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Evaluation of changes in spermiogram of Shika Brown® Breeder cocks fed dietary levels of baobab (*Adansonia digitata*) seed-meal

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Abstract

This study evaluated the effects of varying levels of Baobab seed-meal (BSM) on spermiogram of Shika Brown® breeder cocks. Thirty apparently healthy cocks aged 30 weeks with average body weight of 1.78 ± 0.03 kg were used for this study. They were acclimatized and randomly divided into three groups of 10 each. Group A (control), fed 0% BSM growers diet, groups B, (5%) and group C, (10%) BSM diets. Semen samples were collected from each cock twice weekly for 28 days and spermiogram evaluated. Results indicated significant (P< 0.05) difference for mean volume, percentage live spermatozoa, sperm gross motilities and concentration between the treatment groups (B and C) and the control group (A). Mean abnormal sperm of cocks in groups B and C were significantly (P<0.05) lower compared to group A. It was concluded that BSM is likely to improve semen characteristics in breeder cocks. Therefore, it is recommended that BSM at 5% and 10% is safe and should be incorporated into breeder cocks diet by farmers for enhanced semen characteristics.

Keywords: Baobab, Shika Brown®, spermiogram, semen, breeder.

Introduction

Adansonia digitata (Baobab) is a fruit-producing tree that belongs to the Malvaceae family. It is regarded as the largest succulent plant in the world and the most easily recognized tree in the Savannah of tropical Africa, with an edible parts consisting of the leaves, seeds, and fruit pulp (Gebauer *et al*., 2016). Several compounds including terpenoids, flavonoids, sterols, vitamins, amino acids, carbohydrates and

lipids have been identified from various parts like fruit pulp, seeds, leaves and roots (Sharma *et al*., 2015).

Feed shortage in developing countries, has increased due to competition with humans and livestock production in the tropics (Juma *et al*., 2001). Studies on Baobab seeds in Nigeria and other parts of the world have shown the potentials of the seeds in supplying good quality proteins for humans and livestock.

Nutrition has been shown to have significant effects on semen quality traits (Sotirov *et al*., 2002).Since poultry reproductive potential is determined by the quality of semen produced, semen evaluation is crucial in poultry breeding for selecting breeding males and routine monitoring of reproductive performance. Likewise, fertilization requires the availability of spermatozoa capable of reaching and penetrating the vitelline membrane; this is ensured through good quality semen (Mellor, 2001). Therefore, necessary to explore alternative feed that will reduce the high cost of feeding while ensuring optimal reproductive performance. Therefore, the aim of this study was to investigate the effects of graded levels of Baobab seed-meal on the semen of breeder cocks.

Materials and Methods

Ethical approval

This study was approved by the Ahmadu Bello University Committee on Animal Use and Care with code ABUCAUC/2019/031.

Source of Baobab seeds

Baobab seed were obtained from local markets in Zaria metropolis. The sample was identified at the Herbarium, Department of Botany, Ahmadu Bello University Zaria, Nigeria.

Processing of Baobab seed-meal

The Baobab seeds were processed by soaking in water for 10-15 minutes, thoroughly washed and sun-dried for about 3 days. The dried seeds were then weighed and added to the feed raw materials and ground together to form the experimental diets.

Experimental birds' management and groupings

Thirty (30), Shika Brown® breeder cocks (30-weeks-old) kept under intensive management system were used for the experiment. They were housed in a pen of 10 birds/m^2. Feed and water were provided ad-libitum. The cocks were acclimatized for 21 days under standard diet with 0% Baobab seed-meal and randomly divided into three groups (A, B and C) of 10 cocks each groups A, B and C diets consisted of 0, 5% and 10% Baobab seed-meal (BSM), respectively. The period of feeding with experimental feed lasted for 28 days.

Semen collection and evaluation

Collection of semen from: Semen samples were collected twice weekly from each cock for a period of 28 days as described by Mkpughe & Bratte (2015) and evaluated as described by Zemjanis (1970).

Data analyses

Data were summarized as mean ±standard error of mean and presented using tables. Data were analyzed using one-way analysis of variance (ANOVA). Values of $P \leq 0.05$ were considered significant.

Results and Discussion

This study revealed that varying levels of dietary Baobab seed-meal influenced the semen characteristics of Shika Brown cocks.

Semen volumes were significantly ($P < 0.05$) higher in groups B and C compared to group A (Table 1). This could be could be attributed to the fact that Baobab seed-meal contains high level of vitamin C which improves testicular output, this agreed with the findings of Puron *et al*. (1994) who showed that vitamin C improves physiological characteristics of broiler chicken. The semen colour of group B and C ranged from milky to creamy compared to group A which colour ranged from watery to opalescence and could be due to better feed utilization and antioxidant property of the Baobab seed-meal as reported by Agbessi Dos-Santos (1987).

Table 1: Mean ± SEM semen volume (mL) of Shika Brown® Breeder cocks (n = 10) fed varying levels of BSM

Day	Group A (0% BSM)	Group B (5% BSM)	Group C (10% BSM)
0	0.49 ± 0.24	0.48 ± 0.35	0.36 ± 0.21
4	0.42 ± 0.18	0.33 ± 0.19	0.34 ± 0.11
8	0.23 ± 0.13[a]	0.52 ± 0.15[b]	0.48 ± 0.20[b]
12	0.46 ± 0.19	0.50 ± 0.27	0.50 ± 0.20
16	0.28 ± 0.27[a]	0.44 ± 0.22[b]	0.46 ± 0.18[b]
20	0.41 ± 0.31	0.49 ± 0.24	0.48 ± 0.28
24	0.33 ± 0.18[a]	0.69 ± 0.26[b]	0.58 ± 0.31[b]
28	0.53 ± 0.25	0.53 ± 0.23	0.49 ± 0.23
Mean Total (±SEM)	0.39±0.22 [a]	0.50±0.24 [b]	0.46±0.22 [b]

Values with different superscripts across same row differed significantly at $P< 0.05$.

BSM: Baobab seed-meal

Semen gross motility were significantly (P < 0.05) higher in groups B and C compared to group A (Table 2). Semen motility was found to be higher in the treated group in this present study compared to the control this could be due to the ability of the Baobab seed-meal to prevent lipid peroxidative damages, this finding agreed with the report (Aitken *et al*., 1989). The semen pH showed no significant (P > 0.05) difference (Table 3). The semen pH recorded in this present study was slightly acidic. This agreed with the report of Donoghue & Wishart (2000) who reported pH range of 6.0-8.0 in chickens.

The mean sperm concentrations of groups B and C were significantly (P < 0.05) higher compared to group A (Table 4). The higher concentration in groups B and C compared to the control agrees with the work of Mangiagalli *et al*. (2012) who demonstrated increase in semen concentration due to treatments with Baobab seed meal and this could be attributed to fact that high vitamins, amino acids, carbohydrates and lipids are contained in the

Table 2: Mean ± SEM sperm gross percentage motility (%) of Shika Brown® Breeder cocks (n = 10) fed varying levels of BSM

Day	Group A (0% BSM)	Group B (5% BSM)	Group C (10% BSM)
0	67.00 ±36.30[a]	54.00 ± 43.00[b]	65.00 ± 37.00[a]
4	64.00 ± 35.10[a]	42.50 ± 39.32[b]	67.50 ± 28.60[a]
8	46.50 ± 33.25[a]	81.50 ± 28.87[b]	80.00 ± 28.48[b]
12	57.00 ± 27.51[a]	68.50 ± 26.78[b]	84.00 ± 29.70[c]
16	58.00 ± 41.58[a]	72.50 ± 30.66[b]	81.00 ± 28.94[b]
20	48.50 ± 35.12[a]	81.00 ± 28.66[b]	87.50 ± 8.58[b]
24	60.50 ± 34.52[a]	92.00 ± 3.50[b]	84.00 ± 29.61[b]
28	57.00 ± 29.55[a]	93.00 ± 3.50[b]	83.50 ± 29.44[b]
Mean Total (±SEM)	57.3± 34.11 [a]	73.12± 25.54 [b]	79.06± 27.54 [b]

Values with different superscripts across same row differed significantly at P< 0.05

Table 3: Mean ± SEM semen pH of Shika Brown® Breeder cocks (n = 10) fed varying levels of BSM

Day	Group A (0% BSM)	Group B (5% BSM)	Group C (10% BSM)
0	6.30 ± 2.21	5.60 ± 2.95	5.50 ± 2.92
4	6.70 ± 2.50	6.60 ± 0.52	6.80 ± 0.42
8	5.10 ± 2.73	6.40 ± 2.50	6.90 ± 2.60
12	6.40 ± 0.52	6.20 ± 2.21	5.90 ± 2.13
16	6.40 ± 3.54	6.00 ± 2.16	6.00 ± 2.16
20	6.20 ± 3.74	6.20 ± 2.20	5.60 ± 2.95
24	6.70 ± 2.50[a]	8.00 ± 1.05[b]	6.90 ± 2.60[a]
28	6.70 ± 2.50	7.60 ± 0.97	6.50 ± 2.37
Mean Total (±SEM)	6.31± 2.53 [a]	6.54 ± 1.82 [a]	6.26± 2.27 [a]

Values with different superscripts across same row differed significantly at P< 0.05
BSM: Baobab seed-meal

Table 4: Mean ± SEM sperm concentration ($\times 10^9$/ml) of Shika Brown® Breeder cocks fed varying level of BSM

Day	Group A (0% BSM)	Group B (5% BSM)	Group C (10% BSM)
0	4.61 ± 13.00[a]	5.0 ± 33.60[b]	4.80 ± 14.00[c]
4	5.20 ± 11.00[a]	5.80 ± 37.00[b]	5.50 ± 37.40 [c]
8	5.20 ± 28.00[a]	6.56 ± 41.00 [c]	6.50 ± 20.00[c]
12	6.30 ± 3.72[a]	7.40 ± 19.50[b]	6.80 ± 49.50[b]
16	5.60 ± 18.00[a]	8.23 ± 8.50[b]	7.20 ± 11.00[b]
20	6. 0 ± 4.60[a]	8.2 ± 12.00[b]	8.40 ± 18.00[b]
24	5.20 ± 22.00[a]	8.80 ± 15.00[b]	7.90 ± 15.00[a]
28	5.40 ± 8.60[a]	8.60 ± 33.00[b]	8.0 ± 16.00[b]
Mean Total (±SEM)	5.44 ±13.61 [a]	7.32± 24.8 [b]	6.89 ± 22.62 [c]

Values with different superscripts across same row differed significantly at P < 0.05
BSM: Baobab seed-meal

Table 5: Percentage abnormal sperm (%) of Shika Brown® Breeder cocks (n = 10) fed varying levels of BSM

Day	Group A (0% BSM)	Group B (5% BSM)	Group C (10% BSM)
0	5.10 ± 3.21[a]	4.40 ± 2.50[a]	7.20 ± 5.27[b]
4	14.00 ± 8.99[a]	5.80 ± 3.12[b]	6.30 ± 2.67[b]
8	7.50 ± 2.72	6.10 ± 3.64	8.50 ± 4.86
12	8.40 ± 4.09	7.00 ± 5.03	7.80 ± 2.97
16	5.40 ± 3.16	5.20 ± 3.95	5.50 ± 3.87
20	7.20 ± 4.01	6.40 ± 5.29	5.10 ± 5.99
24	6.10 ± 5.86	6.10 ± 6.05	5.90 ± 3.51
28	8.20 ± 3.52[a]	3.98 ± 5.46[b]	3.80 ± 2.78[b]
Mean Total (±SEM)	7.74± 4.45	5.62 ± 4.38	6.26± 6.26

Values with different superscripts across same row differed significantly at P < 0.05
± SEM: ± Standard Error of Mean; BSM: Baobab seed-meal

Baobab seed meal (Sharma *et al*., 2015). The percentage abnormal spermatozoa of groups B and C were significantly (P < 0.05) lower compared to group A (Table 5). The differences in percentage total abnormal sperm between all the groups are consistent with the report by Aitken & Fisher (1994) who showed decrease abnormal sperm number due to the protection against lipid peroxidation and reduction of degeneration in the germinal epithelium/seminiferous tubules.

Based on our findings, the inclusion of 5% and 10% Baobab seed-meal fed to Shika Brown® breeder cocks increased semen volume, motility, and sperm concentration and decreased proportion of abnormal sperm. Mention if 5% and 10% have same effect or one of them is better.

Conflicts of Interest

The authors declare no conflict of interest.

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