EFFECT OF WHOLE COTTONSEED AND COTTONSEED CAKE ON REPRODUCTIVE PERFORMANCE OF RED SOKOTO BUCKS

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ABSTRACT
A study was conducted to evaluate the effect of feeding cotton products (whole cottonseed and cottonseed cake) on testicular biometry and testicular histology of Red Sokoto bucks. A total of twenty-four (24) healthy Red Sokoto bucks were used and randomly allocated to 6 dietary treatments in a completely randomized design. The treatments contained 10, 20 and 30% inclusion levels of either Whole cottonseed (WCS) or Cottonseed cake (CSC) in the diets which were fed to the bucks over a period of 98 days after a 14-day adjustment period. Bucks fed CSC had significantly (P<0.05) higher scrotal circumference and lower cytoplasmic droplets than those fed WCS. Bucks fed 30% diets with cottonseed products (WCS and CSC) had significantly higher scrotal circumference, testicular weight and corpus weights than those fed other levels of cottonseed products. However, bucks fed CSC had higher testicular length than those fed WCS. Testicular histopathology indicated that higher levels (20 and 30%) of WCS had adverse effect on spermatogenesis with empty seminiferous and epididymal tubules. 30% inclusion of CSC also resulted in tissue degeneration. It was therefore concluded that bucks fed diets with CSC performed better than WCS and that up to 20% of CSC can be fed to breeding bucks whereas WCS should not be fed to breeding bucks except at very low levels (10%) as it negatively affects semen quality, gonadal and extra-gonadal sperm reserves as well as testicular histology of Red Sokoto bucks.
Keywords: Buck, Whole cottonseed, Cottonseed cake, Testicular, Treatment

INTRODUCTION

Testicular traits are important variables directly associated with sperm features and animal fertility. The shape and content of the scrotum are associated with fertility parameter (Coulter and Foote, 1977). Scrotal circumference (SC) and testicular consistency (TC) have been extensively used in predicting the reproductive capacity of male domestic animals (Toe et al., 2000; Ugwu, 2009; Antonio *et al*., 2011). This is because scrotal circumference is an indirect measurement of testicular weight and a reliable indicator of testicular growth and spermatogenic capacity of the testis (Daudu, 1984). Likewise, testicular weigth (TW) is a reliable variable for estimating the sperm production capacity of males. Animal size and traits such as birth weight were shown to be closely related with testicular weight. Keith *et al*., (2009) reported high and positive correlation between testicular measurement and body conformation traits in pubertal Boer goat bucks, while Bitto and Egbunike (2006) recorded high correlations between body weight and testicular morphometry in West African Dwarf (WAD) bucks. These findings are in consonance with the observations of Koyuncu *et al*. (2005); Rajuana *et al*. (2008) and Agga *et al*. (2011). Antonio *et al*. (2011) evaluated scrotal-testicular biometry on Brazilian goats during the rainy and dry periods of the year and reported that the bucks demonstrated higher values of scrotal circumference and testis volume in the dry year periods, an observation also made by Villar *et al*. (1993) and Campos *et al*. (2003) suggested an interference of season on the size of the male reproductive organs. Moreira *et al*. (2001) observed that the increase in the environmental temperatures promote a negative influence correlation on the scrotal circumference and testicular length. However, Bitto and Egbunike (2006) reported that testicular and epididymal morphometry of WAD bucks were unaffected by season.

MATERIALS AND METHODS

Location of Experimental Site

The study was carried out at the Teaching and Research Farm, Department of Animal Science, Faculty of Agriculture, Ahmadu Bello University, Zaria, Kaduna state, Nigeria located on latitude $11^0$33'N and longitude $7^0$42'E. Annual rainfall in this area ranges from 1102 to 1904mm and lasts from late April or early May to mid-October. The site is situated within the Northern-Guinea Savannah zone of Nigeria at an altitude of 610 mm above sea level (Ovimaps, 2014).

Experimental Animals, Design and their Management

Twenty-four (24) Red Sokoto goats bucks of about 6-8 months of age were sourced from Zaria metropolis. They were dewormed using albendazole tablets (Centre-Alben®- Aether Centre Biology Co., Ltd. Beijing) at the rate of 5 mg/kg body weight, covered withTLA-Tetracycline long acting-TLA (oxytetracycline dehydrate) 20% weight/volume injectable solution administered at 0.1 mg/10 kg live weight against possible bacterial infection.

Each buck was kept separately in individual crates. The animals were quarantined for a period of 3 weeks before commencement of the study.

Experimental diets

The experimental diets containing 14% CP were fed to the bucks at 3% per kg body weight every morning with clean fresh water provided *ad libitum.* At the end of the adjustment period, the bucks were randomly allocated to six sub dietary groups of four animals per group in a completely randomized design with the treatments consisting of either whole cotton seed (WCS) included at 10, 20 and 30% or cottonseed cake (CSC) included at 10, 20, and 30% levels.

Data Collection

Data collected in the course of this experiment were for evaluation of gonadal and extra-gonadal sperm reserves and morphology of testes and epididymides of the buck

Testicular Parameters

At the end of the feeding trial, the animals were fasted for about 9-12 hours before slaughter. After slaughtering, the testes and epididymides were harvested immediately for evaluation of gonadal and extra-gonadal sperm reserves (Kabiraj et al., 2011). Testicular Weight: This was done by putting the testes on a sensitive electronic weighing scale (sensitive to the nearest 0.001g) and value recorded. Testicular length: This was performed along the longitudinal axis of the testis beginning from one pole of the testis to the other pole using a non- stretchable tape (in centimeters-cm) and the reading was taken. Epididymal Weight: This was carried out by putting the epididymis on a sensitive electronic weighing scale (sensitive to the nearest 0.001g) and value recorded. The same procedure was carried out to obtain the weight of caput, corpus and cauda. All readings were recorded. Epididymal Length: This was performed using a non-stretchable tape placed along the longitudinal axis of the epididymis running from one pole to the other and value recorded.

Statistical Analysis

All data generated were subjected to Factorial Analysis of Variance (ANOVA) using the General Linear Model (GLM) Procedure of Statistical Analysis System (SAS, 2008) and where statistical significance was observed, the mean values were separated using Tukey.

The following Linear Model was used for the statistical analysis:

$$Y_{ijk} = \mu + A_i + B_j + C_k + (A \times B)_{ij} + (B \times C)_{jk} + e_{ijk}$$

Where:

Y_{ijk} = Observations.

μ = Overall mean

A_i = Effect of cotton products (whole cottonseed and cottonseed cake)

B_j = Effect of inclusion levels

C_k= Effect of bi-weekly collection periods

$(A \times B)$ = Interaction between cotton products and inclusion levels.

$(B \times C)$ = Interaction between inclusion levels and bi-weekly collection periods

e_{ijk} = Experimental error

RESULTS AND DISCUSSION

Interaction Between Inclusion levels of the Cotton products and Position of testicles on Gonadal and Extragonadal sperm reserve of Red Sokoto bucks.

Table 1: Ingredients composition of experimental diets

	Inclusion levels of whole cottonseed and cottonseed cake (%)					
	WCS			**CSC**		
Ingredients	10	20	30	10	20	30
Maize offal	20	15	10	23	21	19
WCS	10	20	30	-	-	-
CSC	-	-	-	10	20	30
BDG	26	21	16	23	15	7
Rice offal	40	40	40	40	40	40
Molasses	2	2	2	2	2	2
Bone meal	1.5	1.5	1.5	1.5	1.5	1.5
Salt	0.5	0.5	0.5	0.5	0.5	0.5
Total	100	100	100	100	100	100

WCS= Whole Cottonseed, CSC=Cottonseed cake, BDG= Brewers dried grain

The results for interaction between inclusion levels and testicular position on gonadal and extra-gonadal sperm reserves are presented below. There were no significant differences (P>0.05) in all the evaluated parameters across the treatments.

Table 2: Effects of interaction between cotton products and position of the testis on testicular biometry and gonadal sperm reserve of Red Sokoto bucks

		Whole cottonseed %	Cottonseed cake %	SEM	P-Values
Testis length (cm)	R	5.33	5.80	0.69	0,17
	L	4.63	6.50		
Testis weight (g)	R	22.31	25.28	3.78	0.13
	L	22.63	17.03		
Testicular volume (ml)	R	11.50	13,83	3.07	0.71
	L	11.00	11.67		
Sperm reserve ($\times 10^6$)	R	117.17	112.33	22.59	0.63
	L	90.17	101.00		

Correlation between Testicular Traits and Sperm Reserves

The Table shows the correlation between testicular morphometry, body weight, sperm concentration, gonadal and extra-gonadal sperm reserves. High positive and significant correlations were found between semen concentration and cauda sperm reserves (r=0.46, P<0.05). Body weight and, testis weight, epididymal length were positively correlated at 0.215, 0.633 (P<0.05). Testicular length and epididymal length of the bucks were positively correlated at 0.394 (P<0.05). Testis length also correlated positively with testis weight (r=0.121, P<0.05). Testis weight correlated positively with epididymal weight, cauda sperm reserve, corpus sperm reserve (r= 0.471, 0.469, 0.476 respectively, P<0.05) and highly with caput sperm reserve at 0.537 (P<0.01). Epididymal weight correlated with corpus sperm reserve (0.451, P<0.05) and caput sperm reserve (0.422, P<0.05). There was very high positive correlation between caput sperm reserve and corpus sperm reserve of the bucks (r= 0.966, P<0.001).

Table 3: The correlation between testicular morphometry, body weight, gonadal and extra-gonadal sperm reserve

	Body weight	Testis length	Testis weight	Testis sperm reserve	Epididymal length	Epididymal weight	Caput sperm reserve	Corpus sperm reserve
Testis length	0.2704							
Testis weight	0.2151*	0.1206						
Testicular sperm reserve	0.2577	0.4263	0.3304					
Epidydimal length	0.6329*	0.3937*	-0.0785	0.1424				
Epidydimal weight	0.3757	0.3031	0.4711*	0.3883	-0.1922			
Caput sperm reserve	0.1997	0.3775	0.5371**	0.2542	0.1334	0.4215*		
Corpus sperm reserve	0.1326	0.3870	0.4764*	0.1849	0.1590	0.4512*	0.9664***	
Cauda sperm reserve	0.2988	0.2147	0.4694*	0.3639	0.1837	0.1573	0.3620	0.2996

CONCLUSION

The bucks fed diets with CSC performed better than WCS and that up to 20% of CSC can be fed to breeding bucks whereas WCS should not be fed to breeding bucks except at very low levels (10%) as it negatively affects gonadal and extra-gonadal sperm reserves as well as testicular histology of Red Sokoto bucks

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