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Research Paper

Semen Quality of Two Breeds of Toms Subjected to Different Ejaculation Frequencies

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ABSTRACT

A study was carried out at the Department of Animal Science Research Farm, University of Nigeria, Nsukka to investigate the effect of frequency of ejaculation (once bi-weekly, once, twice and thrice per week) on semen quality of local and exotic breeds of toms. A total of sixteen turkeys comprising 8 exotic toms and 8 local toms, at 30 weeks of age, were used for the study. The results showed that progressive motility, sperm concentration, live sperm and normal sperm were highly significantly (P<0.01) higher in local than exotic toms, values being 67.61 + 4.24 vs 44.05 +4.24%, 8.34 + 1.52 vs 6.48 + 0.92 × 109 ,82.61 + 4.55 vs 66.43 + 5.70% and 78.46 + 4.36 vs 62.61 + 5.38% respectively. Semen volume and total sperm in ejaculate were highly significantly (P<0.01) higher in exotic than local toms, values being 0.47 + 0.02 vs 0.32 + 0.01ml and 2.95 + 0.39 vs 2.06 + 0.18× 109 respectively. The interaction of breeds and frequency of ejaculation favored (P<0.01) the local toms at once bi-weekly and thrice weekly collection frequencies. It was concluded that once bi-weekly or thrice weekly collection frequencies could be used in any artificial insemination protocol to further select the Nigerian local turkey for improved egg and/or meat production.

KEYWORDS: semen, breeds, turkeys, toms, ejaculation frequency

Introduction

Poultry production remains a surest and fastest means of bridging the animal protein supply needs of any nation especially for countries like Nigeria where animal protein intake per caput is grossly inadequate. This is because of its rapid turn-over due to the inherent short generational interval. Obioha (1992) reported that the use of local chicken in commercial poultry does not make any economic sense as a result of the absence of valuable economic traits in the local chicken. However, it is interesting to note that they possess survival traits, which probably are an adaptation to the harsh tropical environment (Machebe and Ezekwe, 2002).

Turkey production occupies an important position next to chicken and guinea fowl in playing a significant role in augmenting the economic and nutritional status of the Nigerian human population. The Nigerian Local breed of turkey is fastly gaining ground as source of meat and egg amongst several poultry farmers in Nigeria. Generally, turkeys have a myriad of fertility problems. This is because of the low fertility in toms resulting from unsuccessful mating as a consequence of large heavily muscled body size or reduced libido (Burke, 1984) and the high rate of non-fecundity of tom semen (King *et al.,* 2000). Artificial insemination is one of the most effective and widely used techniques for the genetic improvement of farm animals. Artificial insemination is employed on breeder farms to maintain the maximum use of males, as well as to ensure disease prevention, high fertility rates and for economic reasons. Artificial insemination is also carried out when natural mating is impossible in genetically improved animals due to differences in body size (Sexton, 1984). Zahradden *et al*, (2005) reported that artificial insemination is a vital tool for rapid improvement of infertility in turkey by allowing maximum use of the best toms on numerous hens.

In developed countries artificial insemination is used widely in turkey improvement. According to Bakst and Cecil (1989), the success of artificial insemination in the propagation of animal species is directly dependent on the quality of collected semen which is affected by numerous factors. Spermatological evaluation is essential before artificial insemination in order to ascertain the quality of ejaculates to be used.

To make turkey farming contribute meaningfully to the animal protein needs of Nigeria it is very necessary that the local breed of turkey which has shown high adaptation to the harsh environment be made to be a good candidate for artificial insemination. A starting point is to ascertain the seminal characteristics when subjected to different ejaculation frequencies. Zahradden *et al*, (2005) observed that assessment of the semen quality characteristics of poultry species gives an excellent indicator of their reproductive potentials and is a sine qua non to effective artificial insemination programmes. These researchers reported that breed differences exist with respect to frequency of ejaculation with sperm concentration decreasing progressively with increase in frequency of ejaculation. The need to document the effect of breed and ejaculation frequency on semen characteristics of the exotic and local breeds of toms in Nigeria is the research drive that necessitated the present study.

Materials and Methods

Location: The study was carried out in the Poultry Unit of the Department of Animal Science Teaching and Research Farm, University of Nigeria, Nsukka. Geographical coordinates of Nsukka reveals that Nsukka lies within latitude 6o 511 211 N and longitude 7o 231 331 E and is 447m above sea level (www.dateandtime.info). The climate of the study area is typically tropical, with relative humidity ranging from 55-85% with mean daily temperature of 20.0oC – 23.9oC and maximum ranges of 29.5oC – 34.9oC. The rainy season of Nsukka is between April to October and dry season between November - March with annual rainfall range of 1600-1700mm (www.worldweatheronline.com).

Experimental Animals and Care: A total of 16 turkeys comprising eight (8) exotic toms, eight (8) local toms were used for the study. The exotic toms were sourced from Obasanjo farms at Ogun state while the local toms were sourced from a commercial farm at Ekwulobia, Anambra state, all at 20 weeks of age.

The turkeys were reared together in well-ventilated netted pens and fed a breeder diet containing 17% Crude Protein. Water was provided *ad libitum* and routine vaccinations were carried out.

Data Collection: Two toms were randomly assigned to each of the four frequencies of semen collection (once every 2 weeks; once, twice and thrice a week) in a Randomized Complete Block Design. Semen was collected using the abdominal massage technique as described by Burrows and Quinn (1937).

Semen quality traits with respect to volume, motility, live and normal

spermatozoa, concentration and total sperm in ejaculate were evaluated. Data were generated over a period of two months.

Data Analysis: Data collected were subjected to Analysis of Variance (ANOVA) for a Two-Way Classification (more than one observation/cell) using the model described by Obi (2002) and using SPSS package (2003) windows version 8.0.

Results and Discussion: The seminal characteristics of the two breeds of toms under different ejaculation frequencies based on the following indices: semen volume, progressive motility, semen concentration, live sperm, normal sperm, and total sperm in ejaculate are shown in Tables 1 and 2 below.

Table 1: Effect of breed of tom and frequency of ejaculation on semen quality traits

Parameters	Breed	Ejaculation	Frequencies			Overall Mean
		1BW	1W	2W	3W	
SV (ml)	Exotic	0.45 ± 0.02^{ab}	0.38 ± 0.03^{ab}	0.54 ± 0.02^{a}	0.49 ± 0.02^{ab}	0.47 ± 0.02**
	Local	0.37 ± 0.01^{a}	0.28 ± 0.02^{b}	0.30 ± 0.02^{b}	0.34 ± 0.01^{ab}	0.32 ± 0.01*
	Overall	0.41 ± 0.03^{NS}	0.33 ± 0.02*	0.42 ± 0.02**	0.42 ± 0.02**	
PM (%)	Exotic	75.88 ± 1.08^{a}	24.06 ± 6.28^{b}	74.06 ± 1.72^{a}	75.88 ± 1.08^{b}	44.05 ± 4.24**
	Local	84.00 ± 1.24^{ab}	23.75 ± 6.17^{c}	76.25 ± 1.25^{b}	84.00 ± 1.24^{a}	67.61 ± 4.24**
	Overall	79.94 ± 1.32**	23.19 ± 4.33^{NS}	75.16 ± 1.07^{NS}	79.94 ± 1.32**	
SC (x 10^9)	Exotic	13.00 ± 0.85^{a}	3.94 ± 2.44^{b}	10.50 ± 0.39^{a}	13.00 ± 0.85^{b}	6.48 ± 0.92**
	Local	4.50 ± 0.78^{b}	3.94 ± 2.44	13.00 ± 4.47	4.50 ± 0.78^{a}	8.34 ± 1.52^{NS}
	Overall	8.75 ± 1.23**	3.94 ± 1.69^{NS}	11.75 ± 2.22^{NS}	8.75 ± 1.23**	
LS (%)	Exotic	82.75 ± 1.51^{ab}	46.75 ± 12.07^{b}	96.50 ± 0.29^{a}	47.88 ± 12.36^{ab}	66.43 ± 5.70**
	Local	97.00 ± 0.38^{a}	47.00 ± 12.14^{b}	96.50 ± 0.18^{a}	97.13 ± 0.22^{a}	82.61 ± 4.55**
	Overall	89.88 ± 1.99**	46.87 ± 8.42^{NS}	96.50 ± 0.17^{NS}	72.50 ± 7.52**	
NS (%)	Exotic	94.25 ± 0.37^{a}	41.00 ± 10.59^{b}	90.81 ± 0.29^{a}	40.19 ± 10.38^{b}	62.61 ± 5.38**
	Local	96.13 ± 0.23^{a}	41.00 ± 10.59^{b}	91.06 ± 0.29^{a}	94.45 ± 0.41^{a}	78.46 ± 4.36**
	Overall	95.19 ± 0.32**	41.00 ± 7.37^{NS}	90.94 ± 0.21^{NS}	67.34 ± 7.06**	
TS (x 10^9)	Exotic	6.50 ± 1.04^{a}	0.72 ± 0.20^{b}	5.53 ± 0.39^{a}	0.83 ± 0.24^{b}	2.95 ± 0.39**
	Local	1.67 ± 0.30^{bc}	0.42 ± 0.13^{d}	2.59 ± 0.18^{b}	3.37 ± 0.18^{a}	2.06 ± 0.18**
	Overall	4.08 ± 0.81**	0.57 ± 0.12*	4.06 ± 0.34**	2.10 ± 0.27**	

[abc]Means with different superscripts in rows and columns for different traits are significant (P<0.01; P<0.05). **: statistically significant at 0.01 level; *: statistically significant at 0.05 level; NS – not significant.

Key: SV – semen volume; PM – progressive motility; SC – sperm concentration; LS – live sperm; NS – normal sperm; TS – total sperm in ejaculate.

Table 2: Interaction effects of breed and frequencies of ejaculation (BxF) on semen quality traits

	Breed x	Frequency of	Ejaculation (1BW)
Semen Traits	Exotic	Local	LOS
Semen volume (ml)	0.45±0.05	0.37±0.01	NS
Progressive motility (%)	75.88 ± 1.08^{b}	84.00 ± 1.24^{a}	**
Sperm concentration `($x10^9$/ml)	13.00 ± 0.85^{a}	4.50 ± 0.78^{b}	**
Live spermatozoa (%)	82.75 ± 1.51^{b}	97.00 ± 038^{a}	**
Normal spermatozoa (%)	94.25 ± 0.37^{b}	96.13 ± 0.23^{a}	**
Total sperm in ejac. ($x10^9$)	6.50 ± 1.04^{a}	1.67 ± 0.30^{b}	**
	Breed x	Frequency of	Ejaculation (1W)
Semen Traits	Exotic	Local	LOS
Semen volume (ml)	0.38 ± 0.03^{a}	0.28 ± 0.02^{b}	*
Progressive motility (%)	24.06±6.28	23.75±6.17	NS
Sperm concentration ($x10^9$/ml)	3.94±2.44	3.94±2.44	NS
Live spermatozoa (%)	46.75±12.07	47.00±12.14	NS
Normal spermatozoa (%)	41.00±10.59	41.00±10.59	NS
Total sperm in ejac. ($x10^9$)	0.72 ± 0.20^{a}	0.42 ± 0.13^{b}	*
	Breed x	Frequency of	Ejaculation (2W)
Semen Traits	Exotic	Local	LOS
Semen volume (ml)	0.54 ± 0.02^{a}	0.30 ± 0.02^{b}	**
Progressive motility (%)	74.06±1.72	76.25±1.25	NS
Sperm concentration ($x10^9$/ml)	10.50±0.39	13.00±4.47	NS
Live spermatozoa (%)	96.50±0.29	96.50±0.18	NS
Normal spermatozoa (%)	90.81±0.29	91.06±0.29	NS
Total sperm in ejac. ($x10^9$)	5.53 ± 0.24^{a}	2.59 ± 0.18^{b}	**
	Breed x	Frequency of	Ejaculation (3W)
Semen Traits	Exotic	Local	LOS
Semen volume (ml)	0.49 ± 0.02^{a}	0.34 ± 0.01^{b}	**
Progressive motility (%)	18.13 ± 4.72^{b}	94.63 ± 0.65^{a}	**
Sperm concentration ($x10^9$/ml)	1.75 ± 0.46^{b}	10.00 ± 0.29^{a}	**
Live spermatozoa (%)	47.88 ± 12.36^{b}	97.13 ± 0.22^{a}	**
Normal spermatozoa (%)	40.19 ± 10.38^{b}	94.50 ± 0.41^{a}	**
Total sperm in ejac. ($x10^9$)	0.83 ± 0.24^{b}	3.37 ± 0.18^{a}	**

[ab] Means with different superscripts in rows for different traits are significant (*p<0.05; **p<0.01). NS=Not significant. LOS=Level of significance. 1W=once bi-weekly; 2W=twice weekly; 3W=thrice weekly; 1BW=once bi-weekly.

Twice weekly collection frequency favored the exotic toms in semen volume with the value (0.54±0.02ml) though not statistically different (P>0.01) from the volumes recorded in the once, thrice weekly and once bi-weekly ejaculation frequencies. A different level of significance occurred in the local toms (P<0.05) with the toms under once bi-weekly ejaculation frequency yielding the highest volume which is significantly (P<0.05) different from toms in once and twice weekly ejaculation frequencies but not significantly different (P>0.05) from toms in thrice weekly ejaculation frequency. The results of the exotic toms are in

agreement with those of Zahraddeen *et al.,* (2005) who recorded the highest volume (0.35±0.03) under twice weekly ejaculation frequency. This result rather disagrees with those of Noirault and Brillard (1999) who reported a progressive decrease in semen volume with increasing frequency of semen collection. The differences in semen volume of the two breeds of toms-local and exotic under the same ejaculation frequency agrees with the report of Zahraddeen *et al.,* (2005) that breed differences exist with respect to frequency of ejaculation. Equally, the higher semen volumes recorded in the exotic toms over the local toms is in agreement with the findings of the above researcher.

The percentage progressive motility highest value of 75.88±1.08% for exotic toms was recorded under once bi-weekly collection frequency though not significantly (P>0.01) different from toms under twice weekly collection frequency but with both being highly significantly (P<0.01) different from toms under once and thrice weekly collection frequencies. In the local toms, toms under thrice weekly ejaculation frequency had the highest value in progressive motility (94.63±0.65%) which did not differ (P>0.01) significantly from those in twice weekly collection frequency but with both being highly significantly (P<0.01) different from toms in once weekly collection frequency. The higher values in percentage progressive motility of local toms over exotic toms agrees with the findings of Ramamurthy *et al.,* (1989) who reported a negative correlation between body weight and motility in poultry. The results of this study are however not in agreement with those of Zahraddeen *et al.,* (2005) who reported no significant effect of ejaculation frequency on sperm motility.

Sperm concentration was highly significantly (P<0.01) affected by frequency of semen collection in exotic breeds but not in local breeds. In the exotic toms, the highest sperm concentration value of 13.00 ± 0.85 x 10^9/ml was recorded under once bi-weekly semen collection though not significantly (P>0.01) different from toms under twice weekly semen collection frequency but with both being highly significantly (P<0.01) different from toms under once and thrice weekly semen collection frequencies. The sperm concentration values for the exotic toms in this study are in agreement with those of Zahradden *et al*., (2005) and Cecil and Bakst (1988) who had earlier reported that sperm concentration decreases with increasing frequency of semen collection. The non–significant (P>0.05) difference obtained in the local breeds agrees with those of Noirault and Brillard (1999) who observed a non-significant difference in sperm concentration with increasing frequency of ejaculation.

Percentage live sperm in this study was significantly (P<0.01) affected by ejaculation frequency in both the exotic and local breeds of toms. The highest value for live sperm (96.50 ± 0.29%) was recorded in exotic toms under twice weekly ejaculation frequency though not significantly (P>0.05) different from toms under thrice and once bi-weekly collection frequencies but with all being highly significantly (P<0.01) different from toms under once weekly semen collection frequency. In the local breeds, the highest value for live sperm (97.13 ± 0.22%) was recorded in toms under thrice weekly semen collection frequencies though not significantly (P>0.01) different from toms in twice weekly and once bi-weekly collection frequencies but with all being highly significantly (P<0.01) different from toms in once weekly collection frequencies. These results are not in agreement with those of Zaharaddeen *et al.,* (2005) who reported that ejaculation frequency did not affect any other semen quality trait in toms apart from sperm concentration.

The percentage normal spermatozoa in both the exotic and local breeds of toms were significantly (P<0.01) affected by the frequency of semen collection. In the exotic breeds, the highest percentage of normal spermatozoa (95.25 ± 0.37%) was recorded in toms under once bi-weekly collection frequency though not significantly (P>0.01) different from toms under twice weekly collection frequencies but with both being highly significantly (P<0.01) different from toms under once and thrice weekly collection frequencies. In the local toms the highest value for percentage normal spermatozoa (96.13 ± 0.23%) recorded in toms under once bi-weekly was not significantly (P>0.01) different from toms under twice and thrice collection frequencies but with all being highly significantly (P<0.01) different from toms under once weekly collection frequency. The values obtained for normal sperm were not in agreement with those of Zaharaddeen *et al*., (2005) who reported no significant difference in percentage normal sperm when local and exotic toms were ejaculated at various frequencies. Total sperm in ejaculate was highly significantly (P<0.01) affected by frequency of semen collection in both the exotic and local breeds of toms. It was observed that once bi-weekly semen collection frequency yielded the highest total sperm in ejaculate (6.50 ± 1.04 x 10^9) in the exotic toms though not significantly (P>0.05) different from toms under twice weekly collection frequency but with both being highly significantly (P<0.01) different from toms under once weekly and thrice weekly collection frequencies. In the local toms the highest value for total sperm in ejaculate (3.37 ± 0.18 x 10^9) recorded in thrice weekly collection frequency, is significantly different from the toms under once bi-weekly, once weekly and twice weekly collection frequencies. The toms under twice weekly were highly significantly (P<0.01) different from those under once bi-weekly and once weekly collection frequencies. This result indicated that ejaculating local toms once weekly resulted in the least values for total sperm in ejaculate (0.42 ± 0.13 x 10^9). This result is in disagreement with that of Zahraddeen *et al,* (2005) who found no significant differences in total sperm in ejaculate at once, twice and thrice weekly semen collection frequencies. The differences between the results obtained in this study and the reports of other researchers may be due to variations in genetic lines of the turkeys used in the experiments (Hafez, 1985).

The interaction effects of breeds and frequencies of ejaculation (B x F) are shown on Table 2. The results on seminal traits showed that at once bi-weekly frequency of ejaculation, there were highly significant differences (P<0.01) in sperm concentration and total sperm in ejaculate with the exotic toms having higher values while the reverse was the case in the other seminal traits where the local genotype had significantly higher values in progressive motility, live spermatozoa and normal spermatozoa. Semen volume was not affected by the B x F interaction effect at once bi-weekly collection schedule. At once a week collection frequency semen volume was significantly higher (P<0.05) in the exotic breed. Similarly, the interaction effect of B x F on semen volume and total sperm in ejaculate were highly significant (P<0.01) when semen collection was done twice a week. However, when the semen collection frequency was three times per week, the local toms, except for semen volume had highly significantly (P<0.01) better values than the exotic breed in other seminal traits such as progressive motility, sperm concentration, live spermatozoa, normal spermatozoa and total sperm in ejaculate. It was concluded that once bi-weekly or thrice weekly collection frequencies could be used in any artificial insemination protocol to further select the Nigerian local turkey for improved egg and/or meat production.

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