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VARIANCE COMPONENTS DUE TO DIRECT AND MATERNAL EFFECTS AND ESTIMATION OF BREEDING VALUES FOR SOME GROWTH TRAITS OF EGYPTIAN BUFFALO CALVES

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ABSTRACT

Data on growth traits from birth to weaning on 5405 Egyptian buffalo calves (2730 males and 2675 females) progeny of 1565 dams mating by 281 sires during the period from 1971 to 2001 at Mahallet Mousa farm was used in this study. Restricted Maximum Likelihood analysis method was used with animal model to estimate covariance components for birth weight (BW), weaning weight (WW) and daily gain (DG) from birth to weaning. Model included month and year of birth, birth sequence and sex of calf as fixed effects. Random effects were animal, direct and maternal genetic effect, maternal permanent environmental effect and residual effect. Weight of dam at calving was included in the model as covariate.

Overall means and standard errors for BW, WW and DG were 33.4±6.4 kg, 86.7±11.2 kg and 503±107 g/day, respectively. Direct heritability (h^2_d) for BW, WW and DG were 0.35±0.03, 0.39±0.04 and 0.31±0.09, respectively. Corresponding maternal heritability (h^2_m) were 0.19±0.01, 0.16±0.01 and 0.22±0.02, respectively. Total heritabilities (h^2_t) of the mentioned traits were 0.37, 0.38 and 0.38, respectively. Estimates of maternal permanent environmental variance as a proportion of phenotypic variance were 0.07, 0.04 and 0.21 for BW, WW and DG, respectively. Antagonism was observed between additive direct and maternal genetic effects and it were negative in all traits investigated, ranging from -0.65 to -0.08. Genetic and phenotypic correlations between BW and DG were small and negative, -0.19 and -0.34, respectively, while genetic and phenotypic correlations between WW and DG were high and positive, 0.82 and 0.91, respectively.

Predicted breeding values (EBV's) of sires ranged from -2.3 to 2.6 kg for BW, -6.4 to 15.5 kg for WW and -79.9 to 116 g for DG. The (EBV's) for cows ranged from -4.8 to 3.4 kg, -15.8 to 9.7 kg and -131.7 to 99.4 g for the same traits, respectively. Similarly, predicted breeding values (EBV's) for dams ranged from -2.9 to 2.1 kg, -10.6 to 15.5 kg and -111.4 to 118 g, respectively for the above mentioned traits. Correlation coefficients between all traits studied were significant (P<0.05 or P<0.01), except correlation between BW and WW for sire breeding values were not significant. The correlations trends of predicted breeding values were in the same direction with those reported for genetic correlations of the same traits. The present results suggested that inclusion maternal genetic effect and permanent environmental will provide a better chance for genetic improvement and higher accuracy of predicted breeding values than model without these components

Keywords: Growth traits, Egyptian buffalo calves, maternal effect, direct effect, direct heritability, maternal heritability, total heritability and direct-maternal genetic correlations.

INTRODUCTION

It is well known fact that the buffaloes produce about 60% of the total milk output and about 32% red meat produced from about 3.5 million heads of buffaloes in Egypt. This situation is mainly due to selling most of suckling buffalo males for slaughter (as veal meat) at 40 to 60 days of age. The birth weight, weaning weight and growth rate as growth performance traits are affected by genetic and environmental factors, in addition to maternal effect. However, very few researches on maternal effects in buffaloes 'were published in Egypt.

Nevertheless, during the suckling period, the growth in most mammals are measured in the offspring which in fact due to its dam and the environment. The trait measured is generally the phenotypic value of the offspring and consists of at least two components, i.e., offspring growth and a maternal effect contributed by the dam. The maternal effect is strictly environmental relative to the offspring, but phenotypic differences for the maternal effect among dams are expressed in the phenotypic values of the offspring (Willham, 1972). According to Robison (1981), the importance of maternal influence on the growth of young mammals has been recognized. Since, the earliest attempts were to improve livestock production. Cundiff (1972) indicated that maternal effects are more important than direct gene effects during the early postnatal growth of young suckling their mothers. Later in life, however the maternal influence diminishes and direct effects of the genes that influence growth assume primary importance.

Maternal effect is expressed through the environment that a dam avails to her progeny, pre- and post-natally. There are also the genes that are passed onto the dam's progeny affecting the environment that the female progeny provide for their offspring. Weaning and pre-weaning weights partially express the calf rearing ability of a cow beside the calf own genotype.

The presence of maternal effects in the models used to genetic evaluation reduces the variance of direct genetic effects (Meyer, 1992). Part of this reduction is explained by maternal genetic and maternal permanent environmental variances. Since antagonism has been observed between direct and maternal effects, knowledge of the maternal influence on pre- and post-weaning weights, and of the correlation between these effects, is fundamental for achieving unbiased heritability estimates.

The aim of this study was to evaluate the importance of including maternal effects in multiple trait analyses of the variance component estimates and estimate breeding values for birth weight, weaning weight and daily gain from birth to weaning of Egyptian buffalo calves.

MATERIALS AND METHODS

Source of animals and data

The data used in this study was collected from the herd of Egyptian buffaloes raised at Mahallet Mousa Experimental Station of the Animal Production Research Institute, Ministry of Agriculture, Egypt. A total of 5405 Egyptian buffalo calves (2730 males and 2675 females) over the period from 1971 to 2001 born from 3094 buffalo cows mating by 281 sires were used in this analysis.

After birth, all calves were left with their dams to suckle colostrum for the first three days of their life. Then, they were removed from their dams and housed individually in calf pens bedded with rice straw till weaning (at sixteen weeks of age). During this period calves were artificially reared on natural milk provided in pails according to their weight. At the third week of their age and up to the16th weeks, concentrate ration (calf starter meal) and berseem (*Trifolium alexandrinum*) hay were offered to calves according to Animal Production Research Institute (APRI) requirements system. The contents of the calf meal were 48% yellow maize, 17% seed cotton cake, 10% wheat bran, 10% rice polishing residue, 10% linseed meal, 2% molasses, 1% limestone, 1% bone meal and 1% salt (sodium chloride). After reaching sixteen weeks of age, the calves were loosely housed in open sheds where they can normally fed, drink and exercise. Traits studied were birth weight (BW), weaning weight (WW) and daily gain (DG) from birth to weaning of Egyptian buffalo calves. Birth weights of calves were taken within 24 hours from birth, weaning weight at 16 weeks of age and daily gain from birth to weaning calculated as the weight at weaning minus weight at birth divided by the number of days between them.

Statistical Analysis

Adjusted weights were obtained from a least squares analysis (Harvey, 1990), which included month and year of birth, parity (birth sequence) and sex of calf. The model included weight of dam as covariate. Fixed factors (main effects) and covariates were tested and removed from the model if found nonsignificant ($P>0.01$). All fixed effects and linear effects of weight of dams had significant ($P<0.01$) effect on all traits studied. Additionally, least squares analysis cleared that the BW, WW and DG were increase with weight increased. Male calves had highly significant weight at birth, at weaning and daily gain (34.6 kg, 87.7 kg and 505.8 g, respectively) compared with female calves (32.2 kg, 85,7 kg and 500.5 g, respectively) (Table 1).

Animal models were used for final analyses for all data. The multiple-trait derivative-free restricted maximum likelihood (MTDFREML) suite of programs (Boldman *et al.* 1995) was used for univariate and bivariate analyses for all traits. Effects of year and month of birth, parity (birth sequence) and sex of calf were assumed to be fixed. Body weight of cow at calving was included in the model as covariate and effects of animal, direct and maternal genetic effects, maternal permanent environmental effect and random residual effect considered to be random. In multiple traits (three traits) full general animal model used was:

$$\mathbf{Y = X\beta + Za + Mm + Wp_e + e}$$

Where:

Y = observations vector of records, $\boldsymbol{\beta}$ = the vector of fixed effects (level of **month of birth** (=1, 2,..and 12), **year of birth** (=1971, 1972, ...and 2001), **sex** (=1 and 2), and **parity** (birth sequence) (=1, 2,...and 5), a = the vector of direct genetic effects, **m** = the vector of maternal genetic effects, $\mathbf{p_e}$ = the vector of environmental effects contributed by dams to records of their progeny (permanent environmental), and **e** = the vector of residual effects. **X**, **Z**, **M** and **W** are incidence matrices relating records to fixed, direct genetic, maternal genetic and permanent environmental effects, respectively.

Table (1): Distribution of the data by main fixed effects classes affecting birth weight (BW), weaning weight (WW) and daily gain (DG) of Egyptian buffalo calves.

Variable	No.	Traits		
		BW, kg	WW, kg	DG, g
		Mean ± SE	Mean ± SE	Mean ± SE
Overall mean	5405	33.42 ± 6.43	86.69 ± 11.24	503.16 ± 107.85
Month of birth				
1	487	34.05 ± 0.569	86.78 ± 3.24	504.54 ± 16.07
2	440	34.54 ± 0.576	87.35 ± 3.27	511.59 ± 16.32
3	437	34.15 ± 0.579	85.99 ± 3.29	505.18 ± 16.42
4	386	33.40 ± 0.587	83.61 ± 3.34	493.15 ± 16.81
5	460	33.22 ± 0.576	83.25 ± 3.48	482.91 ± 16.36
6	288	33.48 ± 0.608	85.86 ± 3.56	497.83 ± 17.67
7	264	32.69 ± 0.622	88.98 ± 3.20	494.46 ± 17.98
8	414	33.67 ± 0.581	88.89 ± 3.29	519.01 ± 16.41
9	618	33.28 ± 0.561	87.49 ± 3.20	515.62 ± 15.80
10	578	33.43 ± 0.561	86.38 ± 3.10	492.14 ± 15.78
11	570	32.41 ± 0.561	85.75 ± 3.28	491.87 ± 15.64
12	463	32.82 ± 0.573	88.91 ± 3.25	527.60 ± 16.17
Year of birth				
1971	31	31.07 ± 0.889	87.63 ± 7.14	500.44 ± 41.90
1972	39	32.87 ± 0.930	90.27 ± 6.75	500.68 ± 39.49
1973	39	33.18 ± 0.771	84.76 ± 6.54	489.95 ± 38.13
1974	82	35.61 ± 0.971	88.62 ± 5.47	500.66 ± 31.30
1975	102	34.49 ± 0.905	86.50 ± 5.11	500.07 ± 28.96
1976	158	34.80 ± 0.834	89.32 ± 4.73	500.50 ± 26.44
1977	163	34.73 ± 0.804	87.20 ± 4.57	500.60 ± 25.36
1978	187	32.82 ± 0.767	84.53 ± 4.37	500.15 ± 24.02
1979	248	33.57 ± 0.742	85.79 ± 4.15	500.29 ± 22.50
1980	300	33.96 ± 0.724	79.13 ± 3.92	452.43 ± 20.96
1981	222	32.27 ± 0.682	83.14 ± 3.76	512.38 ± 21.24
1982	283	32.45 ± 0.691	76.55 ± 3.78	461.13 ± 19.96
1983	292	34.09 ± 0.656	78.72 ± 3.67	458.27 ± 19.18
1984	335	33.53 ± 0.756	79.16 ± 3.61	467.99 ± 18.79
1985	243	33.33 ± 0.638	79.97 ± 3.72	476.19 ± 19.56
1986	185	34.97 ± 0.631	82.05 ± 3.79	502.55 ± 20.04
1987	56	34.59 ± 0.789	78.64 ± 5.10	522.45 ± 28.87
1988	79	33.90 ± 0.653	76.29 ± 4.65	541.19 ± 25.93
1989	90	32.89 ± 0.664	80.63 ± 4.56	500.89 ± 25.26
1990	100	33.16 ± 0.543	83.34 ± 4.46	500.21 ± 24.63
1991	119	33.21 ± 0.873	85.05 ± 4.45	459.45 ± 24.55
1992	108	32.09 ± 0.745	86.94 ± 4.56	538.01 ± 25.33
1993	136	32.24 ± 0.987	90.03 ± 4.42	486.85 ± 24.38
1994	229	32.39 ± 0.544	84.86 ± 4.27	400.89 ± 25.34
1995	176	32.16 ± 0.771	98.04 ± 4.49	518.02 ± 24.84
1996	138	32.99 ± 0.763	94.71 ± 4.70	523.77 ± 23.22
1997	202	32.69 ± 0.881	91.45 ± 4.64	513.09 ± 24.82
1998	245	33.97 ± 0.670	92.05 ± 4.89	544.07 ± 26.51
1999	250	32.79 ± 0.899	95.73 ± 5.02	561.11 ± 25.31
2000	280	33.54 ± 0.916	101.54 ± 5.18	539.76 ± 27.37
2001	288	35.82 ± 0.937	106.63 ± 5.39	594.66 ± 28.75
Parity				
1	1491	29.98 ± 0.613	85.30 ± 3.42	495.48 ± 15.23
2	1340	33.51 ± 0.558	86.50 ± 3.14	498.39 ± 16.63
3	951	35.25 ± 0.539	87.03 ± 3.06	502.75 ± 20.19
4	893	36.46 ± 0.549	89.45 ± 3.12	523.50 ± 23.28
5	730	36.97 ± 0.577	85.15 ± 3.29	496.29 ± 25.44
Sex of calf				
1 (male)	2730	34.61 ± 0.526	87.70 ± 3.01	505.83 ± 32.01
2 (female)	2675	32.23 ± 0.817	85.68 ± 3.02	500.49 ± 26.37
Regression				
DW, (L)	5405	**0.00520 ± 0.00052**	**0.00558 ± 0.00284**	**0.01973 ± 0.01726**
(Q)	5405	**0.00002 ± 0.00001**	**-0.00001 ± 0.00002**	**-0.00017 ± 0.00009**

The following variance and covariance components for the model were estimated:

σ^2_d is the additive direct genetic variance, σ^2_m is the maternal genetic variance, σ_{dm} is the additive direct and maternal genetic covariance, σ^2_{pe} is the maternal permanent environmental variance.

Estimates of additive direct (h^2_d) and maternal (h^2_m) heritabilities were calculated as ratios of estimates of additive direct (σ^2_d) and maternal genetic (σ^2_m) variances, respectively to the phenotypic variance (σ^2_p). Total heritability $h^2_t = [(\sigma^2_d + 0.5\sigma^2_m + 1.5\sigma_{dm})/\ \sigma^2_p]$ (Willham, 1972). The direct maternal correlation (r_{am}) was computed as the ratio of the estimates of direct-maternal covariances (σ_{dm}) to the product of the square roots of estimates of σ^2_d and σ^2_m. σ^2_{pe} is the ratio of estimates of maternal environmental variance (σ^2_{pe}) to the total phenotypic variance (σ^2_p).

Estimation of covariance components was carried out by restricted maximum likelihood employing a simplex algorithm to search for variance components to minimize **-2log** likelihood (**L**) (Boldman *et al.* 1995). Convergence was assumed when the variance of the function values (**-2logL**) of the simplex was less than 10^{-9}. After the convergence, a restart was performed to verify that it was not a local minimum. Restarts were performed for all analyses, using the final results of the previous analysis, in order to locate the global maximum for the log likelihoods. Starting values for variance components for multi-trait analyses were obtained from single-trait and two-traits analyses.

Best linear unbiased prediction (BLUP) of estimated breeding values (EBV's) were calculated by back-solution using the MTDFREML program for all animals in the pedigree file for multi-traits analysis

RESULTS AND DISCUSSION

(Co)variances and parameters

Estimates of covariances components and heritabilities are given in Tables (2 and 3). The estimate of direct heritability for BW was 0.35 while the maternal heritability was 0.19 indicating improve in birth weight can be obtained through selection. The present 19% relatively higher maternal component (which explains 19% of total variation) indicates that this effect should be kept in the model of analysis, even for BW in such Egyptian buffalo calves population. The same trend was observed also in each WW and DG traits (Table 2). Comparable recent estimates on Zebu cross cattle in tropical environment were, 0.61 and 0.20 for direct heritability of BW and WW, respectively, with the corresponding, values of 0.11 and 0.32 for maternal heritability for the same traits, respectively (Mackinnon *et al.* 1991). Cassiano *et al.* (2004), working on buffaloes in Brazilian Amazon, reported that the Murrah breed showed the highest heritability for BW (0.62) compared with 0.38 in Jafarabadi breed. They concluded that permanent environmental effects on the BW were low (0.00 to 0.16) in all breeds studied. In addition, maternal effects for BW were low to medium (0.11, 0.17, 0.37 and 0.04) for Carabao, Jafarabadi, Mediterranean and Murrah breeds, respectively.

Table (2): Estimates of (co)variance components and parameters for birth and weaning weight and daily gain from birth to weaning in Egyptian buffalo calves.

Item	Traits		
	BW, kg	WW, kg	DG, g
Direct additive genetic variance and covariances (σ^2_d and σ_{didj})			
BW	26.9039		
WW	18.0528	71.7495	
DG	-10.4266	73.7769	112.0326'
Maternal additive genetic variance and covariances (σ^2_m and σ_{mimj})			
BW	14.6573		
WW	10.689	29.4746	
DG	-1.7533	10.8165	79.9119
Permanent environmental variance ($\sigma^2 p_e$)			
BW	5.4308		
WW	-2.4815	6.6106	
DG	18.9690	-2.9010	74.2622
Residual variance (σ^2_e)			
BW	29.5498		
WW	22.1935	75.7275	
DG	-11.4729	56.0599	94.2650
Phenotypic variance (σ^2_p)			
BW	76.5345		
WW	66.5706	183.5624	
DG	-55.5773	233.9826	360.4714
Heritabilities			
h^2_d	0.35 ± 0.03	0.39 ± 0.04	0.31 ± 0.09
h^2_m	0.19 ± 0.01	0.16 ± 0.01	0.22 ± 0.02
h^2_t	0.37	0.38	0.38
Proportion of c^2 and e^2			
c^2	0.07	0.04	0.21
e^2	0.39	0.41	0.26

σ^2_d = direct additive genetic variance, σ^2_m = maternal genetic variance, σ_{didj} = additive genetic covariance between any two traits studied, σ^2_{pe} = maternal permanent environmental variance, σ^2_e = residual (temporary environmental variance), σ^2_p = phenotypic variance, h^2_d = direct heritability and h^2_m = maternal heritability, h^2_t = total heritability $[(\sigma^2_d + 0.5\sigma^2_m + 1.5\sigma_{dm})/\ \sigma^2_p]$, c^2 = fraction of phenotypic variance due to maternal permanent environmental effects and e^2 = fraction of phenotypic variance due to residual effects.

Table (3): Covariances between direct additive and maternal additive genetic effects (σ_{dm}) for birth weight (BW), weaning weight (WW) and daily gain (DG) from birth to weaning in Egyptian buffalo calves.

Maternal additive	Direct additive		
	BW_d	WW_d	DG_d
BW_m	-4.15308	-17.1707	-20.4553
WW_m	-15.1956	-10.5574	-12.7753
DG_m	-22.3352	-6.6640	-10.3481

Weights from birth to weaning, at which almost time all weights of calves depend on its dam, could be a good indicator trait of milking and maternal ability of the cow. The same trend of present estimates of maternal effects (ranging from 0.16 to 0.22) suggests that maternal effects could be conside: in the model of analysis and selection represent criterion for growth traits from birth to weaning in Egyptian buffalo calves.

El-Awady (2004), analyzed 1713 records of Friesian calves by using different animal models, found that the direct heritability were 0.32, 0.34 and 0.37 for BW, WW and DG, respectively and the maternal heritability were 0.17, 0.14 and 0.09, respectively for the same traits. He concluded that inclusion of both types of maternal effects (genetic and permanent environmental) provide a better chance for genetic improvement and higher accuracy of the index for growth traits from birth to weaning than using models with animal or permanent environmental or maternal effect only. In the same direction, Tosh *et al.* (1999) working on a multibreed population of beef cattle, found that the direct heritability values of 0.51 and 0.33 for birth weight and weaning weight was larger than maternal heritabilities of 0.09 and 0.13 for birth and weaning weights, respectively.

Total heritability values for BW, WW and DG, were 0.37, 0.38 and 0.38, respectively (Table 2) which are in close agreement with those obtained by Plasse *et al.* (2002) on Brahman cattle, being 0.36 for BW and higher than 0.16 for WW in the same breed. In addition, Mercadante and Lôbo (1997) calculated mean of 0.26, 0.16 and 0.22 for direct, maternal and total heritability of WW, respectively.

Correlations

Table (4) displays estimated correlations between direct genetic effects, between maternal genetic effects and between direct maternal genetic effects between different traits studied.

Direct genetic correlation between BW and WW was slightly less than the expected (0.41), but not outside the review of Mohuiddin (1993), Crews and Kamp (1999) and El-Awady, (2003). However, between BW and DG was small and negative (-0.19). While the direct correlation between WW and DG was positive and high (0.82). Likewise, phenotypic correlations between the same traits followed the same trend.

Table (4): Estimates of direct and maternal genetic correlations (r_d and r_m) and direct-maternal (r_{am}) genetic correlations between different traits investigated.

Item	BW_d	WW_d	DG_d	BW_m	WW_m
WW_d	0.41 ± 0.01				
DG_d	-0.19 ± 0.00	0.82 ± 0.00			
BW_m	-0.21 ± 0.04	-0.53 ± 0.00	-0.65 ± 0.00		
WW_m	-0.54 ± 0.08	-0.23 ± 0.04	-0.22 ± 0.01	0.51 ± 0.00	
DG_m	-0.48 ± 0.03	-0.08 ± 0.01	-0.11 ± 0.03	-0.05 ± 0.01	0.13 ± 0.03

r_d = direct genetic correlations, r_m = maternal genetic correlations and r_{am} = direct-maternal genetic correlation.

The present estimates of correlations between direct genetic effects for birth and weaning weights indicated a positive relationship between pre- and postnatal direct genetic effects. The same conclusion reported by Koots *et al.* (1994), Plasse *et al.* (2002) and El-Awady, (2004).

The correlations between direct and maternal genetic effects were negative for all traits investigated, ranging from -0.65 to -0.08. Many publications reported same negative direct-maternal genetic correlation for growth traits (Koch *et al.* 1994, Mohuiddin, 1993, Lee and Pollak, 1997,, Lee *et al.*, 2000 and El-Awady, 2003).

The negative correlations between direct and maternal genetic effects was recorded too by Mohuiddin (1993) lead to suggest that many of genes which favour the milking and mothering ability of a cow are partly detrimental for growth of the young calf. Also, Varona *et al.* (1999) and Lee *et al.* (2000) found negative genetic correlations between direct and maternal for birth weight and/or weaning weight and ranged from -0.30 to -0.91. In addition, Koch *et al.* (1994) suggested that the negative correlations between direct and maternal genetic effects could be due to a negative direct influence of the dams on the maternal ability of their female offspring through overfeeding. Also, Tawah *et al.* (1993) concluded that the negative correlation may be the result of an adaptation of the animals to the dry tropical environment where feed resources are scare.

On the other hand, it is important to mention that Plasse *et al.* (2002) reported positive relationship between direct and maternal genetic effect for BW and WW, being 0.22 and 0.07, respectively.

Estimate of genetic correlations involving the maternal effect for BW, WW and DG were positive except correlation between BW and DG was negative and small (-0.05) (Table 4). The maternal permanent environmental effect contributed 7%, 4% and 21% for BW, WW and DG respectively to the phenotypic variance. Close values (12%, 8% and 4%) for the same traits were obtained by El-Awady, (2004) on Friesian calves. Plasse *et al.* (2002) estimated the maternal permanent environmental effect for BW and WW due to the dam by 4% and 14%, respectively on Brahman cattle.

The residual variance accounted 39%, 41% and 26% for BW, WW and DG, respectively of the phenotypic variance. Based on the present results, it appears that the permanent environmental effect due to the dam are of considerable importance in Egyptian buffalo calves to be just in the level of genetic maternal effects. These results are in accordance with the results of Haile-Mariam and Kassa-Mersha (1995) for Boran, Plasse *et al.* (2002) for Brahman cattle and El-Awady (2003) for Friesian calves.

Predicted Breeding Values (PBV' s)

Estimates of minimum and maximum predicted breeding values and their accuracies for BW, WW and DG for sires, cows and dams breeding values are presented in Table (5). The results showed that the range of sire breeding values for BW, WW and DG were 4.9 kg, 22 kg and 196.3 g, respectively, and that for cow were 8.19 kg, 26 kg and 231 g, respectively, whereas for dam breeding values were 5 kg, 26 kg and 229 g, respectively. The mention obtained breeding values lead to the great role of the maternal component in the growth traits from birth to weaning in Egyptian buffalo calves. These effects appeared in the cow breeding values with high accuracy (over 80%); and by the way it means that selection of buffalo cows for the next generation would lead to higher genetic improvement in the herd.

Table (5): Range of breeding values through Sires (SBV's), Cows (CBV's), and Dams (DBV's) and its accuracy's (%) for birth weight (BW), weaning weight (WW) and daily gain (DG) from birth to weaning in Egyptian buffalo calves.

Traits	Estimate of breeding values (EBV's)					
	Sires					
	Min±SE	Max±SE	Range	Accuracy	Positive%	Negative%
BW	-2.3±3.5	2.6±3.6	4.9	49-63	54.2	45.8
WW	-6.4±5.4	15.5±10.7	21.9	71-83	51.0	49.0
DG	-79.9±11.3	116.4±14.1	196.3	68-78	45.8	54.2
	Cows					
BW	-4.8±3.1	3.4±2.9	8.19	62-66	47.7	52.3
WW	-15.8±7.5	9.7±6.4	25.5	77-84	46.2	53.8
DG	-131.7±10.8	99.4±11.3	231.1	69-71	47.7	52.3
	Dams					
BW	-2.9±3.8	2.1±3.7	5.0	00-36	49.6	49.0
WW	-10.6±8.9	15.5±10.7	26.1	00-43	50.4	48.1
DG	-111.4±13.5	118.2±14.3	229.6	00-47	47.9	50.6

The accuracy of cow breeding values was higher than that of sire breeding values as well as dam breeding values, which may be due to the part of maternal genetic and permanent environmental effects due to the cow.

The present results reflect large differences among breeding values of sires, cows and dams in the different traits studied, therefore, using selection program will lead to improve BW, WW and DG.

The correlation coefficients between breeding values of different traits investigated are shown in Table (6). It could be noticed that the trend of correlations of predicted breeding values were reflect the same direction with those reported for genetic correlations for the same traits (Table 3).

Table (6): Correlations between breeding values of birth weight (BW), weaning weight (WW) and daily gain (DG) from birth to weaning in Egyptian buffalo calves of sires, cows, dams and all animals.

Traits	Traits							
	EBV's (Sires)		EBV's (Cows)		EBV's (Dams)		EBV's (All animals)	
	BW	WW	BW	WW	BW	WW	BW	WW
WW	0.10		0.10*		0.07		0.10**	
DG	-0.82**	0.48**	-0.75**	0.57**	-0.72**	0.64**	-0.75**	0.58**

Conclusion

The evaluation of the present result in fact showed an attempt for estimating the direct and maternal genetic effects and breeding values of growth traits from birth to weaning of Egyptian buffalo calves, with REML using animal model, from different sources of pedigree. As well as, no doubt in the value of including the maternal genetic effects in a model of (co)variance components estimation in BW, WW and DG traits of Egyptian buffalo calves. The antagonism observed between direct and maternal genetic effects for all traits studied, suggesting that postnatal growth can be increased without increasing birth weight, and this will be effective in reducing the incidence and severity of dystosia. Consequently, selection for WW and growth rate based on direct genetic effect only may not give optimal response because of the negative genetic correlation between direct and maternal effects. Therefore, in future, the recommendation of inclusion maternal genetic effect and permanent environmental will provide a better chance for genetic improvement and higher accuracy of predicted breeding values than model without these components.

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مكونات التباين الراجع إلى التأثيرات الوراثية المباشرة و الأمية وتقدير القيم التربوية لبعض صفات النمو فى عجول الجاموس المصرى

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استخدم فى هذه الدراسة ٥٤٠٥ سجلا لصفات النمو من الولادة حتى الفطام لعجول الجاموس المصرى (٢٧٣٠ ذكر و٢٦٧٥ أنثى) بنات لعدد ١٥٦٥ أم و٢٨١ أب خلال الفترة من ١٩٧١ إلى ٢٠٠١م بمزرعة محلة موسى. قدرت مكونات التباين باستخدام طريقة الاحتمالات العظمى المحددة Restricted Maximum Likelihood بنموذج الحيوان لتقدير مكونات التباين للوزن عند الولادة، الوزن عند الفطام ومعدل النمو اليومى من الميلاد حتى الفطام. اشتمل نموذج التحليل الإحصائي على شهر وسنة الميلاد، الموسم (ترتيب الولادة)، الجنس كتأثيرات عشوائية، أما التأثيرات العشوائية فاشتملت على الحيوان والتأثير الوراثي المباشر، التأثير الوراثي الأمي المباشر، التأثير البيئى الدائم والتأثير المتبقي. اخذ وزن الأم عند الولادة كانحدار .

كانت المتوسطات العامة والانحرافات القياسية للوزن عند الميلاد، الوزن عند الفطام ومعدل النمو اليومى من الميلاد حتى الفطام ٣٣,٤ ±٦,٤ ، ٨٦,٧ ±١١,٢ كيلوجرام و٥٠٣ ±١٠٧ جرام/ يوم، على التوالي. كانت قيم المكافئ الوراثى المباشرة ٠,٣٥ ±٠,٠٣، ٠,٣٩ ±٠,٠٤ و٠,٣١ ±٠,٠٩، لنفس الصفات السابقة على التوالي. أما قيم المكافئ الوراثى الأمي كانت ٠,١٩ ±٠,٠١، ٠,١٦ ±٠,٠١ و٠,٢٢ ±٠,٠٢، على التوالي. كانت قيم المكافئ الوراثى الكلى للصفات سالفه الذكر كانت ٠,٣٧، ٠,٣٨ و٠,٣٨، على التوالي. كانت تقديرات التباين البيئي الأمي الدائم كنسبة من التباين المظهرى ٠,٠٧، ٠,٠٤ و٠,٢١ للوزن عند الميلاد، الوزن عند الفطام ومعدل النمو اليومى من الميلاد حتى الفطام، على التوالي. لوحظ التضاد بين التأثيرات الوراثية المباشرة والتأثيرات الأمية الوراثية وكان سلبيا في كل الصفات وتراوح من -٠,٦٥ إلى -٠,٠٨.كان الارتباط الوراثى والمظهرى بين الوزن عند الميلاد ومعدل النمو اليومى من الميلاد حتى الفطام ضعيفا وسالبا - ٠,١٩ و-٠,٣٤، على التوالي، بينما كان الارتباط الوراثى والمظهرى بين الوزن عند الفطام ومعدل النمو اليومى من الميلاد حتى الفطام كان عاليا و موجبا ٠,٨٢ و٠,٩١، على التوالي.

تَراوحت القيَم التربوية المتوقعة للآباء من -٢,٣ إلى ٢,٦ كيلوجرام للوزن عند الميلاد ومن -٦,٤ إلى ١٥,٥ كيلوجرام للوزن عند الفطام و من -٧٩,٩ إلى ١١٦ جرام لمعدل النمو اليومى من الميلاد حتى الفطام بينما تراوحت القيم التربوية للأبقار من -٤,٨ إلى ٣,٤ كيلوجرام ، - ١٥,٨ إلى ٩,٧ كيلوجرام و-١٣١,٧ إلى ٩٩,٤ جرام لنفس الصفات على التوالي. وأيضا فقد تراوحت القيم التربوية للأمهات من -٢,٩ إلى ٢,١ كيلوجرام ، - ١٠,٦ إلى ١٥,٥ كيلوجرام و-١١١,٤ إلى ١١٨ جرام للصفات المذكورة أعلاه.

معاملات الارتباط بين كل الصفات المدروسة كانت معنوية، ماعدا الارتباط بين الوزن عند الميلاد والوزن عند الفطام فقد كان غير معنوى. اتجاهات الارتباطات الوراثية بين القيم التربوية المتوقعة كانت في نفس اتجاه الارتباطات الوراثية لنفس الصفات. تشير الدراسة الحالية الى أن اشتمال النموذج الإحصائي على مكونات التأثير الوراثى الأمى المباشر و البيئى الدائم سيؤدى الى زيادة التحسين الوراثى ودقة القيم التربوية عن النموذج الغير محتوى عليهما.