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GENETIC EVALUATION FOR MILK AND SEMEN VARIABLES ON EGYPTIAN BUFFALOES

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ABSTRACT

2584 lactation records of Egyptian buffaloes calving between 1992 to 2010 kept at Natafe El Gadded farm were studied. Several variables Animal model (SVAM) was used. Milk variables are milk production (MP), days in milk (DM), and calving interval (CI) and semen quality are ejaculate volume (EV) life of sperm (LS) and total Motility (TM). The overall means of MP, LL, CI, EV, LS, and TM were 2025 kg, 203 d, 447 d, 3.25 ml, 65.91% and 58.40%, respectively. Heritabilities were 0.23, 0.13, 0.02, 0.08, 0.27 and 0.24, for milk production, lactation length, current calving interval, ejaculate volume, live of sperm and total motility, respectively. Genetic association among MP and each of DM and CI were positive and were 0.80, 0.04, respectively, while among DM and CI was negative (-0.54). Genetic association among EV and each of LS and TM were .04 and -0.03, respectively, while among LS and TM was (1.0). In conclusion, our findings provide useful information on the heritability of milk production, life of sperm and mass motility traits in Egyptian buffaloes and relationships among them and should assist in selection for improvement of milk yield and semen traits in Egyptian buffaloes and bulls.

Keywords: *Bubalus bubalis*, buffaloes, genetic evaluation, milk, semen, Egyptian buffaloes

INTRODUCTION

Productive traits such as milk yield and lactation length and semen variables such as volume, live of sperm and total motility and reproductive variables such as current calving interval in Egyptian buffaloes are affected by non-genetic and genetic effects. Heritability estimates for milk yield and semen variables are medium to high and ranged from 0.22 to 0.61 as reported by (Khattab *et al*., 2003; Khattab *et al*., 2023; Mourad and Khattan, 2009; El- Awady *et al*., 2021; Easa *et al*., 2023) on Egyptian buffaloes and Kumar *et al*. (2022) (0.289) on Murrah buffaloes. While heritability estimates for lactation length and current calving interval are low and ranged from 0.002 to 0.13 as found by Mourad and Khattab (2009), Helmy and Somida (2021); Khattab *et al.* (2023) with Egyptian buffaloes, and Vyas *et al.* (2021); Kumar *et al.* (2022) with Surti and Murrah

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buffaloes, respectively.

Therefore, the objective of this study was to estimate phenotypic and genetic parameters of milk and semen variables in Egyptian buffaloes. The results will help us better understand the genetic basis of milk and semen traits, contributing to their genetic improvement in Egyptian buffalo and bulls.

MATERIALS AND METHODS

Milk and semen variables of Egyptian buffaloes from 1992 to 2010 were obtained from El- Nataf El- Gedded station fitting to Animal Production Research Institute (APRI), Agriculture Research Center, Dokki, Giza, Egypt. A total of 2584 milk records of female buffaloes sired by 79 bulls and semen variables collected from 109 bulls were used. Milk variables studied are milk production (MP), days in milk (DM), and calving interval (CI). The semen variables studied are ejaculate volume (EV), live of sperm (LS) and total motility (TM). Semen was collected for each bull twice a week. El-Basuini (2010) explained the methods of calculated volume, life of sperm and total motility of sperm.

Several variables animal models (SVAM) according to Boldman *et al*. (1995) were used. For milk variables, the model contains the main effects of month and year of parturition and lactation order, and random effects of animals, uncorrelated random environmental and residual. For semen quality the model contains the main effect of month and year of collection, age of bull as a covariate and random effects of animals and residual.

RESULTS AND DISCUSSIONS

Arithmetic means, standard deviations, and coefficients of variation for different variable studied are presented in Table 1. Means of MP, DM and CI are 2025 kg, 203 d and 447 d, respectively. Means of MP and DM are lower than those found by Easa *et al*. (2022) with Egyptian buffaloes reported that the average MP and DM were 2260 kg and 271 d, respectively, while average CI was 587 d. On the other hand, Abu El- Naser (2020) with Egyptian buffaloes stated that the average MP and DM were 1547 kg and 189 d, respectively. Oz *et al*. (2022) with Anatolian buffaloes found that MP and LL were 1079 kg and 264 d. The bulls had an average semen volume of 3.25 ml, life of sperm of 65.91% and total motility of 58.40% (Table 1). The present means were in the range reported in Egyptian buffaloes by Abdel- Wanees and El-Basiuni (2018) (3.6 to 4.2 ml), (67.3 to 79.45) and (61.1 to 75.3%), respectively. The present meaning of EV was greater than those found by Kumar *et al*. (2023) (2.82 ml) with Murrah buffalo bulls. While the present means of LS and TM were lower that those stated by Dessouki (2005) with another herd of Egyptian buffalo bulls and being 81.5% and 80.3%, respectively. Large CV % for MP, DM, and EV (30.28 to 38.70%, Table 1), return to the great change among and females buffaloes and bulls for essential productive and fertility variables. The current estimates of CV% for MP, DM and CI are lower than obtained by Dalia El- Hedainy *et al*. (2020) and being 45, 33 and 26%, respectively. The variation among the current estimates and those stated by other published studies on different strains of buffaloes could be attributed to genetics, age and weight of females and bulls, herd management practices, herd size, feed quality, temperature of artificial vagina, calving season, and different

statistical models of analysis.

The Estimated of genetic parameters for milk and semen variables are presented in Table 1. The direct heritability estimates (h^2) for MP, DM, CI, EV, LS, and TM were 0.23±0.05, 0.13±0.02, 0.02±0.02, 0.08±0.03, 0.27±0.06 and 0.24±0.06, respectively (Table 1). All the estimates were significantly greater than zero as shown by the standard error of these estimates, except for calving interval (Table 1). Value of h^2 for MP was moderate (0.23) and similar to those reported by Khattab *et al*. (2023) (0.22) in Egyptian buffaloes; Kumar *et al*. (2022) (0.289) in Murrah buffaloes. While the present value was lower than those recorded by Khattab *et al*. (2003) (0.43) and Easa *et al*. (2022) (0.61) in Egyptian buffaloes. In contrast, the present value was higher than that reported by El- Awady *et al*. (2021) (0.39) worked on 1391 lactation records of Egyptian buffaloes. Heritability estimates for days in milk, current calving interval and volume of sperm was low and being 0.13, 0.02 and 0.08, respectively (Table 1) and indicate that a genetic selection for these traits is not expected to have a genetic response through a selection scheme in this population, it should depend mainly on improving managerial practices, controlled on heat stress and feeding system. Similarly, Mourad and Khattab (2009); Khattab *et al*. (2023) with Egyptian buffaloes, found that direct h^2 estimates for DM was 0.13 and 0.17, respectively. Helmy and Somida (2021); Easa *et al*. (2022) with Egyptian buffaloes, stated that h^2 estimates for CI were 0.002 and 0.09, respectively. In addition, Vyas *et al*. (2021) with Surti buffaloes, using different models, found that direct h^2 estimates for CI was zero. Kumar *et al*. (2022) with Murrah buffaloes, stated that h^2 estimates for LL was 0.144. Estimates of heritability for LS and TM were 0.27±0.06 and 0.24±0.06, respectively (Table 1). Similarly, Druet *et al*. (2009) with Holstein cows reported that heritability estimates for motility and livability were 0.43 and 0.21, respectively. Khattab *et al*. (2022) with Friesian bulls found that h^2 estimates for LS and TM were 0.29 and 0.33, respectively. The Medium values of h^2 for milk production, live of sperm and total motility, suggested that good opportunities do exist for improvement of milk yield and both livability and total motility of sperm by selection of female buffalo and bulls. While for lactation length, calving interval, and ejaculate volume of sperm a major part of these traits could be due to non- genetic factors. Therefore, improvement of these variables could be achieved by improving feeding and better management system.

Phenotypic and genetic associations among MP and LL were positive and highly significantly 0.94 and 0.80, respectively. Phenotypic and genetic association among MP and CI were 0.65 and 0.04, respectively, while phenotypic and genetic among LL and CI were 0.18 and -0.54, respectively (Table 1). These corrections suggested that selection for greater yielding buffaloes would cause a correlated increase in their lactation length and decrease calving interval. Similar results are reported by some authors worked on Egyptian buffaloes (Mourad and Khattab, 2009; Abu El- Naser 2020; Dalia El- Hedainy *et al*., 2020; Helmy and Somida, 2021 Easa *et al*., 2022) and, similar to Kumar *et al*. (2022) with Murrah buffaloes.

Phenotypic and genetic association among ejaculate volume and each of LS and TM were very low and ranged from -0.03 to 0.04 (Table 1), while phenotypic and genetic correlation among LS and TM were positive, highly significant and being 1.00 and 0.89, respectively (Table 1). These results concluded that the life of sperm and total motility are highly correlated with each other

Table 1. Means, standard deviation (SD), coefficients of variability (CV %), heritability estimates (h^2), genetic correlation (r_g) and phenotypic correlation (r_p) among different variables studied.

Variables	No.	Mean	SD	CV%	h^2
Milk production (MP), kg	2584	2025	613.13	30.28	0.23±0.05
Days in milk (DM), d	2584	203	61.31	30.28	0.13±0.02
Calving interval (CI), d	2584	447	101.98	22.81	0.02±0.02
Ejaculate volume (EV), ml	1149	3.25	1.25	38.70	0.08±0.03
Live sperm, % (LS)	1149	65.91	14.39	21.83	0.27±0.06
Total motility, % (TM)	1149	58.40	15.14	25.93	0.24±0.06
Genetic correlation (r_g)					
MP with DM	0.80±0.10				
MP with CI	0.04±0.40				
DM with CI	-0.54±0.35				
EV with LS	0.04±0.23				
EV with TM	-0.03±0.23				
LS with TM	1.00±0.01				
Phenotypic correlation (r_p)					
MP with DM	0.94				
MP with CI	0.65				
DM with CI	0.18				
EV with LS	0.04				
EV with TM	0.04				
LS with TM	0.89				

which make sense as these traits are biologically linked and selection of one variable will increase the other variable. The present results are similar to Khattab *et al*. (2022) with Friesian cows in Egypt found that EV and TS and TM were 0.037 and 0.22, respectively and genetic correlation between TS and TM was 0.88. The present results show that livability and motility of sperm are correlated traits and selection of one trait will increase the other trait. Kumar *et al*. (2023) arrived at the same results on Murrah buffaloes.

CONCLUSION

In this study we estimated the genetic parameters for milk and semen variable. The heritability for milk production, life of sperm and total motility were medium and ranged from 0.23 to 0.27, while for lactation length, current calving interval and volume of semen were low and ranged from 0.02 to 0.13. The present results indicating that genetic parameters for milk production, live of sperm and total motility can be considered during selection of buffalo bulls in breeding program,

while improvement of lactation length, calving interval and volume of sperm could be achieved by successful feeding and management system.

REFERENCES

Abdel- Wanees Gabr, A. and M.F. El- Basuini. 2018. Effect of Tonophosphan, Zinc Oxide, and ascorbic acid on semen, sexual desire, and the fertility rate of Egyptian buffalo bulls. *Annals of Agricultural Sciences*, **63**: 215-221. DOI: 10.1016/j.aoas.2018.12.001

Abul El- Naser, I. 2020. Direct and maternal genetic trends for some productive and reproductive traits in Egyptian buffaloes. *Jurnal Ilmu Ternak dan Veteriner*, **25**(1): 1-10. DOI: 10.14334/jitv.v25i1.2069

Boldman, K.G., L.A. Kriese, L.D. Van Vleck and S.D. Kachman. 1995. *A Manual for Use of MTDFREM, A Set of Programs to Obtain Estimates of Variance and Covariance*, Department of Agriculture, Research Services, USA. 114p.

Dalia, K.A. El- Hedainy, Kholood, A.K. Elbanhay, A.M.S. Amin, M.M.I. Salem, M.H. Hammoud and A.S.A. El-Barbary. 2020. Genetic trend for milk production and longevity traits of Egyptian buffalo. *Egyptian Journal of Animal Production*, **57**(3): 95-100. DOI: 10.21608/ejap.2020.121419

Dessouki, H.S.M. 2005. *Determination of plasma membrane, Integrity and acrosomal damage of Egyptian buffalo spermatozoa in relation to freezing and type of extender.* M.Sc., Thesis, Faculty of Agriculture, Cairo University, Egypt.

Druet, T., S. Fritz, E. Sekkem, B. Basso, O. Gerard, L. Salas Cortes, P. Humblot, X. Druart and A. Eggen. 2009. Estimation of genetic parameters and genome scan for 15 semen characteristics traits of Holstein bulls. *J. Aim. Breed. Genet.*, **126**(4): 269-277. DOI: 10.1111/j.1439-0388.2008.00788.x

El- Basuini, M.F. 2010. *Genetic evaluation for semen traits on buffalo bulls*. M.Sc., Thesis, Faculty of Agriculture, Tanta University, Egypt.

Helmy, A.A.H. and R.A.M. Somida. 2021. Genetic parameters for some reproductive traits in Egyptian buffaloes. *Egyptian Journal of Animal Production*, **58**(2): 57-61. DOI: 10.21608/ejap.2021.67104.1011

Easa, A.A., A.H. Abdel-Aziz, A.S. El-Barbary, N.M. Kostomakhin, M.A.F. Nasr and T.A. Imbabi. 2022. Genetic parameters of production and reproduction traits of Egyptian buffaloes under subtropical conditions. *Trop. Anim. Health Prod.*, **45**(5): 270. DOI: 10.1007/s11250-022-03251-2

El-Awady, H.G., A.F. Ibrahim and I.A.M. Abu El-Naser. 2021. The effect of age at first calving on productive life and lifetime profit in lactating Egyptian buffaloes. *Buffalo Bull.*, **40**(1): 71-85. Available on: https://kukrdb.lib.ku.ac.th/journal/BuffaloBulletin/search_detail/result/408327

Khattab, A.S., H.G. El Awady, M.N. El Arian and K.A. Mourad. 2003. Genetic analysis of some performance traits using an animal model in a herd of Egyptian buffaloes. *Egyptian Journal of Animal Production*, **40**(1): 15-26. DOI: 10.21608/EJAP.2003.107036

Khattab, A.S., A.S. Adenaike, S.M. El- Komy, H.M. El Genedy, S.O. Peters and A.M. Hussein. 2022. Genetic evaluation of semen traits in Friesian bulls raised in Egypt. *Theriogenology*, **179**: 39-44. DOI: 10.1016/j.

theriogenology2021.11.011

Khattab, A.S., S.O. Peters, A.S. Adenaike, A. Amal El Sawy, S.S. Sanad, A.S. El- Barbary and A.K. Thiruvenkadan. 2023. A comparison of several Methodologies of selection index for productive and reproductive characteristics in Egyptian buffaloes. *Trop. Anim. Health Prod*., **55**(3): 200. DOI: 101007/s11250-023-03625-0

Kumar, A., V. Vonta, U. Verma and U. Singh. 2022. Estimates of genetic parameters for production and reproduction traits in Murrah buffaloes (Riverine buffalo) in India. *Buffalo Bull*., **41**(1): 135-141. DOI: 10.56825/bufbu.2022.4113396

Kumar, D., J.S. Mehta, A. Jerome, P. Kumar, D. Kumar, B. Shivani, C.S. Patil, R. Bala, N. Verma, S. Nain, R.K. Sharma and P. Singh. 2023. Genetic analysis for semen quality traits in buffalo bulls. *Trop. Anim. Health Prod*., **55**(5): 313. DOI: 10.1007/s11250-023-03756-4

Mourad, K.A. and A.S. Khattab. 2009. A comparison between different selection indices for some productive traits on Egyptian buffaloes. *Archiv fur Tierzucht*, **52**(5): 476-484. DOI: 10.5194/aab-52-476-2009

Oz, S., K. Alkoyak and S. Kucukersan. 2022. Effects of calving year, season, and age on some lactations of Anatolian buffaloes reared at farmer conditions in Turkey, *Ankara Univ. Vet. Fak*., **69**: 157-162. DOI: 10.33988/auvfd.813234

Vyas, P., U. Pannu, M. Gaur and P. Joshi. 2021. Genetic evaluation of Surti buffalo on the basis of reproduction traits by all repeatability univariate models of WOMAT. *Buffalo. Bull*., **40**(3): 409-418. Available on: https://kukrdb.lib.ku.ac.th/journal/BuffaloBulletin/search_detail/result/412864