TESTICULAR, EPIDIDYMAL BIOMETRY AND GONODAL SPERM RESERVES OF RED SOKOTO BUCKS FED WHOLE COTTONSEED AND COTTONSEED CAKE DIETS

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Abstract
The study was conducted to evaluate testicular, epididymal biometry, gonadal and extra-gonadal sperm reserves of Red Sokoto bucks fed graded levels of whole cottonseed and cottonseed cake diets. 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 fed to the bucks over a period of 98 days after a 14-day adjustment period. The results showed that bucks fed CSC had significantly ($P<0.05$) higher testis length, caput weight and cauda weight than those fed WCS. Bucks fed 30% diets with cottonseed products (WCS and CSC) had significantly higher testicular weight and corpus weights than those fed 10 and 20% levels of cottonseed products. The parameters decreased with increasing levels of WCS but increased with increasing levels of CSC. 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 gonadal and extra-gonadal sperm reserves of Red Sokoto bucks.

Keywords: Red Sokoto bucks, testicular, epididymal, gonadal and extra-gonadal, whole cottonseed and cottonseed cake

Description of Problem

Testicular traits are important variables directly associated with sperm features and animal fertility. As evaluated by [1] testicular biometry of Brazilian goats reported that the bucks demonstrated higher values of scrotal circumference and testis volume in the dry year periods. The shape and content of the scrotum are associated with fertility parameter [2].Scrotal circumference (SC) and testicular consistency (TC) have been extensively used in predicting the reproductive capacity of male domestic animals [3,4,1] 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 [5], [6] recorded high correlation between body weight and testicular morphometry in West African Dwarf (WAD) bucks, [7] observed that the increase in the environmental temperatures promote a negative influence correlation on the scrotal circumference and testicular length. However, [6] reported that testicular and epididymal morphometry of WAD bucks were unaffected by season. [8] Reported an increase in testicular measurements as age and body weight increased. [9]Age has been reported to influence testicular traits in Ethiopian bucks.

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. The site is situated within the Northern-Guinea Savannah zone of Nigeria at an altitude of 610 mm above sea level [10].

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 at the rate of 5 mg/kg body weight, covered with TLA-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 in a completely randomized design. The animals were quarantined for a period of 3 weeks and further 2 weeks for adjustment period before commencement of the study.

Experimental diets

The experimental diets containing 14% CP (Table 1) 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. Each group constituted a treatment and each buck within a group was a replicate 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 buck semen (for characteristics and morphology), blood samples, scrotal circumference, testes and epididymides.

Testicular Parameters

At the end of the feeding trial, the animals were fasted for about 9-12 hours before slaughter. After slaughter, the testes and epididymides were harvested immediately for evaluation of testicular and epididymal biometry, as well as gonadal and extra-gonadal sperm reserves. [8] Each of the epididymis was carefully separated from the testis. This was done to determine lengths, weights and volumes of right and left testes, lengths and weights of right and left epididymides, caput, corpus and cauda weights and volumes, gonadal and extra gonadal sperm reserves. Testicular length was measured 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). Epididymal weight was determined by weighing the epididymis on a sensitive electronic weighing scale (sensitive to the nearest 0.001g). The same procedure was carried out to obtain the weight of caput, corpus and cauda epididymides. Epididymal length was measured using a non-stretchable tape placed along the longitudinal axis of the epididymis running from one end to the other.

Statistical Analysis

All data generated were subjected to Factorial Analysis of Variance (ANOVA) using the General Linear Model (GLM) Procedure of Statistical Analysis System [11] and where statistical significance was observed, the mean values were separated using Tukey.

The following Linear Model was used for the statistical analysis of testicular parameters:

$Y_{ijk} = \mu + A_i + B_j + (A\times B)_{ij} + e_{ijk},$ Where:

Y_{ijk} = Observations.

μ = Overall mean

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

B_j = Effect of inclusion levels

(A×B) = Interaction between cotton products and inclusion levels.

e_{ijk} = Experimental error

Results and Discussion

Effect of Whole cottonseed and Cottonseed cake on Testicular Biometry, Gonadal and Extra-gonadal Sperm Reserve of Red Sokoto bucks

Table 2 shows the influence of cotton products on gonadal and extra-gonadal sperm reserves of Red Sokoto bucks fed diets with WCS and CSC. There was non-significant (P>0.05) difference in the testis weight, testis volume, testis sperm reserve, whole epididymal length and weight, corpus weight and corpus sperm reserve of the bucks. However, bucks fed CSC had significantly (P<0.05) higher testis length (6.15cm), caput weight (2.33g), cauda weight (2.33g), caput sperm reserve ($63.5x10^6$) and corpus sperm reserve ($76.5x10^6$) than those fed WCS (4.98cm, 1.69g, 1.59g, $43.42x10^6$ and $38.58x10^6$ respectively. Although, body weights of the animals increased numerically with increasing levels of inclusion. However, testis weight and corpus weight differed significantly (P<0.05) by decreasing at 20% inclusion of the cotton products and increasing at 30% inclusion of the cotton products.

Table 1: Ingredients composition of experimental diets

	Inclusion levels of whole cottonseed and cottonseed cake (%)					
	Whole cottonseed (WCS)			Cottonseed cake (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

Table 2: Effect of Whole cottonseed and Cottonseed cake on testicular biometry, gonadal and extra-gonadal sperm reserve of Red Sokoto bucks

Parameters	WCS	CSC	SEM	P-Value
Testis length (cm)	4.98^b	6.15^a	0.34	0.03
Testis weight (g)	22.47	21.15	1.89	0.63
Testis volume (ml)	11.25	12.75	1.53	0.50
Sperm/spermatid reserve (x 10^6)	103.67	106.67	11.29	0.85
Epidydimal length (cm)	8.65	9.72	5.77	0.21
Epidydimal weight (g)	4.42	5.14	0.54	0.36
Caput Weight (g)	1.69^b	2.33^a	0.17	0.02
Corpus weight (g)	0.46	0.33	0.07	0.18
Cauda weight (g)	1.59^b	2.23^a	0.17	0.02
Caput sperm/ spermatid reserve (× 10^6)	43.42	63.50	13.81	0.09
Corpus sperm/ spermatid reserve (×10^6)	55.25	73.17	15.85	0.40
Cauda sperm/ spermatid reserve (×10^6)	142.42	143.58	19.05	0.96

Means within rows with different superscripts are significantly different (* = P<0.05), SEM: Standard error of means; LOS: Level of significance WCS: Whole cottonseed; CSC: Cottonseed cake.

Effect of Whole cottonseed and Cottonseed cake on Testicular Biometry, Gonadal and Extra-gonadal Sperm Reserve of Red Sokoto bucks

The result indicates that bucks fed CSC had significantly (P<0.05) higher testis length, caput weight and cauda weight than those fed WCS. Similar observations were made in bucks fed

CSC having higher testicular values such as testicular and epididymal weight, length and sperm reserves [12]. Epididymal (caput, corpus and cauda) sperm reserves were also higher in animal fed CSC, although not significantly. The different effects observed between WCS and CSC on extra gonadal sperm may be due to the fact that WCS has high levels of gossypol (which significantly affect spermatogenesis) than CSC. The study revealed that the testicular length was significantly different (P<0.05) among the inclusion levels of both products studied, 10% level of inclusion recorded the highest value of 6.64cm followed by 30% inclusion (5.49cm) while 20% inclusion level recorded the lowest value of 4.58cm. Testis weight and corpus weight followed the same pattern as testicular length. The sperm count of the caput, corpus and cauda epididymides decreased insignificantly (P>0.05) with increasing levels of the cotton products

Effect of Whole cottonseed and Cottonseed cake on Testicular Biometry, Gonadal and Extra-gonadal Sperm Reserve of Red Sokoto bucks

There were no significant (P>0.05) differences in most of the testicular parameters and body weight of the animals as the level of inclusion of the WCS and CSC increased (Table 3). Although, body weights of the animals increased numerically with increasing levels of inclusion. However, testis weight and corpus weight differed significantly (P<0.05) by decreasing at 20% inclusion of the cotton products and increasing at 30% inclusion of the cotton products.

Table 3: Testicular parameters and gonadal and extra-gonadal sperm reserve of Red Sokoto bucks fed levels of Whole cottonseed and Cottonseed cake diets

Parameters	10	20	30	SEM	P-Value
Testis length (cm)	6.64^{a}	4.58^{b}	5.49^{b}	0.34	0.01
Testis weight (g)	22.81^{a}	17.36^{b}	25.26^{a}	1.89	0.04
Testis volume (ml)	12.25	11.63	12.13	1.53	0.97
Sperm/spermatid reserve (x10^6)	113.75	83.5	118.25	11.29	0.19
Epidydimal length (cm)	10.28	8.58	8.70	5.77	0.20
Epidydimal weight (g)	4.62	4.33	5.39	0.54	0.52
Caput Weight (g)	2.33	1.68	2.03	0.17	0.12
Corpus weight (g)	0.29^{a}	0.27^{b}	0.33^{a}	0.03	0.02
Cauda weight (g)	1.93	2.04	2.24	0.17	0.65
Caput sperm reserve ($\times 10^6$)	65.88	55.13	64.25	13.81	0.22
Corpus sperm reserve ($\times 10^6$)	73.25	45.13	54.25	15.85	0.40
Cauda sperm reserve ($\times 10^6$)	159.00	147.25	122.75	19.05	0.43

Means within rows with different superscripts are significantly different (* = P<0.05) SEM: Standard error of means; LOS: Level of significance WCS: Whole cottonseed; CSC: Cottonseed cake,

Conclusion and Application

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 gonadal and extra-gonadal sperm reserves of Red Sokoto bucks**.** The red Sokoto bucks can be fed with CSC without any adverse effect on testicular biometry, gonadal and extra-gonadal sperm reserve while WCS should be fed at low level of inclusion.

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