J. Animal and Poultry Prod., Mansoura Univ., Vol.8 (8): 311 - 318,2017

Estimation of the Genetic Parameters of Semen Characteristics in Bronze Turkey Raised in Egypt

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ABSTRACT

A total number of 50 males of 13 sires and 22 dams at 36, 40 and 44 weeks of age of of Bronze turkey at Mehallet-Mousa Turkey Station, Animal Production Research Institute at Kafr El-Sheikh Governorate were used in this study. Semen characteristics were recorded at 36, 40 and 44 weeks of age. Results showed that means of semen characteristics were ranged from 78.63 to 88.68 for advanced motility (AM), from 4.06 to 4.16 for Mass motility (MM), from 9.67 to 10.73% for dead spermatozoa (D), from 3.18 to 4.86 for Concentration (Cn), from 6.59 to 6.82 for pH, from 0.32 to 0.41 ml for volume (VOL) and from 89.27 to 90.33% for livability (LIVE) at 36, 40 and 44 weeks of age. Values of coefficients of variation (CV%) ranged from 6.4٩ to 10.97 % for (AM), from 16.92 to 26.72 % for (MM), from 29.01 to 47.27 % for (dead spermatozoa), from 6.27 to 17.01 %for (Cn), from 1.71 to 6.72% for (pH), from 11.84 to 20.55 % for (VOL) and from 3.10 to 5.27 % for (LIVE) at 36, 40 and 44 weeks of age..Direct additive genetic variance (σ^2_a) ranged from 10.776 to 18.791 for AM, from 0.176 to 0.392 for (MM), from 2.235 to 5.538 for (D), from 0.013 to 0.083 for (CN), from 0.002 to 0.062 for (pH), 0.002 to 0.003 for (VOL) and from 2.235 to 8.427 for (LIVE). While maternal additive genetic variance (σ^2_m) ranged from 3.088, 3.890 for AM, 0.044 to 0.363 for MM. 0.662 to 2.289 for D, 0.002 to 0.023 for CN, 0.001 to 0.017 for pH, 0.001 to 0.001 for VOL and 0.662 to 0.873 for LIVE. Direct habitability (h^2_a) had moderate estimates and were ranged from 0.30 for pH at 40 weeks of age to 0.41 for dead spermatozoa and VOL at 36 weeks of age. While maternal habitability (h^2_m) were low an ranged from 0.07 for pH at 36 weeks of age to 0.14 for VOL at 36 weeks of age. The ranges in predicted breeding values (PBV) for bards ranged from 0.03 to 7.63 for AM, 0.71 to 2.19 for MM traits, 2.84 t 5.33 for dead, 0.22 to 0.58 for Cn, 0.23 to 0.44 for pH, 0.06 to 0.07 for VOL and 2.83 to 5.33 for LIVE traits., for dams ranged from 4.59 to 5.51 for AM, 0.89 to 1.34 for MM traits, 2.14 2.72 for dead, 0.19 to 0.36 for Cn, 0.12 to 4.55 for pH, 0.04 to 0.06 for VOL and 2.14 to 2.70 for LIVE traits for sires ranged from 3.16 to 4.39 for AM, 0.39 to 0.84 for MM traits, 1.37 to 2.24 for dead, 0.11 to 0.19 for Cn, 0.09 to 3.17 for pH, 0.025 to 0.031 for VOL and 1.37 to 2.24 for LIVE traits. The ranges in predicted breeding values (PBV) for males ranged from 5.41 to 9.08 for AM, 0.71 to 2.15 for MM, 2.83 to 5.33 for D, 0.21 to 0.58 for CN, 0.23 to 5.41 for pH, 0.06 to 0.07 for VOL and 2.84 to 5.33 for LIVE. The average positive% of PBV for males were 48.0, 54.0, 54.0, 52.0, 56.7, 48.0 and 66.0% for AM, MM, D, CN, pH, VOL AND LIVE, respectively. .Genetic and phenotypic correlations among the semen characteristics were mostly positive and significantly ($P<0.05$, $P<0.01$, $P<0.001$) and were low to high at 36, 40 and 44 weeks of age.

INTRODUCTION

Turkey is the only commercial poultry species completely dependent upon artificial insemination for fertile egg production. Although time and labor intensive, artificial insemination has proven to be a key strategy for achieving rapid genetic improvement in economically important traits such as growth rate and feed efficiency. One benefit of artificial insemination that has not been fully realized by the industry is that it maximizes the fertility potential of turkey semen. Semen quality is also important factor determining the breeding value of males, because it influences the fertilization rate of the eggs for hatching as well as the reproductive efficiency of their progeny (Mc Gary *et al.,* 2002).

Many indicators are currently used to evaluate semen quality including ejaculate volume, semen color, sperm concentration, sperm motility, sperm viability and percent sperm deformity (MoCe and Graham, 2008). It is appropriate to select the best sperm quality traits for breeding program instead of including them all. Thempson (2008) proposed selection based on the genetic parameters of estimated traits. Genetic improvements in the commercial turkey are achieved via selection in the pure lines of the primary breeding companies. Pure lines can be generally classified into two differing categories; sire lines and dam lines. Inclusion of traits and their weighting is based largely on their economic to the turkey industry (Wood, 2009). Williams and McGibbon (1956 a and b) evaluating semen characteristics among some turkey breeds, and they found correlation between body weight and semen volume, also they found increasing of reproductive organs as a result of high body weight, so, they produced high amount of semen. De Reviers and Williams (1984) and Pizzari *et al.,* (2004) found that increasing of sperms production is a result of increasing tests size. El-Sawy (1996) found that heavy toms of Nicholas breed were higher in semen volume, sperm concentration, motility, live/dead sperm ratio when comparable with Bronze toms breed. Siegal and Dunnington (1990), Galal (2007) and Amany A. El-Sahn (2007) found that positive significant relations between body weight and ejaculate volume, also between testis weight and total count of sperms, total count of motile and live sperms. Liu *et al.,* (2008) found that the correlation coefficient between semen quality factor (SQF) and fertility was 0.985 ($P<0.01$), indicating that the SQF can be used as a good indicator of fertility for geese.

Genetic parameter estimates such as heritability, genetic variation and genetic correlations are therefore important when developing a selection index. These parameters are used when redacting direct and correlated responses to selection and their accuracy will have a large impact on the progress in a breeding program. In order to ensure the accuracy of a selection index, the genetic parameters must be recalculated often. In addition to changing the genetic parameters in the selection index, examining the trends from the genetic parameter estimates will give insight into the fluctuation in genetic variation over time within a population (Willems, 2014).

The objective of this work was to estimate genetic direct and maternal additive genetic variance, direct and maternal heritability, evaluate the performance of sires, dams and their bards for semen characteristics in Bronze turkey toms through breeding values predicted of all birds and evaluate the relationship between semen characteristics of turkeys.

MATERIALS AND METHODS

This work was carried out at Mehallet-Mousa Turkey Station, Animal Production Research Institute at Kafr El-Sheikh Governorate. Fifty toms of Bronze turkey were taken randomly at sexual maturity. Toms were housed individually in flour pens, water and feed were offered *ad libitum*. The ration (containing 18 - 19% crude protein and 3000 Kcal /Kg as ME) was used.

Semen quality of each male was examined two weeks before and during the commence of artificial insemination. Usually the semen we collected on alternate days for every male by the manual massage technique as described by Burrows and Quinn (1937), and immediately examined after collection for:

1- Ejaculate volume to the nearest 0.01 ml. 2- The concentration of sperm (as cited by El Sawy, 1996). 3- Mass motility by placing a small drop of diluted semen on a slide and scoring system was devised to rate the overall motion as described by El Sawy, 1996), as follow: Scoring 4: samples showing very vigorous movement. Scoring 3: samples showing moderate movement. Scoring 2: samples showing slow movement. Scoring 1: samples showing very slow movement. Scoring 0: samples showing no movement. Degrees of pH were recorded by electric pH meter. Artificial insemination was applied according to Lake and Stewart (1978).

Data

Data of individually 50 males of 13 sires and 22 dams of Bronze turkey were used in this study. Semen characteristics (advanced motility(AM); Mass motility (MM); dead spermatozoa, Concentration (Cn); pH; Volume (VOL); and livability (LIVE); at 36, 40 and 44 weeks of age, respectively. The symbols of the traits studied were described in Table 1.

Statistical analysis:

Data for semen characteristics were analyzed using single trait animal model (STAM). MTDFRAML program of Boldman *et al.,* (1995) was used. Variances obtained by REML method of VARCOMP procedure (SAS, 2002) were used as starting values for the estimation of variance components. Analysis was done according to the following animal model were used as starting values for the estimation of variance components. Analysis was done according to the following animal model.

The assumed model in matrix notation was:

$$y = Xb + Z_aU_a + Z_mU_m + e,$$

Where,

y= vector of observations on animal, b= vector of fixed effect peculiar to month of production, U_a= vactor of random additive genetic effects, U_m= maternal genetic effect and e = vectors of random error; X, Z_a, and Z_m are incidence matrix relating individual records to b, a, and m and , respectively

RESULTS AND DISCUSSION

Means, standard deviation (SD) and coefficients of variation (CV %) for semen characteristics at 36, 40 and 44 weeks of age traits are given in Table 1. Means ranged from 78.63 to 88.68, from 4.06 to 4.16, from 9.67 to 10.73, from 3.18 to 4.86, from 6.59 to 6.82, from 0.32 to 0.41 and from 89.33 to 90..33 for AM, MM, D, CN, pH, VOL and LIVE trais at 36, 40 and 44 weeks of age, respectively. While the corresponding ranges of CV% were 6.49, to 10.97%, 16.92 to 26.72%, 29.01 to 47.27%, 16.92 to 18.10%, 29.01 to 47.27%, 6.27 to 17.01%, 1.71 to 6.72%, 11.84 to 20.55% and 3.10 to 5.27%. Similar findings were reported by Ngu *et al.,* (2014) and Kotlowska *et al.,* (2005). **Hu *et al.,* (2013)** found that the roosters Testes had an average semen volume of 0.34 ml, pH of 7.43, color of 2.40 , 71.12% sperm viability, motility of 7.51, 8.76% deformities and sperm concentration of 1.16 × 10^9 /mL. With the exception of semen pH, which had a CV of 2.13%, the remaining traits had high CV, between 18 and 24%. Cheng *et al.* (2002) reported that mean of viability and semen concentrations were 69.61% and 4.35, respectively.

Table 1. Means, standard deviation (SD) and coefficient of variability (CV%) for semen characteristics of Bronze turkey toms.

Trait	Mean	SD	CV%
Advanced motility at 36 weeks (AM36)	78.63	8.49	10.97
Advanced motility at 40 weeks (AM40)	88.68	5.71	6.49
Advanced motility at 44 weeks (AM44)	83.72	8.05	9.62
Mass motility at 36 weeks (MM36)	4.06	1.08	26.72
Mass motility at 40 weeks (MM40)	4.14	0.75	18.10
Mass motility at 44weeks (MM44)	4.16	0.70	16.92
Dead at 36 weeks (d36%)	10.73	4.02	37.48
Dead at 40 weeks (d40%)	10.04	4.75	47.27
Dead at 44weeks (d44%)	9.67	2.80	29.01
Concentration at 36 weeks (Cn36)	4.86	0.43	8.76
Concentration at 40 weeks (Cn40	4.16	0.26	6.27
Concentration at 44 weeks (Cn44)	3.18	0.54	17.01
pH at 36 weeks (pH36)	6.59	0.44	6.72
pH at 40 weeks (pH40)	6.82	0.11	1.71
pH at 44 weeks (pH44)	6.61	0.26	3.98
Volume at 36 weeks (VOL36)	0.32	0.06	20.55
Volume at 40 weeks (VOL40)	0.41	0.07	18.30
Volume at 44 weeks (VOL44)	0.34	0.04	11.84
livability at 36 weeks (LIVE3)	89.33	4.02	4.50
livability at 40 weeks (LIVE40	89.94	4.74	5.27
livability at 44 weeks (LIVE44)	90.33	2.08	3.10

+VOL(ml); LIVE(%); D(%); CN(*10^9/ml)

Variance components:

Estimates of additive genetic variance components (σ^2_a) and maternal additive genetic variance (σ^2_m) for semen quality traits studied at 36, 40 and 44 weeks of age are given in Table 2. Esrimares of additive genetic variance σ^2_a were low to high. They ranged from 10.776 to 23.881, 0.176 to 0.392, 2.235 to 8.427, 0.013 to 0.083, 0.002 to 0.062, 0.002 to 0.003, 2.235 to 8.427

for AM, MM, D, CN, pH, VOL and LIVE semen quality traits, respectively (Table 2). Similar trend was observed by Hu *et al.,* (2013) who showed moderate to high additive genetic variance components (σ^2_a) were estimated for sperm viability (52%), motility (85%). Moderate (semen volume and semen concentration) to low additive genetic variance components (σ^2_a) for (pH).

The estimates of additive maternal variance (σ^2_m) were low and they ranged from 3.085 to 6.489, 0.049 to 0.363, 0.662 to 2.289, 0.002 to 0.023, 0.001 to 0.017, 0.001 to 0.001 and 0.662 to 0.873 for AM, MM, D, CN, pH, VOL and LIVE semen quality traits, respectively (Table 2).f the present study revealed the possibility of improving these traits.

Heritability:

Direct habitability (h^2_a) for semen characteristics at 36, 40 and 44 weeks of age traits are given in Table 2. Results noticed moderate direct habitability (h^2_a) were ranged from 0.30 for pH at 36 weeks of age to 0.41 for dead and VOL at 36 weeks of age. These results are similar to Kabir et al. (2007) and Hu *et al.* (2013). Hu *et al.,* (2013) showed moderate to high heritabilities were estimated for sperm viability (0.52), motility (0.85) and percent deformity (0.60). Moderate to low heritabilities were estimated for semen volume (0.28), semen color (0.19), and sperm concentration (0.12) but the heritability of semen pH was very low (0.03). There are few and inconsistent estimates of genetic parameters of semen quality traits in chickens and Turkey. Soller et al.(1965) concluded that semen volume, sperm concentration and motility in White Rock roosters are highly heritable traits. Heritabilities for semen volume and sperm concentration (0.41 and 0.50, respectively) were nearly to ourfindings. The inconsistencies probaly reflect the different breeds, sample size, and structure or management in the different studies. While maternal habitability (h^2_m) were low and ranged from 0.18 for pH at 36 weeks of age to 0.14 for VOL at 36 weeks of age. These results are in agreement with our findings and reveal that improving most of the traits studied could be achieved by selection.

Table 2. Estimates of variance components, direct heritability and maternal heritability for semen characteristics of males in Bronze turkey.

Traits	σ^2_a	σ^2_m	σ^2_e	σ^2_p	h^2_a	h^2_m
AM36	18.791	3.890	23.689	46.369	0.34	0.07
AM40	10.776	3.085	9.851	26.712	0.38	0.11
AM44	23.881	6.489	20.904	51.274	0.39	0.11
MM36	1.339	0.363	1.187.	2.889	0.39	0.11
MM40	0.176	0.049	0.189	0.414	0.36	0.10
MM44	0.392	0.123	0.551	1.066	0.30	0.10
D36%	5.538	1.174	4.482	11.194	0.41	0.09
D40%	8.427	2.289	7.388	18.104	0.39	0.11
D44%	2.235	0.662	2.593	5.490	0.35	0.10
Cn36	0.048	0.013	0.096	0.157	0.36	0.09
Cn40	0.013	0.002	0.021	0.036	0.30	0.06
Cn44	0.083	0.023	0.094	0.200	0.35	0.10
PH36	0.062	0.017	0.072	0.151	0.30	0.10
PH40	0.002	0.001	0.006	0.009	0.35	0.10
PH44	0.016	0.003	0.27	0.289	0.31	0.05
VOL36	0.003	0.001	0.016	0.020	0.41	0.14
VOL40	0.003	0.001	0.002	0.006	0.39	0.137
VOL44	0.002	0.001	0.002	0.005	0.38	0.13
LV36	4.208	0.873	5.309	10.390	0.34	0.07
LV40	8.427	2.28	7.388	18.095	0.39	0.11
LV44	2.235	0.662	2.593	5.490	0.35	0.10

+ Traits as described in Table 1.

σ^2_a = direct additive variance; σ^2_m=maternal additive variance; h^2_a = direct heritability ; h^2_m= maternal heritability.

Predicted breeding values for males (with records):

Predicted breeding values for males (with records) the minimum, maximum and ranges of predicted breeding value (PBV) in addition to their standard errors and accuracy (r_{IA})for semen quality traits are given in Table 3. The ranges of predicted breeding values (PBV) for males (with records) ranged from 5.41 to 9.08, from 0.71 to 2.19, from 2.83 to 5.33, from .21 to 0.58, from 0.23 to 5.41, from 0.06 to 0.07, from 2.84 to 5.33 for AM, MM, D, CN, pH, VOL and LIVE traits respectively (Table 3). It is noted that the range between minimum and maximum PBV decrease at 40 weeks of age for most semen traits studied. Review of literature studies in this point (PBV) for semen quality may be few or not available.

Positive PBV and its percentage for semen quality traits studied are shown in Table 3. The positive PBV% ranged from 44-52%, 44-64%, 30-40%, 48-60%, 44-66%, 46-52% and 60-70% for AM, MM, D,CN, pH, VOL and LIVE traits, respectively, while the corresponding average positive PBV% were 48, 54, 34, 52, 56.7, 48 and 66%, respectively. It is noticed that positive PBV is low at 40 weeks of age compared to 36 and 44 weeks of age, and consequently, it could be select the best males based on PBV at 36 or 44 weeks of age. This may be due to that additive genetic variance for most semen quality traits studied is low at 40 weeks of age compared to 36 and 44 weeks of age.

Accuracy (r_{IA}) of PBVs is defined as the correlation (r) between the true breeding value (A) and the estimated breeding value (I). Accuracy estimates for PBV recorded high accuracy for semen quality traits studied. This may be due to that the heritability estimates obtained for semen quality traits were reasonable.Rank correlations among accuracies of PBV for all semen characteristics were strong highly significant and positively correlated.

Table 3. Minimum, maximum and ranges of predicted breeding values for males (with records), their standard errors (SE) and accuracy (r_{IA}) of prediction (PBV) for semen characteristics in Bronze turkey.

Traits	Minimum			maximum			Range	Positive PBV	Positive% PBV
	PBV	SE	r_{IA}	PBV	SE	r_{IA}			
AM36	-5.09	2.88	0.73	3.99	2.97	0.75	9.08	26	52
AM40	-3.09	2.11	0.74	2.32	2.19	0.77	5.41	22	44
AM44	-4.05	3.11	0.75	3.58	2.23	0.77	7.63	24	48
MM36	-1.62	0.74	0.75	0.58	0.77	0.77	2.19	32	64
MM40	-0.38	0.28	0.73	0.32	0.29	0.75	0.71	27	54
MM44	-0.46	0.44	0.72	0.80	0.46	0.74	1.26	22	44
D36%	-1.33	1.45	0.77	3.31	1.51	0.79	4.64	16	32
D40%	-1.30	1.85	0.75	4.03	1.85	0.77	5.33	15	30
D44%	-1.27	1.01	0.73	1.27	1.01	0.74	2.83	20	40
Cn36	-0.21	0.15	0.73	0.19	0.15	0.75	0.40	24	48
Cn40	-0.11	0.08	0.70	0.11	0.08	0.75	0.21	30	60
Cn44	-0.30	0.19	0.73	0.28	0.20	0.75	0.58	24	48
PH36	-0.27	0.17	0.72	0.18	0.18	0.74	0.44	33	66
PH40	-3.09	2.11	0.74	2.52	2.19	0.77	5.41	22	44
PH44	-0.13	0.09	0.77	0.10	0.09	0.72	0.23	30	60
VOL36	-0.03	0.03	0.77	0.03	0.03	0.80	0.06	23	46
VOL40	-0.04	0.03	0.76	0.03	0.03	0.78	0.07	26	52
VOL44	-0.04	0.03	*0.75*	0.03	0.03	*0.78*	0.07	23	46
LIVE36	-2.83	1.36	0.73	1.21	1.40	0.75	4.04	34	68
LIVE40	-4.03	1.85	0.75	1.30	1.92	0.77	5.33	35	70
LIVE44	-1.57	1.01	0.72	1.25	1.04	0.74	2.84	30	60

+ Traits as described in Table 1; PBV = predicted breeding value.

Predicted breeding values for sires of males (without records):

Predicted breeding values for sires of males (without records) the minimum, maximum and ranges of predicted breeding value (PBV) in addition to their standard errors and accuracy for semen quality traits are given in Table 4 at 36, 40 and 44 weeks of age. The ranges in predicted breeding values (PBV) for sires of males ranged from 3.17 to 4.39, from 0.39 to 0.84, from 1.37 to 2.24, from 0.11 to 0.27, from 0.09 to 3.17, from 0.03 to 0.03, and from 1.37 to 2.24 for AM, MM, D, CN, pH, VOL and LIVE traits respectively (Table 4).

Positive PBV and its percentage for semen quality traits studied are shown in Table 4. The positive PBV% ranged from 46.2 to 69.2%, 46.2 to 61.2%, 46.2 to 61.5%, 46.2 to 61.5%, 46.2 to 53.8%, 46.2 to 53.9% and 30.8 to 53.9.2% for AM, MM, D,CN, pH, VOL and LIVE traits, respectively, while the corresponding average positive PBV% were 53.3, 51.3, 53.8, 53.8, 51.3. 48.7,and 43.6%, respectively, at 36, 40 and 44 weeks of age. It is noticed that positive PBV is the same trend of males. Accuracy estimates for PBV were lower than those recorded for males. This is the trend of ranges of PBV for males.

Predicted breeding values for dams of males (without records):

Predicted breeding values for sires of males (without records) the minimum, maximum and ranges of predicted breeding value (PBV) in addition to their standard errors and accuracy for semen quality traits are given in Table 5. The ranges in predicted breeding values (PBV) for dams of males ranged from 4.95 to 5.51, from 0.45 to 1.34, from 2.14 to 2.72, from 0.19 to 0.36, from 0.12 to 4.59, from 0.04 to 0.06, and from 2.14 to 2.70 for AM, MM, D, CN, pH, VOL and LIVE traits respectively (Table 5).

Positive PBV and its percentage for semen quality traits studied are shown in Table 5. The positive PBV% ranged from 40.9 to 50.0%, 45.5 to 72.7%, 36.4 to 45.5%, 45.5 to 50.0%, 40.9 to 54.5%, 45.5 to 50.0% and 54.5 to 63.6% for AM, MM, D,CN, pH, VOL and LIVE traits, respectively, while the corresponding average positive PBV% were 45.5, 56.1, 42.9, 48.5, 48.5. 48.5,and 57.6%, respectively, at 36, 40 and 44 weeks of age. It is noticed that average positive PBV% is similar to their corresponding values in dams of males. Accuracy estimates for PBV were similar to those recorded for males and they were higher than those recorded for sires of males

Table 4. Minimum, maximum and ranges of predicted breeding values for sires of males (without records), their standard errors (SE) and accuracy (r_{IA}) of prediction (PBV) for semen characteristics in Bronze turkey.

Traits	Minimum			maximum			Range	Positive	Positive%
	PBV	SE	r_{IA}	PBV	SE	r_{IA}		PBV	PBV
AM36	-1.55	3.67	0.42	2.84	3.94	0.53	4.39	6	46.2
AM40	-1.97	2.76	0.42	1.20	2.98	0.54	3.17	6	46.2
AM44	-1.91	4.10	0.42	1.54	4.43	0.55	3.45	9	69.2
MM36	-0.44	0.97	0.42	0.40	1.05	0.54	0.84	8	61.5
MM40	-0.20	0.36	0.42	0.19	0.38	0.53	0.39	6	46.2
MM44	-0.29	0.56	0.41	0.28	0.60	0.53	0.56	6	46.2
D36%	-1.05	1.96	0.44	0.94	2.12	0.56	1.99	8	61.5
D40%	-0.88	2.43	0.42	1.35	2.63	0.55	2.24	6	46.2
D44%	-0.78	1.27	0.41	0.60	1.63	0.53	1.37	7	53.8
Cn36	-0.09	0.19	0.42	0.09	0.20	0.53	0.18	8	61.5
Cn40	-0.3	0.10	0.41	0.07	0.10	0.52	0.11	6	46.2
Cn44	-0.12	0.24	0.41	0.15	0.26	0.53	0.27	7	53.8
PH36	-0.14	0.21	0.41	0.11	0.23	0.53	0.25	7	53.8
PH40	-1.97	2.76	0.42	1.20	2.98	0.54	3.17	6	46.2
PH44	-0.05	0.11	0.42	0.04	0.12	0.52	0.09	7	53.8
VOL36	-0.02	0.04	0.41	0.02	0.05	0.55	0.03	7	53.8
VOL40	-0.02	0.04	0.41	0.01	0.05	0.54	0.03	6	46.2
VOL44	-0.01	0.04	*0.40*	0.01	0.05	*0.53*	0.03	6	46.2
LIVE36	-0.86	1.74	0.42	0.95	1.86	0.53	1.81	4	30.8
LIVE40	-1.35	2.43	0.42	0.88	2.63	0.55	2.24	7	53.8
LIVE44	-0.60	1.27	0.41	0.78	1.36	0.53	1.37	6	46.2

+ Traits as described in Table 1; PBV = predicted breeding value.

Table 5. Minimum, maximum and ranges of predicted breeding values for dams of males (without records), their standard errors (SE) and accuracy (r_{IA}) of prediction (PBV) for semen characteristics in Bronze turkey.

Traits	Minimum			maximum			Range	Positive	Positive%
	PBV	SE	r_{IA}	PBV	SE	r_{IA}		PBV	PBV
AM36	-2.97	3.07	0.48	2.53	3.80	0.71	5.51	10	45.5
AM40	-2.19	2.45	0.47	2.41	2.90	0.66	4.95	9	40.9
AM44	-2.21	3.70	0.46	2.96	4.35	0.65	5.17	11	50.0
MM36	-0.95	0.88	0.46	0.39	1.03	0.63	1.34	16	72.7
MM40	-0.25	0.32	0.46	0.20	0.37	0.66	0.45	11	50.0
MM44	-0.34	0.51	0.44	0.52	0.59	0.63	0.85	10	45.5
D36%	-0.88	1.72	0.47	1.84	2.07	0.68	2.72	10	45.5
D40%	-1.21	2.20	0.46	1.48	2.58	0.65	2.70	10	45.5
D44%	-0.83	1.16	0.44	1.32	1.34	0.63	2.14	8	36.4
Cn36	-0.19	0.17	0.44	0.15	0.20	0.65	0.34	11	50.0
Cn40	-0.09	0.08	0.45	0.10	0.10	0.68	0.19	10	45.5
Cn44	-0.16	0.22	0.45	0.20	0.26	0.65	0.36	11	50.0
PH36	-0.14	0.19	0.45	0.10	0.22	0.65	0.26	11	50.0
PH40	-0.19	2.15	0.47	2.41	2.90	0.66	4.59	9	40.9
PH44	-0.06	0.10	0.42	0.06	0.12	0.65	0.12	12	54.5
VOL36	-0.03	0.04	0.53	0.02	0.04	0.73	0.06	11	50.0
VOL40	0.02	0.04	0.51	0.02	0.01	0.71	0.04	11	50.0
VOL44	0.02	0.3	*0.52*	0.02	0.4	*0.71*	0.04	10	45.5
LIVE36	-1.75	1.45	0.48	0.88	1.80	0.71	2.62	12	54.5
LIVE40	-1.48	2.20	0.46	1.21	2.58	0.65	2.70	12	54.5
LIVE44	-1.31	1.16	0.44	0.83	1.34	0.63	2.14	14	63.6

+ Traits as defined in Table 1.

Phenotypic (rP) and Genetic (rG) correlation among predicted breeding values:

Correlations in the form of genetic (were computed between breeding values predicted) and phenotypic among the semen characteristics are presented in Table 6. Genetic correlations among AM and (MM, CN, VOL) were mostly positive correlated. While the genetic correlations among CN and dead, live and VOL were mostly negative correlated. Phenotypic correlations among AM and MM, dead and VOL) were mostly negative correlated. While Phenotypic correlations among AM and live were positive correlated. These findings are in agreement with findings of Oke and Ihemeson (2010) that obtained a negative correlation between semen concentration and semen volume in different chicken genotypes and concluded that semen volume may not represent an excellent indicator of semen viability and fertility. Ngu *et al.,* (2014) found that the genotypes showed a positive correlation between DSO and semen motility, total spermatozoa, total live spermatozoa and total live normal spermatozoa. This implies that as one trait increases, the other traits also increase. This corresponds with the findings of McDaniel *et al.,* (1995) who noted that the evaluation of the male chicken for breeding soundness must be based on semen motility and concentration. Daily sperm output could therefore serve as a useful indicator of the quality and quantity of viable semen in turkeys. Positive and significant coefficients were also obtained between semen volume and concentration and between body weight and semen volume. However, there was a negative correlation between semen volume and total live normal spermatozoa. This is an indication that volume may not be a good indicator of semen quality.

Table 6 Estimates of pearson correlations (above diagonal) and Phenotypic correlations (below diagonal) for males in Bronze.

Traits	BW36	BW40	BW44	BL36	BL40	BL44	BC36	BC40	BC44	KL36	KL40	KL44	SL36	SL40	SL44
BW36		0.969***	0.969***	-0.139	0.005	0.005	0.358	0.358**	0.005	0.367***	0.145	0.187*	0.366**	0.145	0.187
BW40	0.979***		0.999***	-0.008	0.082	0.082	0.364**	0.364**	0.082	0.276*	0.116	0.169	0.276	0.116	0.169
BW44	0.814***	0.797***		-0.008	0.082	0.082	0.364**	0.364**	0.082	0.276	0.116	0.169	0.276	0.116	0.169
BL36	0.013	0.071	-0.198		0.537***	0.537***	-0.339	-0.339	0.537***	-0.290*	0.107	0.070	-0.290	0.107*	0.070
BL40	0.013	0.071	-0.198	0.999***		0.999***	-0.205	-0.205	0.999***	0.137	0.292*	0.032	0.137	0.292*	0.032
BL44	0.058	0.134	0.001	0.569***	0.999***		-0.205	-0.205	0.999***	0.137	0.292*	0.032	0.137	0.292*	0.32
BC36	0.181	0.179	0.331*	-0.653***	-0.653***	-0.562***		0.999***	-0.205	0.051	-0.166	0.169	0.087	0.051	-0.166
BC40	0.181	0.179	0.331*	0.563***	0.563***	-0.592***	0.999***		-0.205	0.051	-0.166	0.168	-0.085	-0.024	0.087
BC44	0.523***	0.559***	0.439**	0.215	0.215	0.251	0.045	0.045		0.137	0.292*	0.032	0.215	0.404**	0.469***
KL36	-0.184	-0.228	-0.216	0.189	0.189	0.098	-0.529***	-0.529***	-0.329*		0.501***	0.096	-0.235	-0.137	-0.074
KL40	-0.184	-0.087	-0.105	0.643***	0.643***	0.612***	-0.727***	-0.727***	-0.057	0.475***		0.127	-0.300	-0.127	-0.0317
KL44	0.043	0.112	0.065	0.018	0.018	0.557***	-0.205	-0.205	0.183	0.243	0.285		0.408**	0.195	0.022
SL36	0.315*	0.251	0.036	-0.115	-0.115	-0.019	-0.110	-0.110	0.036	-0.013	-0.159	-0.222		0.676***	0.152
SL40	0.447**	0.370	0.287*	-0.194	-0.194	-0.088	-0.079	-0.079	0.134	0.126	-0.143	-0.083	0.883***		0.334
SL44	0.146	0.023	0.192	-0.301*	-0.301*	-0.324*	0.999***	0.0001	0.055	0.070	-0.301*	-0.059	0.044	0.334*	

+Traits as defined in Table 1.

ns = non significant, *=P<0.05, p<0.01.

Table 6. cont.

Traits	Cn44	Ph36	Ph40	Ph44	VOL36	VOL40	VOL44	LIV36	LIV40	LIV44
AM36	0.183	-0.4016**	-0.012	0.472***	0.587***	-0.527***	-0.256	0.860***	-0.032	0.224
AM40	-0.311*	-0.057	0.999***	0.341*	-0.312*	-0.135	0.041	-0.226	0.744***	0.112
AM44	-0.243	-0.640***	0.711***	-0.028	0.114	-0.463***	0.289*	0.034	0.114	0.300*
MML36	0.182	-0.259	-0.338**	0.333**	0.571***	-0.481***	-0.414**	0.912***	-324*	0.243
MM40	-0.284*	0.010	0.802	0.399**	-0.302*	-0.018	-0.117	-0.438	0.645***	-0.133
MM44	-0.049	0.016	-0.083	0.234	-0.158	0.094	-0.615***	-0.051	-0.195	0.014
Dead36	-0.188	0.363**	0.225	-0.213	-0.590***	0.505***	0.090	-0.999***	0.266	-0.307*
Dead40	0.137	-0.486***	-0.744***	-0.617***	0.561***	-0.263	0.158	0.262	0.999***	0.061
Dead44	-0.141	0.369**	-0.112	-0.017	0.047	0.555***	-0.377***	-0.308*	0.061	0.999***
Cn36	0.069	0.142	-0.054	-0.206	-0.088	0.059	0.041	-0.157	-0.071	-0.187
Cn40	-0.048	-0.001	0.248	0.049	-0.056	-0.033	0.139	0.004	0.257	0.007
Cn44		-0.006	-0.311	0.055	0.045	-0.039	0.011	0.185	-0.137	0.141
Ph36	0.085		-0.056	0.141	-0.725***	0.668***	-0.258	-0.361**	0.486***	-0.369***
Ph40	-0.027	-0.441**		0.340**	-0.312*	-0.135	0.0412	-0.226	0.744***	0.112
Ph44	0.089	0.108	0.825***		-0.033	-0.029	-0.679***	0.212	0.617	0.017
VOL36	-0.012	-0.780***	0.308*	-0.119		-0.485***	-0.059	0.598***	-0.560***	-0.047
VOL40	0.038	0.718***	-0.283*	0.057	-0..2598		-0.109	-0.504	0.263	-0.555
VOL44	0.027	-0.495***	-0.402**	-0.656***	0.178	-0.514***		-0.082	-0.158	0.377***
LIV36	0.172	0.685***	0.410**	0.171	0.659***	-0.522***	0.440**		-0.262	0.308
LIV40	0.029	0.549***	0.494***	0.854***	-0.519***	0.343*	-0.813***	-0.324*		-0.061
LIV44	0.158	-0.471***	0.251	0.152	0.040	-0.740***	0.605***	0.720***	-0.173	

+Traits are defined in Table 1. **ns=non significant, *=p<0.05, **=p<0.01, ***=p<0.001.**

Hu *et al.,* (2013) showed high and positive genetic correlations were found between semen volume and percent deformity (rA= 0.47) and between semen volume and sperm concentration (rA= 0.68). Low but not significant phenotypic correlations between these traits were observed, except for the high correlation between sperm viability and sperm motility (rP= 0.59). Semen pH had negative genetic correlations with all other traits (ranged from −0.36 to −0.66). Positive genetic correlations existed between semen color and sperm motility, percent deformity and concentration, but a negative genetic correlation existed between semen color and sperm viability. There were high genetic (rA= 0.88) and phenotypic (rP =0.59) correlations between sperm motility and viability both of which had negative genetic correlations with sperm abnormalities (rA= −0.27, −0.37, respectively. Sperm concentration showed a negative genetic correlation with sperm viability (rA= −0.72) and a positive genetic correlation with percent deformity (rA= 0.53).

CONCLUSION

1- Estimates of predicted breeding values using animal model are more reliable, i.e. the prediction are BLUP associated with lower predicted error variance.
2- Estimates of heritabilities and positive genetic correlations among predictors lead to conclude that males could be selected based on BLUP estimates obtained at early ages.
3- Heritability (h^2_a) had moderate direct habitability (h^2_a) for most traits studied and the ranges of estimated breeding values were high for advanced motility (AM) and it could be concluded that advanced motility trait could be improved by selection. Positive correlations among the semen characteristics this is an indication that advanced motility may be a good indicator of semen quality.

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التقييم الوراثي لبعض صفات السائل المنوى في الرومي البرونزى المربى في مصر

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قسم بحوث الأرانب والرومى والطيور المائية، معهد بحوث الإنتاج الحيوانى والدواجن، مركز البحوث الزراعية، وزارة الزراعه، الجيزة – مصر

تم إستخدام عدد ٥٠ سجل إنتاجي من ذكور الرومي البرونزى من قطيع محطة الرومى بمحلة موسى كفر الشيخ التابعة لمعهد بحوث الإنتاج الحيوانى، مركز البحوث الزراعية، مصر. وقد درست صفات السائل المنوى للديوك عند عمر ٣٦، ٤٠، ٤٤ أسبوع وقد أوضحت النتائج مايلى:تراوحت متوسطات قيم صفات السائل المنوى من ٨٧.٦٣ – ٨٨.٦٨% لصفة الحركة التقدمية، من٤.١٦ – ٤.١٦ للحركة الموجية، من ٩.٦٧ – ١٠.٧٣% للحيوانات المنوية الميتة، من ٣.١٨-٤.٨٦*$١٠^{٩}$ لتركيز الحيوانات المنوية فى الـ ١مل، من ٦.٥٩ – ٦.٨٢لدرجة الحموضة، من ٠.٣٢ – ٠.٤١ مل لحجم القذفة ومن ٨٩.٣٣ – ٩٠.٣٣% للحيوانات المنوية الحية عند ٣٦، ٤٠، ٤٤ أسبوع من العمر.تراوحت قيم معاملات الاختلاف لصفات السائل المنوى من ٦.٤٩ – ١٠.٩٧% لصفة الحركة التقدمية، من ١٦.٩٢ – ٢٦.٧٢% للحركة الموجية، من ٢٩.٠١ – ٤٧.٢٧% للحبوانات المنوية الميتة، من ٦.٢٧ – ١٧.٠١% لتركيز الحيوانات المنوية، من ١.٧١ – ٦.٧٢% لدرجة الحموضة، من ١١.٨٤ – ٢٠.٥٥% لحجم القذفة ومن ٣.١٠ – ٥.٢٧% للحيوانات المنوية الحية عند ٣٦، ٤٠، ٤٤ أسبوع من العمر.وكانت قيم المكافئ الوراثى المضيف متوسطة وتراوحت من ٠.٣٠ لدرجة الحموضة عند ٣٦ أسبوع من العمر الى ٠.٤١ لصفات الحيوانات المنوية الميتة وحجم القذفة عند ٣٦ اسبوع من العمر. بينما كانت قيم المكافئ الوراثي الأموى منخفضة وتراوحت من ٠.٠٥ لدرجة الحموضة عند ٤٤ أسبوع من العمر الى ٠.١٤ لصفة حجم القذفة عند ٣٦ اسبوع من العمر.كان مدي القيم التربوية للصفات المدروسة لذكور الرومى ٥.٤١ – ٩.٠٨ لصفة الحركة التقدمية، من ٠.٧١ – ٢.١٩ للحركة الموجية، من ٢.٨٣-٥.٣٣ للحيوانات المنوية الميتة، من ٠.٢١ -٠.٥٨ لتركيز الحيوانات المنوية، من ٠.٢٣ – ٠.٤٤ لدرجة الحموضة، من ٠.٠٦ – ٠.٠٧ مل لحجم القذفة ومن ٢.٨٤ – ٥.٣٣ للحيوانات المنوية الحية. كان مدي القيم التربوية للصفات المدروسة لأمهات الذكور ٤.٥٩ –٥.٥١ لصفة الحركة التقدمية، من ٠.٨٩ - ١.٣٤ للحركة الموجية، من ٢.١٤-٢.٧٢ للحيوانات المنوية الميتة، من ٠.١٩ -٠.٣٦ لتركيز الحيوانات المنوية، من ٠.١٢ – ٤.٥٥ لدرجة الحموضة، من ٠.٠٤ – ٠.٠٦ مل لحجم القذفة ومن ٢.١٤ – ٢.٧٠ للحيوانات المنوية الحية.كان مدي القيم التربوية للصفات المدروسة لأباء الذكور ٣.١٧ – ٤.٣٩ لصفة الحركة التقدمية، من ٠.٣٩ - ٠.٨٤ للحركة الموجية، من ١.٣٧-٢.٢٤ للحيوانات المنوية الميتة، من ٠.١٨ -٠.٢٧ لتركيز الحيوانات المنوية، من ٠.٠٩ – ٣.١٧ لدرجة الحموضة، من ٠.٠٣ – ٠.٠٣ مل لحجم القذفة ومن ١.٣٧ – ٢.٢٤ للحيوانات المنوية الحية عند ٣٦، ٤٠، ٤٤ اسبوع من العمر.كان معظم معامل الارتباط الوراثى موجب ومعنوى وتراوحت مابين القيم المنخفضة والعالية.