ISSN 1682-8356
ansinet.org/ijps

INTERNATIONAL JOURNAL OF

POULTRY SCIENCE

ANSInet
308 Lasani Town, Sargodha Road, Faisalabad - Pakistan
Mob: +92 300 3008585, Fax: +92 41 8815544
E-mail: editorijps@gmail.com

International Journal of Poultry Science 7 (12): 1200-1203, 2008
ISSN 1682-8356

Determination of Gonadal Sperm/Spermatid Reserves in Shikabrown Breeder Cocks

J.A. Obidi[1], B.I. Onyeanusi[2], J.O. Ayo[1], P.I. Rekwot[1] and T. Dzenda[1]
[1]Department of Veterinary Physiology and Pharmacology, [2]Department of Veterinary Anatomy,
Ahmadu Bello University, Zaria, Nigeria

Abstract: The objective of this study was to determine gonadal sperm/spermatid reserves in Shikabrown breeder cocks. Five cocks, each of Shikabrown White and Shikabrown Red, were slaughtered after one year of evaluation of seminal characteristics. To determine testicular integrity of the breeder cocks, left and right testes from each slaughtered samples were carefully dissected out of the abdomen and marked accordingly. Each testis weight, length and volume were measured, followed by the determination of gonadal sperm/spermatid reserves. The mean testicular lengths for Shikabrown White were 4.22±0.03cm and 3.98±0.04cm for the right and left testes, respectively; while that for Shikabrown Red were 4.40±0.1cm and 4.44±0.09cm for right and left testes, respectively. The mean testicular weight of Shikabrown Red cocks was significantly ($P < 0.01$) higher than that of Shikabrown White cocks (12.39±0.76g and 10.23±0.25g, respectively). The mean gonadal sperm/spermatid reserves (x 10^9 per ml testis) for the right testes in Shikabrown White and Shikabrown Red cocks were 57.6±5.6 and 103.2±22.3 ($P < 0.01$), respectively, while those of the left testes were 84.8±18.2 and 209.4±95.1, respectively. The left mean gonadal sperm/spermatid reserves in Shikabrown Red strain was statistically ($P < 0.01$) higher than Shikabrown White strain. This study suggests: I) that there are strain differences in testicular function of the breeder cocks and ii) that there are differences in spermatogenic capacity between the right and left testes in breeder cocks.

Key words: Determination, gonadal, sperm/spermatid, shikabrown, breeder cocks

INTRODUCTION

The growth and development of the testes in Farm animals have been well documented by many workers (Lake, 1971; Rekwot *et al*., 1987; Etches, 1996; Rozenboim *et al*., 1990). Testicular development in domestic animals has also been related to their short and long-term reproductive functions (Wilson *et al*., 1965; Romero-Sanchez *et al*., 2007) which is reported to be under genetic control (Barbato, 1999).

Photoperiodic (Umeda *et al*., 1992) and nutritional (Omole, 1982; Lisowski and Bednarczyk, 2005; Romero-Sanchez *et al*., 2007) influences; gonadal development and spermatogenesis (Rekwot *et al*., 1987; Penfold *et al*., 2000), have been reported to be under endocrine (hormonal) pulses. The combined influences of these important control factors may result ultimately in enhancing or inhibiting reproductive efficiency in the male, depending on the balance between the negative and positive control factors.

The testes are the biological industry in male species involved in spermatogenesis and hormonal secretion. Adequate knowledge of the ability of the testes to produce sperm cells is essential in poultry breeding. Osinowo *et al*. (1981) and Togun and Egbunike (2006) reported that testis size is a good indicator of the present and future sperm production in bulls. They further observed that the knowledge of basic morphometric characteristics of reproductive organs is of great value in breeding, soundness assessment and potential fertility in Bunaji breeding bulls.

Shikabrown breeder stock is a heavy breed brown-egg layer, developed at the National Animal Production Research Institute, Ahmadu Bello University, Shika-Zaria. It is hardy and highly adapted to the harsh tropical environment with a high genetic (reproductive) potential that is acceptable for commercial production. There is a paucity of information in the available literature on the morphometric characteristics of reproductive organs and predictive reproductive efficiency in poultry breeds of chickens, including the Shikabrown breeder cocks.

Therefore, the aim of the present study was to quantify some testicular parameters involved in evaluation of semen quality as a predictive measure of reproductive efficiency (fertility) of Shikabrown breeder cocks.

MATERIALS AND METHODS

Experimental cocks: The experimental cocks comprised 20 each of Shikabrown White and Shikabrown Red breeders, maintained at the Poultry Breeding Unit of National Animal Production Research Institute, Ahmadu Bello University, Zaria, Nigeria.

Management system: The birds were fed *ad libitum* on breeder's mash, containing 17% crude protein. Water was also provided *ad libitum*, while all the necessary

vaccines and veterinary health care were given as recommended. Weekly live weights of cocks were taken using a weighing scale.

Semen collection: Cocks were subjected to weekly semen collection for 12 months. Semen was obtained by gentle massage (stroking) of the back feathers; the abdomen being massaged towards the tail with the other hand according to the method of Lake and Stewart (1978). Each ejaculate was evaluated for volume, motility, concentration, percent total abnormality and percent dead, to determine the effects of season on the seminal parameters.

Determination of gonadal sperm/spermatid reserves: At the end of the seasonal evaluation investigation, five cocks each of the Shikabrown White and Shikabrown Red were randomly selected from the experimental cocks. They were slaughtered to determine their gonadal sperm/spermatid reserves; that is, their integrity to support gonadal functions. The two testes of each of the 10 cocks were carefully removed and labeled for proper identification. The weight, length and volume of each testis were determined. The determination of sperm and spermatid reserves was done according to the standard method of Igboeli and Rakha (1971) and Rekwot *et al.* (1994).

Briefly, each testis was homogenized in 20ml of saline with antibiotic and centrifuged for about two minutes. The homogenate volume, after rinsing the blender container with 50ml of saline and adding the effluent, was measured. About 5ml of the homogenate was transferred to a conical flask and further dilution was made with 30ml of saline and the homogenate was stored overnight at 5°C to allow sperm cells to ooze out of the tissues. Finally, the gonadal sperm/spermatid concentration was determined with a haemocytometer according to the method of Coles (1974). The concentration of spermatozoa was determined using the erythrocyte counting chamber of a haemocytometer that was crossed with microscopic grids containing small squares.

Sperm cells and spermatids were counted diagonally from top left to bottom right in five large squares according to the method of Rekwot *et al.* (1994).

RESULTS

The results of the gonadal sperm/spermatid reserves are presented in Table 1 and Figs. 1-3. The mean testicular lengths for the Shikabrown White cocks were 4.22±0.03cm and 3.98±0.04cm for the right and left testes, respectively. The mean testicular lengths for the Shikabrown Red breeder cocks were 4.40±0.1cm and 4.44±0.09cm for the right and left testes, respectively. There was no significant ($P > 0.05$) difference between the right testicular lengths of the White and Red breeder cock strains, but there was a high significant ($P < 0.01$) difference between the left testicular lengths with an average of 3.98±0.4cm and 4.44±0.09cm for the Shikabrown White and Shikabrown Red, respectively.

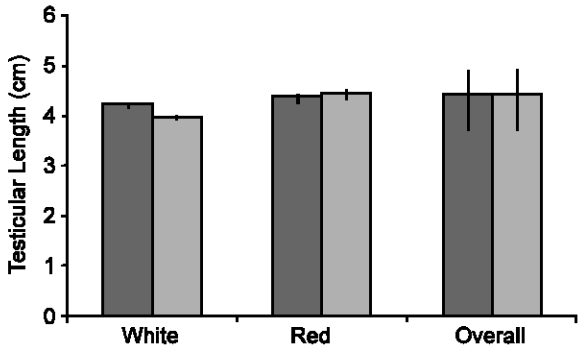

Fig. 1: Right and Left Testicular Lengths in Shikabrown Breeder Cocks

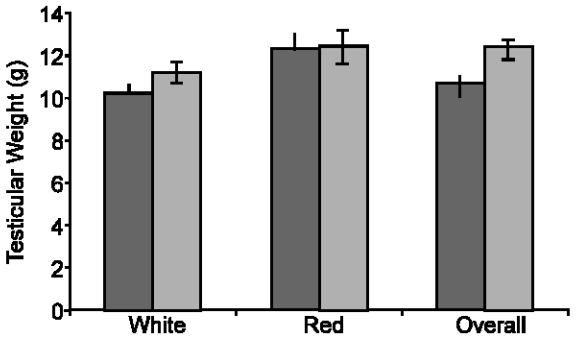

Fig. 2: Right and Left Testicular Weights in Shikabrown Breeder Cocks

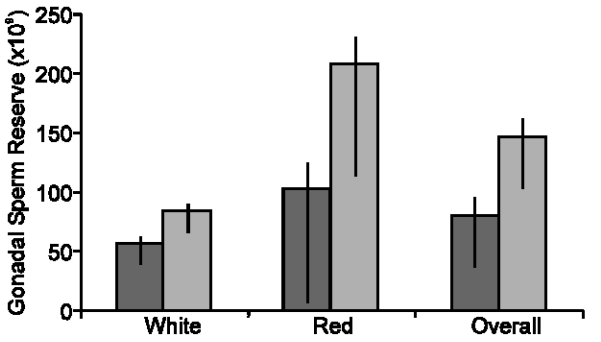

Fig. 3: Right and Left Testicular Gonadal Sperm Reserves

There was no statistical difference ($P > 0.05$) between the overall means in testicular lengths in both strains. The right testicular weights of Shikabrown White and Shikabrown Red cocks were significantly ($P < 0.01$) different. The mean right testicular weight of Shikabrown Red breeder cocks was higher than that of Shikabrown White cocks (12.40±0.08g and 10.23±0.25g,

Table 1: Gonadal Sperm and Spermatid Reserves of Shikabrown Breeder Cocks (Mean±SEM)

Parameter	Shikabrown White	Shikabrown Red	Overall Mean (SEM)
Testicular Length (cm)			
Right Testes	4.22±0.03[a]	4.40±0.1[a]	4.41±0.5
Left Testes	3.98±0.04[a]	4.44±0.09[b]	4.42±0.7
Testicular Weight (g)			
Right Testes	10.23±0.5[a]	12.39±0.76[b]	10.74±0.4
Left Testes	11.25±0.5[c]	12.456±0.8[c]	12.42±0.55
Gonadal Sperm Reserves (x 10^9)			
Right Testes	57.6±5.6[a]	103.2±22.3[a]	80.40±16.1
Left Testes	84.8±18.2[a]	209.4±95.1[b]	147.1±44.0

Within same strain, means with different superscript alphabets are significantly ($P < 0.05$) different.

respectively). The mean weights of the left testes in both strains of breeder cocks were also statistically ($P < 0.01$) different.

However, there was no statistical difference ($P > 0.05$) between the overall means of the right and left testes in both strains. The gonadal sperm/spermatid reserves for the right testes in Shikabrown White and Shikabrown Red cocks were 57.6±5.6 x 10^9 and 103.2±22.3 x 10^9/g testis ($P < 0.01$), respectively, while those of the left testes were 84.8±18.2 x 10^9 and 209.4±95.1 x 10^9/g testis ($P < 0.01$), respectively.

The mean gonadal sperm/spermatid reserves in the right testis of the Shikabrown White breeder cocks were significantly ($P < 0.01$) different from those of the left testes, with the left having higher reserves. Similarly, the mean gonadal sperm/spermatid reserves in the right testes of Shikabrown Red strain were significantly ($P < 0.01$) different (Table 1). There was a significant ($P < 0.01$) difference between strains in this parameter, with higher values in the Red strain than the White (57.6±5.6 x 10^9 and 103.2±22.3 x 10^9/g testis), in Shikabrown White and Shikabrown Red, respectively.

Furthermore, the mean gonadal sperm/spermatid reserves in the left testis in Shikabrown Red were significantly ($P < 0.01$) higher than those of Shikabrown White (209.4±95.1 x 10^9 and 84.8±18.2 x 10^9/g testis), respectively.

The difference between the overall mean gonadal sperm/spermatid reserves of the right and left testes in both strains was highly significant ($P < 0.01$) (Table 1).

DISCUSSION

The results of the gonadal sperm/spermatid reserves for the two strains of Shikabrown breeder cocks showed a significant ($P < 0.05$) variation between the left and right testicular weights, with the former being heavier than the latter in both strains (Table 1). This observation corroborates the findings of Etches (1996), who reported a higher weight in the left testis of Plymouth Rock breeder cocks. The report of Thurston and Korn (2000) in the turkey tom also supports the finding of the present study. Testicular weights have been reported to have a high correlation with sperm reserves in the testes or epididymis and this is a direct reflection of testicular integrity for sperm production (Osinowo *et al*., 1981; Adeyemo *et al*., 2007). Paired mean testes weight reported by Adeyemo *et al*. (2007) as 5.72±2.43g for Isa brown cocks was significantly lower than the overall paired mean testes value of 11.60±0.5g observed in this study. This difference may be attributed to two important reasons.

First, the ages at which this parameter was determined, which is 18 weeks in Isa brown cocks and 22 months in the Shikabrown cocks, were relatively far apart. The influence of age has been reported on testicular integrity. Secondly, the observed variation may also be influenced by genetic factors. The influences of these factors on testicular development in domestic animals have been well documented (Osinowo *et al*., 1981; Lustra *et al*., 1978; Rekwot *et al*., 1987; Togun and Egbunike, 2006). However, paired mean testes weight in Shikabrown cocks in the present study is within the limit reported by Lake (1971) for optimum fertility (Table 1). The present study showed a significant variation in gonadal sperm/spermatid reserves in Shikabrown breeder cocks. In both strains, the left testicular reserves were significantly ($P < 0.01$) higher than the right. It is worthy to note that Adeyemo *et al*. (2007) have reported a high correlation between testicular mass and sperm reserves and this is in agreement with the present study. The higher left gonadal sperm/spermatid reserves may be due to a higher proportion of sertoli cells and seminiferous tubules which have been reported to be responsible for initiation and sustenance of spermatogenesis (Adeyemo *et al*., 2007).

Conclusion: It is concluded that there are strain differences in testicular function of breeder cocks and also in spermatogenic capacity between the right and left testes in breeder cocks. It is imperative, however, that further research be conducted to improve on the reproductive capability of Shikabrown breeder cocks in our environment.

REFERENCES

Adeyemo, G.O., O.G. Longe and D.O. Adejumo, 2007. The reproductive performance of breeder cocks fed cotton seed cake-based diets. Int. J. Poult. Sci., 6: 140-144.

Barbato, G.F., 1999. Genetic relationships between selection for growth and reproductive effectiveness. Poultry Science, 78: 444-452.

Coles, E.H., 1974. Veterinary clinical pathology. Saunders, Philadephia, 2nd Ed., pp: 31-131.

Etches, R.J., 1996. Biotechnology and genetic improvement of poultry: Proceedings of the 11th World's Poultry Progress, New Delhi, 1: 295-304.

Igboeli, G. and A.M. Rakha, 1971. Puberty and related phenomena in Angoni (Short horned Zebu) bulls. J. Anim. Sci., 38: 647-650.

Lake, P.E., 1971. The male in reproduction. In: Physiology and Biochemistry of the Domestic Fowl. D.J. Bell and B.M. Freeman (eds.), 3: 1411-1447.

Lake, P.E. and J.M. Stewart, 1978. Artificial insemination in poultry. Bulletin, Ministry of Agriculture, Fisheries and Food, No. 213.

Lisowski, M. and J. Bednarczyk, 2005. Effects of tamoxifen dose and nutrition schem during growth on stimulation of the reproductive system in Cornish breed cocks. Folia biologica (Krakow), 53: 1-6.

Lustra, D.D., J.J. Ford and S.E. Echternkamp, 1978. Puberty in beef bulls: hormone concentrations, growth, testicular development, sperm production and sexual aggressiveness in bulls of different breeds. J. Anim. Sci., 49: 1012-1020.

Omole, T.A., 1982. The effects of levels of dietary protein on growth and reproductive performance in rabbits. J. Appl. Rabbit Res., 52: 83-88.

Osinowo, E.O., E.C. Molokwu and D.C. Osori, 1981. Growth and testicular Development in Bunaji Bulls. J. Anim. Resources, 16: 55-67.

Penfold, L.M., D.E. Wildt, T.L. Herzog, W. Lynch, L. Ware, S.E. Derrickson and S.L. Monfort, 2000. Seasonal patterns of LH, testosterone and semen quality in the Northern Pintail duck. Reproductive Fertility Development, 12: 229-235.

Rekwot, P.I., O.S. Lamidi, A.M. Adamu, C.U. Egbuedo, J.S. Ruwaan and S.N. Okereke, 1987. Reproductive performance of Bunaji bulls grazing natural pasture and receiving supplements containing palm kernel meal. Nig. Vet. J., 18: 26-36.

Rekwot, P.I., E.O. Oyedipe and G.W. Ehoche, 1994. The effects of feed restriction and realimentation on the growth and reproductive function of Bokoloji bulls. Theriogenology, 42: 287-295.

Romero-Sanchez, H., P.W. Plumstead and J. Brake, 2007. Feeding broiler breeder males. 1. Effect of feeding program and dietary crude protein during rearing on body weight and fertility of broiler breeder males. Poultry Science, 86: 168-174.

Romero-Sanchez, H., P.W. Plumstead, N. Leksrisornpong and J. Brake, 2007. Poultry Science, 86: 175-181.

Rozenboim, I., B. Robinzin, E. Amon and N. Snapir, 1990. The effect of tamoxifen on Semen fertilization capacity in White Leghorn male chicks. Poultry Science, 69: 1220-1222.

Thurston, R.J. and N. Korn, 2000. Analysis of semen quality of a turkey with a duplicated cloacae and vent. Avian Diseases, 44: 1007-1011.

Togun, V.A. and G.N. Egbunike, 2006. Seasonal variations in the sperm production characteristics of Zebu (White Fulani) cattle genitalia in the humid tropical environment. Middle-East J. Sci. Resources, 1: In press.

Umeda, I.H., H. Hayakawa, S. Kamiya and Y. Tanabe, 1992. Novel lighting systems stimulating gonadal development and expediting sexual maturity of male and female chickens. Am. J. Anim. Sci., 6: 127-132.

Wilson, H.R., P.W. Waldroup, J.E. Jones, D.J. Duerre and R.H. Harms, 1965. Protein levels in growing diets and reproductive performance of cockerels. J. Nutr., 85: 29-37.