg/kg increase in DWC, whereas WWT increased by 0.018 kg/kg increase in DWC. The present results were nearly the same obtained by Afifi and Soliman (1971) in Egypt who found that regression coefficient of BWT on DWC was 0.01 kg and WWT was 0.016 kg. Omar (1984) found that DWC, irrespective of age, had a significant (P<0.01) effect on BWT of her calves. Kabuga and Agyemang (1985) found that BWT of Holstein-Friesian calves increased by 0.027 kg per kg increase in cow' s weight at calving. Saint-Martin *et al.* (1988) reported that dam's body weight at calving significantly affected growth rate and body weight of calves.

Effect of Birth weight on WWT and ADG: Weaning weight of calves increased significantly (P<0.001) by 0.36 kg per kg increase in BWT. Meanwhile ADG decreased significantly (P<0.001) by -6.16 g/d per kg increase in BWT (Table 2). The negative relationship between BWT and ADG could be explained since the lighter calves need fewer amounts of requirements of maintenance ration compared with calves with heavier BWT. Kabuga and Agyemang (1985) found that WWT of Holstein-Friesian calves increased by 1.31 kg per kg increase in BWT. Maroof and Arafat (1985) using Friesian cattle found that WWT and preweaning ADG were significantly affected by BWT. Abassa *et al.* (1993) working on Zebu cattle in Cameroon found that an increase of 1 kg in BWT led to an increase of 1.27 kg in WWT.

The analyses of non-genetic factors affecting growth traits given in Table 2, showed the importance of adjusting the individual records of calves for the environmental effects. Northcutt *et al* (1994) came to the same conclusion. They studied adjustment factors for weaning weight in Angus field records and concluded that adjustment factors may be specific to the genetic changes for growth in the breed.

Sire effect:

Sire of the calf had highly significant (P<0.001) effects on BWT, WWT and ADG (Table 2) with proportions of variation 6.03, 6.96 and 7.04% of the total variance for the three traits, respectively (Table 3). Several studies agreed upon the presence of significant effect for sire of calf on growth traits (Afifi and Soliman, 1971; Al-Amin, 1979; Kabuga and Agyemang, 1985; Maarof *et al.*, 1988; Abassa *et al*, 1993; Duc *et al.*, 1993; Colborn *et al.*, 1997; Oudah and Mehrez, 2000; Lengyel *et al.*, 2001 and Pogdanovic and Djurdjevic, 2001). The present results indicate the possibility of genetic improvement in live body weights of calves through sire selection. The moderate variance components of BWT, WWT and ADG due to sire reported here (Table 3) led to moderate heritability estimates (Table 4) which consequently suggest that there is a relatively good opportunity for selection. Wilson *et al* (1986) estimated variance components from field-collected performance records for the American Hereford and the American Angus breeds and found that sire variances (δ^2_s) for birth weight were 1.34 and .66 kg^2, respectively and residual error variances (δ^2_e) were 8.43 and 9.26 kg^2, respectively. Estimates obtained forning weight were: $\delta^2{}_s$ 20.37 and 17.13 kg^2; and $\delta^2{}_e$ were 438.09 and 267.38 kg^2 for the Hereford and Angus breeds, respectively. Pogdanovic and Djurdjevic (2001) reported that sire component accounted for about 27.18 and 10.10% of the total variation in BWT and ADG, respectively.

Genetic parameters: Heritability estimates of BWT, WWT and ADG given in Table 4 show that 0.241, 0.279 and 0.281 of the total variance in the three traits, respectively are due to additive genetic variance. This indicates that genetic change can be made by selection for these traits. It is clear from the present results that WWT generally has higher heritability estimates than BWT (0.279 *vs.* 0.241). This would indicate that environmental factors, in relation to additive genetic factors, had more influence on BWT than on WWT. This may be attributed to the high maternal influence associated with calf growth performance during pregnancy. The moderate heritability estimates for WWT and ADG in this study indicate that to select calves for their own genetic merit for weight and gain, it would be better to use WWT as a selection criterion rather than BWT.

Table 3: Estimates of sire variance component (δ^2s), error variance component (δ^2e) and proportions of variance (V%) due to sire effect for BWT, WWT and ADG.

Trait	Sire		Error	
	(δ^2s)	(V %)	(δ^2e)	(V %)
BWT (kg)	1.13	6.03	17.6	93.97
WWT (kg)	5.91	6.96	79.0	93.04
ADG (g/d)	5.70	7.04	75.3	92.96

* d.f of sires and error components were 48 and 1120, respectively.

The present heritability estimates for BWT, WWT and ADG do not widely differ from average literature values. For example, Sakhare and Ingale (1984) found that h^2 for ADG from birth to 3 month was 0.20. Tawonezvi (1989) stated that heritability estimates for BWT and for pre-weaning daily live weight gain were 0.44 and 0.37, respectively. Veseth *et al* (1993) reported that the heritability estimates for BWT and WWT and preweaning ADG were 0.18, 0.17 and 0.20, respectively. De Mattos *et al.* (2000) working on Herefords in three countries found that heritability estimates for WWT were 0.24, 0.20 and 0.23 for USA, Canada, and Uruguay, respectively. Lengyel *et al.* (2001) reported that heritability estimates for WWT and preweaning ADG ranged between 0.10 to 0.20 .

The results given in Table 4 show also that the genetic, phenotypic and environmental correlation coefficients between BWT and WWT were weak and positive (0.147, 0.185 and 0.199, respectively), indicating that a calf's breeding value for birth weight tells us little about his breeding value for weaning weight. Hence, using information on BWT for a bull do not predict accurately the bull's breeding value for WWT. In contrast, the genetic, phenotypic and environmental correlation coefficients between ADG and WWT were strong and positive (0.907, 0.892 and 0.886, respectively), suggesting that calves with high breeding values for WWT are also likely to have high breeding values for ADG and vice versa. Selection for increased WWT will increase ADG. So that, making initial selections at weaning from among the top-performing male and heifer calves should be keeping for replacements, those calves with inherent rapid growth potential.

Table 4: Estimates of genetic parameters of BWT, WWT and ADG traits in Friesian calves*.

Trait	BWT	WWT	ADG
BWT	0.241 ± 0.077	0.185 (0.199)	-0.278 (-0.277)
WWT	0.147 ± 0.254	0.279 ± 0.082	0.892 (0.886)
ADG	-0.285 ± 0.268	0.907 ± 0.046	0.281 ± 0.082

*** Heritability estimates (± S.E) on the diagonal, genetic (± S.E) and phenotypic correlations below and above diagonal, respectively and environmental correlations between parentheses.**

The genetic, phenotypic and environmental correlation coefficients between BWT and ADG were moderate and negative (-0.285, -0.278 and -0.277, respectively). This means that the fastest gaining bull (during suckling period) is not necessarily the bull with the heaviest birth weight, as well as the two traits are genetically negatively correlated. In the same direction, continued selection for heavier BWT may lead to increased calving difficulty. It is known that calf birth weight is most highly related to calving difficulty (Williamson and Humes, 1985) . As calf birth weight increases, the percentage of cows requiring calving assistance also increases suggesting that selection for lower birth weights is attainable as a means to reduce calving difficulty. Similar resuts were obtained by Shibata and Kumazaki (1984) who found that genetic and phenotypic correlations of BWT with preweaning ADG and WWT were -0.19 to 0.40, while preweaning ADG showed high genetic and phenotypic correlations with WWT (0.95 and 0.98, respectively). DeNise *et al.* (1988) also reported negative genetic correlation (-0.49) between BWT and preweaning gain. Tawonezvi (1989) working on Mashona calves found that genetic correlations were relatively low for birth weight with weaning weight (0.42). He also added that higher genetic correlations were observed for pre-weaning gain with weaning weight (0.98). Lengyel *et al.* (2001) reported that the genetic, phenotypic and environmental correlations between WWT and preweaning ADG were strong and positive. These results in close agreement with those reported in the present study.

Estimated sire transmitting abilities (EAT's): The values of ETA's for BWT, WWT and ADG (estimated as deviations from the means) ranged from -0.856 to +2.24 kg for BWT, from -3.86 to +4.46 kg for WWT and from -36.4 to +42.3 g/d for ADG and ranged between 3.10, 8.32 kg and 60.7 g/d, for the previous traits, respectively (Table 5). These ranges represent 9.90, 8.58 and 9.73% from the adjusted herd averages of the three traits, respectively. Regarding percentage of number of sires that had positive BLUP estimates for BWT, WWT and ADG (Table 5), about 43.24 to 48.65% of the sires had positive values. The extensive use of the top sires that have positive BLUP estimates in artificial insemination will lead to genetic improvement in growth traits of this herd. It is preferable also that only bulls that have acceptable birth weight ETA's should be considered for use on first-calf heifers since birth weight is the most significant factor affecting dystocia.

Table 5: Minimum, maximum and ranges of estimated sire transmitting ability and percentage of sires with positive estimates for growth traits⁺.

Trait	Blup estimates			(%) of sires with
	Minimum	Maximum	Range	positive estimates
BWT (kg)	- 0.856	2.24	3.10	48.65
WWT (kg)	- 3.860	4.46	8.32	43.24
ADG (g/d)	- 36.4	42.3	60.7	43.24

+ (number of used sires = 37 with five offspring at least).

From the results given in Table 6, it could be noticed that there are large differences between the bottom and the top sires in ETA's values. These results reflect large genetic differences between sires for different traits studied. This shows that there is a high genetic potential for rapid genetic improvement in these traits through sire selection. Since, BWT has a negative relationship with growth rate, most sires that have below average BWT ETAs will have over average WWT ETAs (Table 6). therefore, there are sires available that are below average for birth weight and excel breed average for growth rate. Breeders should consider setting mimimum standards for birth weight ETA along with maximum standards for growth ETAs when selecting bulls and drawing breeding program.

Table 6: The most frequently used sires (40.5% of the total number) and their proofs of estimated sire transmitting abilities (ETA's) as deviation from the mean along with their rank on the basis of the best linear unbiased predictors (BLUP) for BWT, WWT and ADG traits.

Code of Sire	Number of calves per sire	Proof					
		BWT (kg)		WWT (kg)		ADG (g/d)	
		ETA	Rank	ETA	Rank	ETA	Rank
83	214	2.240	1	1.246	8	11.8	8
Barker	124	-0.578	31	2.330	5	22.0	5
1	71	-0.071	20	-1.652	33	-15.3	31
103	61	0.815	4	-0.196	19	-2.02	20
42	56	-0.287	23	0.650	14	5.62	15
586	53	-0.046	19	-0.186	18	-1.75	18
1124	49	-0.553	29	-0.926	26	-8.91	26
11	46	0.702	5	-0.243	20	-2.01	19
5	36	-0.735	35	2.340	4	22.5	4
1090	36	-0.409	27	0.691	13	6.80	12
473	31	0.062	13	-0.742	24	-7.32	24
4310	28	-0.819	36	0.620	15	6.63	14
1155	26	-0.370	25	0.751	12	6.76	13
767	24	-0.608	32	-1.166	30	-10.9	30
33211	23	0.046	15	1.027	9	9.60	9

The Spearman rank correlation coefficients among ETA's of sires for BWT, WWT and preweaning ADG are presented in Table 7. For growth traits, rank correlation coefficients between sire ETAs tended to be different among sires. Strong and positive Spearman rank correlation coefficient between ETA's of ADG and WWT (0.998) although some changes in rank did occur (Table 6). Meanwhile, the corresponding coefficients between BWT and ADG or WWT were low and negative (-0.170 and -0.170, respectively) (Table 7). The negative relationship between ETA's of sire for BWT and WWT or ADG was revealed indicating different nature of the two traits.

Table 7: Rank correlation coefficients among sire transmitting abilities (ETA's) for BWT, WWT and ADG traits.

Trait	ADG	WWT
BWT	-0.170	- 0.170
WWT	0.998	

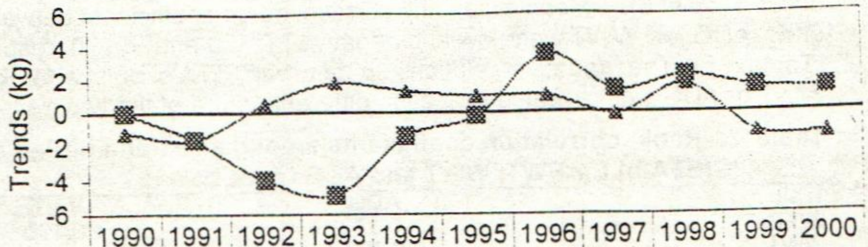
Genetic and phenotypic trends: The annual phenotypic and genetic trends in BWT were positive and significant being 0.149 and 0.503 kg/year, respectively. Generally the trends in birth weight have shown an increase. Meanwhile, the phenotypic trends in both WWT and ADG were negative and significant being -0.268 and -2.55 kg/year in the two traits, respectively. The genetic trends in the same two traits were negative also but not significant being -0.060 and -0.615 g/d/year, respectively (Table 8 and figure 1). Mean of ETA's by year of birth indicated that genetic trends were positive for BWT and negative for WWT and ADG. Negative genetic trend for WWT and preweaning ADG were reported in this herd despite the positive genetic trend for BWT suggesting that selection overcame the genetic antagonism between these traits. From figure 1 it could be noticed that the genetic trends in BWT were negative between the years from 1990 to 1995 and from 1995 onward the trend became positive with no specific trend for the phenotypic trends. The genetic and phenotypic trends in both WWT and ADG were nearly similar (Figure 1) this may be because the strong and positive relationship between them especially WWT considers one component of the ADG.

Table 8: Estimates of annual phenotypic and genetic trends ± (SE) in BWT, WWT and ADG traits.

Trends	Growth traits		
	BWT (kg/year)	WWT (kg/year)	ADG (g/d/year)
Phenotypic	0.149 ± 0.33***	-0.268 ± 0.069***	-2.55 ± 0.66***
Genetic	0.503 ± 0.20*	-0.060 ± 0.44 N.S	-0.615 ± 4.19 N.S

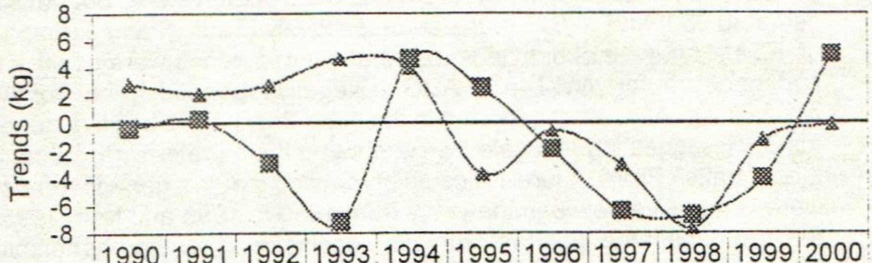
CONCLUSION

The present results on BWT, WWT and preweaning ADG indicate that: 1) variation due to definable environmental effects must be removed by use of suitable adjustment factors, 2) genetics parameters are available that will produce acceptable birth weight, while maintaining above average growth potential, 3) the economic importance must be given to growth traits in breeding programs to improve the growth performance of bull and heifer calves and 4) the conclusions can be drawn with more explanations when more data and additional traits (such as post-weaning growth and weights) are analyzed.



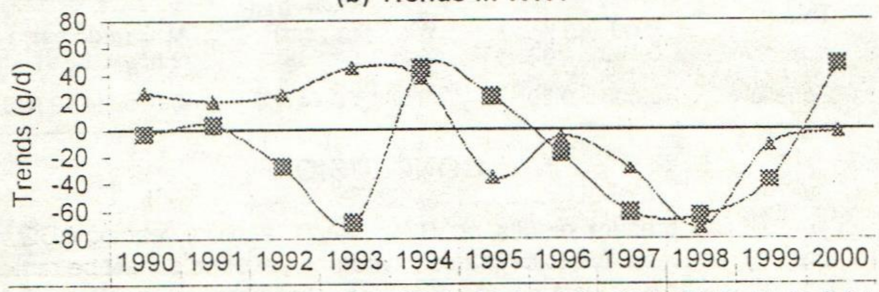
	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
P	-1.2	-1.6	0.5	1.8	1.3	1	1	-0.1	1.7	-1.2	-1.3
G	0.02	-1.59	-3.96	-4.88	-1.39	-0.18	3.51	1.38	2.24	1.52	1.4

(a) Trends in BWT



	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
P	2.86	2.13	2.74	4.69	3.96	-3.74	-0.57	-3.03	-7.68	-1.23	-0.14
G	-0.39	0.3	-2.95	-7.25	4.69	2.53	-1.9	-6.44	-6.74	-4.01	4.94

(b) Trends in WWT



	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
P	27	20.4	25.9	45.3	37.4	-35.8	-5.5	-28.4	-72.2	-11.9	-2.24
G	-3.75	2.93	-27.8	-68.6	44.4	24	-18.1	-61.2	-64.1	-38.1	46.8

(c) Trends in ADG

Figure 1: Means of annual phenotypic (P) and genetic (G) (ETAs values as deviation from the mean) trends for BWT (a), WWT (b) and preweaning ADG (c) during the period from 1990 to 2000.

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تقدير المعايير الوراثية وتقييم الطلائق والاتجاهات الوراثية لصفات النمو في مرحلة ما قبل الفطام في عجول الفريزيان في مصر

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استخدمت فى هذه الدراسة سجلات وزن الميلاد ووزن الفطام لعدد ١١٨٤ عجل فريزيان (٥٩٣ ذكور ، ٥٩١ إناث) ابناء لعدد ٤٩ طلوقة من ٤٨٩ أم خلال ١٩٩٠ إلى ٢٠٠٠ . بلغ متوسط عدد العجول لكل أب٣ر١٨ . استخدمت طريقة تحليل الحد الأدنى للمربعات بنموذج احصائى احتوى على تأثير الأب (كمتغير عشوائى) وتأثير كل من سنة الميلاد وموسم الميلاد وجنس العجل (كمتغيرات ثابتة). كما تم إضافة وزن الأم عند الولادة الى نموذج التحليل الاحصائى (كمعامل انحدار خطى) على كل من وزن الميلاد ووزن الفطام ومعدل النمو اليومى من الميلاد حتى الفطام (الأسبوع الخامس عشر من الميلاد). كما أضيف كل من وزن الميلاد وعمر العجل عند الفطام (مدة الرضاعة) الى نموذج التحليل الاحصائى (كمعامل انحدار خطى) عند تحليل كل من وزن الفطام ومعدل النمو اليومى. ويمكن تلخيص النتائج فيما يلى:

١. بلغت متوسطات الحد الأدنى للمربعات لكل من وزن الميلاد ووزن الفطام ومعدل النمو اليومى ٣ر٣١ ±٣٣ر٠ ، ٩٧ر٠ ± ٧٥ر٠ كجم ، ٦٢٤ ± ٧٢ر٠ جم / يوم على التوالى.

٢. كان لكل من الأب وسنة الميلاد وجنس العجل ووزن الأم عند الولادة ووزن الميلاد تأثيرات عالية المعنوية (على مستوى ٠٠١ر٠) على جميع الصفات المدروسة. كما أظهر موسم الميلاد تأثير عالى المعنوية (على مستوى ٠١ر٠) على وزن الميلاد فقط. بلغ معامل انحدار وزن الميلاد ووزن الفطام على وزن الأم عند الولادة ٠٢١ر٠ ، ١٨ر٠ كجم/كجم من وزن الأم عند الولادة على التوالى. كما بلغ معامل انحدار وزن الفطام ومعدل النمو اليومى على وزن الميلاد ٣٦ر٠ كجم ، – ١٦ر٦ جم /كجم من وزن الميلاد على التوالى . العجول المولودة فى فصل الربيع كانت الأثقل وزنا بينما تلك المولودة فى الخريف كانت الأقل وزنا عند الميلاد (٣٢ر٠ فى مقابل ٦ر٣٠ كجم).

٣. بلغت مكونات تباين الأب لكل من وزن الميلاد ووزن الفطام ومعدل النمو اليومى ٠٣ر٦ ، ٩٦ر٦ ، ٠٤ر٧ % من التباين الكلى على التوالى. كما بلغت قيم المكافئ الوراثى ٢٤١ر٠ ، ٢٧٩ر٠ ، ٢٨١ر٠ على التوالى. كانت جميع معاملات الارتباط الوراثى والمظهرى والبيئى بين الصفات المدروسة منخفضة وموجبة فيما عدا تلك الارتباطات بين وزن الفطام ومعدل النمو اليومى كانت عالية (٩٠٧ر٠ ، ٨٩٢ر٠ ، ٨٨٦ر٠ على التوالى) وبين وزن الميلاد ومعدل النمو اليومى كانت سالبة (– ٢٨٥ر٠ ، – ٢٧٨ر٠ ، – ٢٧٧ر٠ على التوالى).

٤. قدرت قيم المقدرة العبورية للطلائق كانحراف عن المتوسط العام للصفة بطريقة أفضل تقدير خطى غير متحيز للطلائق التى توفر لها خمسة عجول فأكثر (٣٧ طلوقة) وقد تراوحت قيم المقدرة العبورية ما بين – ٨٥٦ر٠ الى + ٢٤ر٢ كجم لصفة وزن الميلاد ، – ٨٦ر٣ الى + ٤٦ر٤ كجم لصفة وزن الفطام ، – ١ر٣٦ الى + ٣ر٤٢ جم/يوم لصفة معدل النمو اليومى. كما بلغت نسبة الطلائق التى تحمل قيم عبورية موجبة بالنسبة للعدد الكلى للطلائق ما بين ٢٤ر٤٣ الى ٦٥ر٤٨ % لجميع الصفات. كانت قيم معامل ارتباط الرتب لبيرسون بين قيم المقدرة العبورية للطلائق لصفات وزن الميلاد وكل من وزن الفطام ومعدل النمو اليومى منخفضة وسالبة (– ١٧ر٠ ، – ١٧ر٠ على التوالى) بينما كان نفس المعامل بين وزن الفطام ومعدل النمو اليومى عال وموجب (٩٨٨ر٠).

٥. مقدار متوسط التغير السنوى المظهرى والوراثى فى صفة وزن الميلاد موجب ومعنوى (١٤٨ر٠ ، ٥٠٣ر٠ كجم/عام على التوالى). كما كان متوسط التغير السنوى المظهرى لصفات وزن الفطام ومعدل النمو اليومى سالب ومعنوى (– ٢٦٨ر٠ كجم/عام ، – ٥٥ر٢ (جم/يوم)/عام على التوالى) فى حين أن مقدار متوسط التغير السنوى الوراثى لنفس الصفتين كان سالبا أيضا الا انه غير معنوى (– ٠٦٠ر٠ كجم/عام ، – ٦١٥ر٠ (جم/يوم)/عام على التوالى).

يستخلص من هذه الدراسة ما يلى:١) تعديل السجلات الفردية للعجول للتأثيرات البيئية المختلفة سوف يزيل جزء كبير من التباين الغير وراثى فى صفات النمو، ٢) يمكن باستخدام التحسين الوراثى الحصول على عجول ذات وزن مناسب عند الميلاد مع المحافظة على معدل نمو عال ٤) يجب وضع الأهمية الأقتصادية لصفات النمو فى برامج التربية وذلك لتحسين هذه الصفات فى العجول وكذلك عجلات التربية.