PHENOTYPIC AND GENETIC PARAMETERS FOR GROWTH TRAITS IN FRIESIAN CALVES IN EGYPT

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ABSTRACT

A total of 313 Friesian calves, (145 male and 168 females) born from 138 cows mating with 45 sires during 1994 and 1995, were used. Data were obtained from Sakha Experimental Farm, Ministry of Agriculture, Dokki, Cairo, Egypt. Heritability of birth weight (BW), weaning weight (WW) at 15th week of age, 180 day weight (180W) and 365 day weight (365W), repeatability and phenotypic and genetic correlations between different body weight were calculated. Moreover, influence factors of different traits studies (year and season of birth, sex, number of calving and the interaction between season of birth and sex) was analysed.

Least square means and standard errors for BW, WW, 180W, and 365W are 28.72 ± 0.09 kg, 118.27 ± 1.02 kg, 152.21 ± 2.50 kg and 222.96 ± 3.45 kg, respectively. Heritability estimates were 0.359 ± 0.193, 1.120 ± 0.250, 0.942 ± 0.241 and 1.620 ± 0.259 for BW, WW, 180W and 365W, respectively. Repeatability estimates were 0.10, 0.22, 0.24 and 0.41, for the same studied traits, respectively. All phenotypic and genetic correlations among studied traits are positive and significant ($P < 0.01$). The most important influence factor was the sire and the least important was sex. First born calves had lower body weight for all four traits studies. Winter and Spring born calves had the best results for all studied traits.

INTRODUCTION

Friesian cattle are the most imported dairy cattle in Egypt and they are potential dual purpose animals, also it contribute about 60% of red meat production (Oudah, 2001). To some extend the weight of the calf before weaning could be related to weight and sex of the mother. The correlations between the phenotypic expressions of weight influence in the different offspring of the same cow are due partially at least to the similarity of the genotypes and to the material environment (Molina et al. 1999). In addition, birth weight and weaning weight are affected by several genetic and nongentic factors (i.e., year and season of birth, sex and dam's parity).

In improving programs of dairy and beef cattle, the repeatability (t) of the variables related to weight may be useful from different points of view. It indicates the increase in precision that can be obtained by repeated observations, this permits prediction of the future cow performance and reflects the cow's capacity at different ages and it improves the effectiveness of selection.

The objectives of this study are to estimate phenotypic and genetic parameters for birth weight, weaning weight, body weight at 180 day and body weight at 365 day for Friesian calves raised at Sakha Farm in Egypt.

MATERIAL AND METHODS

Data used in the present study were obtained from Sakha Experimental Farm located in the Northern part of the Delta and belonging to Animal Production Research Institute, Dokki, Cairo, Egypt. A total number of calves were 313 (145 males and 168 females) born from 45 sires during two years (1994 and 1995).

Calves were suckled colostrums from their dams for the first three days after calving, then they were given natural milk by bucket and free fodder calf starter till the end of weaning period at fifteen week of age. An amount of 437.6 kg of natural milk was available for each calf during the suckling period. Beside milk, green fodders were 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 Alexndrinum) and green maize or elephant grass were offered in Summer. The concentrates (calf meal) were offered to calved from the beginning of the third or fourth week of age according to their age and 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 variables analysed are birth weight, weaning weight (15^{th} week of age), 180 day weight and 365 day weight. The following linear mixed model are used:

$$Y_{ijklmn} = U + S_i + Y_j + M_k + Se_l + P_m + (M_k * Se_l) + e_{ijklmn}$$

Where

Y_{ijklmn}	= the observations
U	= overall mean
S_i	= the random effect of the i^{th} sire
Y_j	= fixed effect of year of birth
M_k	= fixed effect of month of birth
Se_l	= fixed effect of sex
P_m	= fixed effect of dam's parity

$(M_k * Se_l)$ = the interaction between season of birth and sex
e_{ijklmn} = residual.

The model used for the analysis included the fixed effects of year and season of birth, sex, dam's parity and the interaction between season of birth and sex, in addition, the random effect of sire. Estimates of sire and reminder components of variance and covariance, phenotypic and genetic correlations are calculated according to Harvey (1987). The repeatability values were obtained by the classic procedure of interclass correlations (Harvey 1987).

RESULTS AND DISCUSSIONS

Least squares means and their standard errors (S.E.) for different traits are presented in Table 1. Least square means of birth weight (BW), weaning weight (WW), weight at 180 day (180W) and body weight (365W) are 28.72 ± 0.09, 118.27 ± 1.02, 152.21 ± 2.5 and 222.96 ± 3.45 Kg, respectively. The present mean of birth weight is within the range (25.9 to 37.3 kg) which reported by Alim and Taher (1979), Emam (2000) and Oudah (2001) working on Friesian cattle in Egypt. While the present weaning weight is higher than those reported by Alim and Taher (1979)(96.9 kg), Afifi et al. (1975)(93.0 kg) and Oudah (2001)(96.6 kg). Also the present means of 180W and 365W are higher than those (113.90 and 124.6 kg) reported by Bagci et al. (1999) working on Friesian cattle in Turkey. The differences between our results and other results could be due to differences in the genotype, management, number of animals, year of study and/or methods of analysis.

Table 1. Least squares means and standard errors (S.E.) for factors affecting birth weight (BW), weaning weight (WW), weight at 180 days (180W) and weight at 365 days (365W) for Friesian calves.

Traits	Least squares means	Standard errors (S.E.)
Birth weight (BW), kg	28.72	± 0.09
Weaning weight (WW), kg	118.27	± 1.02
Body weight at 180 days, kg	152.21	± 2.50
Body weight at 365 days, kg	222.96	± 3.45

a- Random Effect

Sire of the calf had a significant effect ($P < 0.01$, Table 2) on different traits studies. Similarly, Afifi and Soliman (1971), Khalifa and Khalafallah (1979), Maarof et al. (1988), Bogdanovic et al. (2001) and

Oudah (2001). Bogdanovic et al. (2001) working on Simmental cattle found that sire had a significant effect on growth traits and sire components accounted about 7.18, 10.10 and 15.92 % of the total variance in birth weight, average daily gain and relative daily gain, respectively. The present results indicate that the possibility of genetic improvement in live body weight of calves through sire selection.

Table 2. Least squares analysis of variance for factors affecting birth weight (BW), weaning weight (WW), 180 day body weight (180W) and 365 day body weight (365W) for Friesian cattle.

Source of variation	D.f.	BW M.S.	WW M.S.	180W M.S.	365W M.S.
Between sires	44	11.12**	469.39**	688.29**	1596.39**
Between year of birth	1	0.85	843.16*	615.32	289.18*
Between season of birth	3	34.71**	315.94*	497.77	264.39
Between dam's parity	4	17.42*	89.24	141.46	581.11
Between sex	1	0.09*	0.44	397.91	511.14
Sex X Season of birth	3	1.81	12.26	383.06	241.16**
Reminder	256	7.08	144.72	287.85	324.22

** $P < 0.01$ * $P < 0.05$

b- Fixed effects

Year of birth had a significant effect ($P < 0.05$) on weaning weight and yearly weight ($P < 0.05$, Table2). Willis and Wilson (1974), Khalifa and Khalafallah (1979), Kabuga and Agyemang (1984), Emam (2000), Lengyel et al. (2001) and Oudah (2001) arrived to the same results in different breeds in dairy cattle. The differences in weaning weight and yearly weight may be due to differences in management and agro climatic conditions.

Season of birth had a significant effect on birth and weaning weight ($P < 0.01$, Table 2). Similarly, observations by Afifi and Soliman (1971), Khalifa and Khalafallah (1979), Badran and El-Barbary (1986) Emam (2000), Lengyel et al. (2001) and Oudah (2001) working on different breeds of dairy cattle in different countries. The present results (Table 2) indicated that, Winter and Spring calves had higher body weight at birth and weaning than those born on Summer and Autumn. This could be attributed to the favourable climatic conditions for abundant growth and availability of good quality feed (Egyptian clover Berseem) during Winter and Spring calves. Oudah (2001) working on 1184 males and female Friesian calves in Egypt, arrived at the same conclusion, also he added that the attributed seasonal fluctuations in birth weight 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. In addition, Lengyel et al. (2001) working on Simmental beef calves (695 males and 698 female) found that spring calves born had the best result in birth weight.

Table 2 show nonsignificant effect of sex on different studied traits. On the other hand, significant effect of sex on body weight at different ages were reported by Afifi and Soliman (1971), Khalifa and Khalafallah (1979), Emam (2000), Lengyel et al. (2001) and Oudah (2001).

Dam's parity had a significant effect on birth weight ($P < 0.01$, Table 2). The present results indicated that the first calves produced calves that were significant lighter at birth than calves produced in subsequent pregnancies, this is logically due to increase in body weight of dam combined with advancing age at calving. Similarly, Khalifa and Khalafallah (1979) and Lengyel et al. (2001) came to the same results.

c- Genetic Parameters

Fstimates of heritability, phenotypic and genetic correlations and repeatability are presented in Table 3. Heritability estimates for birth weight (0.359 ± 0.193) is in agreement with other estimates reported for Friesian cattle in Egypt (Afifi and Soliman 1971 (0.20), Badran and El-Barbary 1986 (0.54), Maarof et al. 1988 (0.44) and Oudah 2001 (0.24). According to the moderate of heritability of birth weight, it could be concluded the possibility of genetic improvement for birth weight according to selection. Khalifa and Khalafallah (1979) working on Kenana cattle came to the same conclusion. Heritability estimates for WW, 180W and 365W are 1.120 ± 0.250, 0.942 ± 0.241 and 1.620 ± 0.259, respectively. The higher estimates of heritability may be due to limited number of records. In addition, the present mean of weaning weight is higher than the estimates reported by Afifi and Soliman (1971) (0.53), Maarof et al. (1988) (0.430), Oudah (2001) (0.27) and Lengyel et al. (2001) (0.10).

Table 3. Heritability estimates (on diagonal), genetic correlation (below diagonal), phenotypic correlation (above diagonal) and repeatability.

Traits	BW	WW	180W	365W	Repeatability
BW	0.359 ± 0.193	0.10	0.20	0.40	0.10
WW	0.274 ± 0.303	1.120 ± 0.250	0.75	0.63	0.22
180W	0.440 ± 0.319	0.850 ± 0.075	0.942 ± 0.241	0.75	0.24
365W	0.234 ± 0.279	0.650 ± 0.120	0.913 ± 0.054	1.620 ± 0.259	0.41

Repeatability estimates for BW, WW, 180W and 365W are 0.10, 0.22, 0.24 and 0.41, respectively. The present estimates are lower than

heritability estimates of these traits, indicated that the genotype of the calf is more important than maternal influence in determining body weight. Molina et al. (1999) working on Retinto beef cattle, found that repeatability estimates for birth weight ranged from 0.093 ± 0.23 to 0.296 ± 0.199, for weaning weight ranged from 0.335 ± 0.026 to 0.458 ± 0.095 and for 180 day weight ranged from 0.420 ± 0.028 to 0.598 ± 0.050. The relatively higher repeatability estimates for WW, 180W and 365W indicated that selection for weights at early weights at early age is a good indication for weights at later ages. Molina et al. (1999) concluded that the moderate repeatability estimates for body weight at birth, 90 day weight, 180 day weight, indicate that the selection on the basis of the first records may be effective in improving the overall performance of the herd in the next year. Also the same authors concluded that it is necessary to correct the different variables for the different environmental effects before calculating the repeatability.

Estimates of phenotypic and genetic correlations between different traits studies are positive and highly significant (Table 3). The present results are in agreement with the results obtained by Emam (2000), Lengyel et al. (2001) and Oudah (2001). The present results suggested that selection for higher birth weight would cause a correlated increase in weaning weight, body weight at 6 months and yearlying weight. Finally, adjusting the individual records of cows for the environmental effects will remove large portions of the nongenetic variations in growth performance. Also, the high genetic differences among sires, for the different traits studied indicate the high genetic potential for rapid genetic improvement in body weight. Also, the economic importance must be given to these traits in breeding programs, taken into consideration more priority for milk production of the dam.

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الملخص العربي

المعايير المظهرية والوراثية للنمو في بعض عجول الفريزيان في مصر

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أجريت الدراسة في محطة بحوث الإنتاج الحيواني بسخا- التابعة لوزارة الزراعة- الدقي.
شملت الدراسة على ٣١٣ عجول وعجلات فريزيان (منهم ١٤٥ ذكور , ١٦٨ إناث) والتي تمثل نتاج ١٣٨ بقرة ملقحة من ٤٥ طلوقة- خلال الفترة من عام ١٩٩٤ حتى عام ١٩٩٥.
تم تقدير المكافئ الوراثي للوزن عند كل من الميلاد- الفطام عند عمر ١٥ أسبوع- والوزن عند ١٨٠ يوم- والوزن عند ٣٦٥ يوم كما تم دراسة الارتباط الوراثي والمظهري بين الأوزان المختلفة- وكذلك دراسة تأثير بعض العوامل البيئية مثل سنة وموسم الولادة والجنس وعدد الولادات- والعلاقة بين موسم الولادة وجنس المولود على الأوزان المختلفة. وقد حللت البيانات المتحصل عليها طبقا لبرنامج هارفي ١٩٨٧. والنتائج المتحصل عليها تتلخص في الآتي:
أوضحت طريقة تحليل التباين بطريقة الحد الأدنى للمربعات أن الوزن عند الميلاد- ووزن الفطام عند ١٥ أسبوع- والوزن عند ١٨٠ يوم والوزن عند ٣٦٥ يوم هو: ٢٨,٧٢ ± ٠,٠٩ كجم , ١١٨,٢٧ ± ١,٠٢كجم , ١٥٢,٢١ ± ٢,٥٠ كجم , ٢٢٢,٩٦ ± ٣,٤٥ كجم على التوالي. وأن قيم المكافئ الوراثي ٠,٣٥٩ ± ٠,١٩٣ ، ١,١٢٠ ± ٠,٢٥٠ , ٠,٩٤٥ ± ٠,٢٤١ , ١,٦٢٠ ± ٠,٢٥٩ , للوزن عند الميلاد- ووزن الفطام عند ١٥ أسبوع- والوزن عند عمر ١٨٠ يوم- والوزن عند ٣٦٥ يوم على التوالي.
وكانت تقديرات المعامل التكراري ٠,١٠ , ٠,٢٢ , ٠,٢٤ , ٠,٤١ لنفس الصفات المدروسة على التوالي.
أوضحت الدراسة أن معامل الإرتباط الوراثي والمظهري للصفات المدروسة أنها موجبة وعالية المعنوية- وظهر أن أهم العوامل المؤثرة كانت للذكور وأقل تأثير كان للجنس- والعجول التي ولدت من أول موسم ولادة كانت منخفضة الوزن بالنسبة لكل الأوزان المدروسة- في حين أن العجول المولودة في الشتاء و الربيع كانت أفضلها في جميع الأوزان المدروسة.