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*Full Length Research Paper*

# Correlation between age, weight, scrotal circumference and the testicular and epididymal parameters of Red Sokoto bucks

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**The effect of age, weight and scrotal circumference on the testicular and epididymal parameters was studied in the Red Sokoto bucks. Thirty-six testes from Red Sokoto bucks were used for this study. The animal's age, weight, and scrotal circumference were determined and correlated with testicular weight, testicular diameter, testicular length, epididymal length, gonadal and extra-gonadal sperm motility and viability. All parameters were correlated positively and negatively at various instances of $p < 0.01$ and $p < 0.05$. The sperm morphological abnormalities showed that tailless head (primary abnormality), headless tail (secondary abnormality), bent tail (secondary abnormality), curved tail (secondary abnormality), bent mid-piece (tertiary abnormality) and curved mid-piece (secondary abnormality), total sperm abnormalities and total cell count were found to be significant at $p < 0.01$. It was concluded that the age, weight and scrotal circumference of Red Sokoto buck were positively correlated to its testicular and epididymal parameters and therefore are potentially useful in the evaluation of the breeding soundness of the bucks.**

**Key words:** Epididymis, Red Sokoto bucks, scrotal circumference, testes, weight.

## INTRODUCTION

Goats are important domestic farm animals in the world as a source of meat, milk, skin and wool (Onakpa et al., 2010). In Nigeria, it has been estimated that there are about 34.5 million goats and this population makes it the second mostimportant livestock species (Onakpa et al., 2010).

Three main varieties of goats are recognized in Nigeria: The Sahel, Desert or West African long-legged goat, the Red Sokoto goat and the West African Dwarf goat (Onakpa et al., 2010). The Red Sokoto goat is also called Maradi, Red skin, Sokoto Red, Katsina Light Brown, Mambilla, Bornu White or Damagian Dapple Grey. They are mainly distributed in Northern Nigeria (Sokoto and Kano States) and Southern Nigeria where the climate is semi-arid with a single rainfall season of 4 to 6 months. They are owned by the Hausa speaking agricultural tribes (Wilson, 1984).

Although Red Sokoto goats are known to breed all year round, their fertility characteristics have not been fully documented to facilitate effective genetic improvement by

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selection and crossbreeding at all levels of production. In the male for instance, there is the need to establish measurable criteria for judging breeding soundness and guiding selection of males for breeding. These criteria include scrotal measurements, libido and semen quality tests (Michelson et al., 1981; Ogwuegbu et al., 1985) and the relationships between them.

Biometric parameters, such as scrotal circumference (SC), testicular weight (TW) and testicular length (TL), are essential measurements in the andrological evaluation of a breeding animal. Among these parameters, SC is used most often because it is easy to measure and displays a high correlation with body weight and reproductive capacity (libido), particularly sperm production (Brito et al., 2004). While the biometric data related to SC help define the reproductive parameters for a species, SC alone should not be used for the selection of breeders. Rather, a complete andrological evaluation (a breeding soundness examination), including an evaluation of semen quality, should be performed to certify the reproductive capacity of a male (Ohashi et al., 2007).

Some studies have shown the reproductive parameters of the Red Sokoto goat, but with none correlating the age, weight and scrotal circumference with the testicular and epididymal parameters. This study is therefore aimed at investigating the correlation of age, weight, scrotal circumference on the left and right testicular and epididymal parameters of Red Sokoto bucks.

## MATERIALS AND METHODS

### Experimental animals and sample collection

Thirty-six testes were collected from Red Sokoto bucks slaughtered at Bodija abattoir located in Ibadan North Local Government Area of Oyo State, Nigeria on geographic grid reference of longitude 3°5N and latitude 7°20 N. The body weights, scrotal circumference and ages of the animals were taken prior to slaughter. The intra-scrotal testes were maintained at a warm condition (37°C), immediately the animals were slaughtered and transferred to the laboratory.

### Testicular and epididymal biometrics

The testes collected were separated from the epididymis and weighed individually. The right and left epididymides were also weighed after trimming off the body of the testes. The testicular circumference, testicular lengths and epididymal lengths were measured using a flexible metric tape and recorded.

### Semen collection

Semen samples were collected from the body of the testes and epididymis through an incision made with a scalpel blade. The semen samples were analysed to determine the percentage sperm motility, viability and morphological characteristics as described by Zemjanis (1977).

### Percentage motility

Percentage motility was evaluated with a drop of semen with drop of 2.9% buffered sodium citrate on a warm glass slide covered with a glass slip and viewed at a magnification of ×40. Only sperm cells moving in a unidirectional motion were included in the motility rating, while sperm cells moving in circles, in backward direction or pendulating movement were excluded.

### Percentage viability

Percentage viability was done by staining one drop of semen and one drop of warm Eosin-Nigrosin stain on a warm slide. A thin smear was then made of mixture of semen and stain. The smear was air dried and observed under the microscope. The ratio of the *in vitro* dead sperm cells was observed and it is based upon the principle of Eosin penetrating and staining the dead autolysing sperm cells whereas viable sperm repel the stain (Zemjanis, 1977).

### Sperm morphology

A drop of semen was placed with two drops of Wells and Awa stain. The semen and stain were thoroughly mixed together, and a smear was made on another slide. The smear was dried and observed under light microscope, starting from lower power magnification to high magnification.

The presence of abnormal cells, out of at least 600 sperm cells from several fields on the slide was noted and their total percentage was estimated.

### Data analysis

Simple correlation was calculated for some testicular parameters. Paired comparisons were done using students ‘t” test for sperm characteristics. Analysis of variance (One-way ANOVA) was used to compare the mean values of the testicular and epididymal parameters.

## RESULTS

It was observed that both the right and left testicular parameters were positively correlated at 0.470 ($P<0.01$), with the weight and scrotal circumference of the bucks. The weight and testicular weight of the bucks were positively correlated at 0.507 ($P<0.01$), the scrotal circumference and testicular weight of the bucks were positively correlated at 0.781 ($P<0.01$), the scrotal circumference and the testicular diameter of the bucks were positively correlated at 0.544 ($p<0.01$), the scrotal circumference and the epididymal length of the bucks were positively correlated at 0.521 ($p<0.01$), the testicular weight and testicular diameter of the bucks were positively correlated at 0.898 ($p<0.01$), the testicular weight and the testicular length of the bucks were positively correlated at 0.363 ($p<0.05$), the testicular weight and the epididymal length of the bucks were positively correlated at 0.635 ($p<0.01$), the testicular diameter and the testicular length of the

**Table 1.** Descriptive statistics for the right and left testes and epididymides of Red Sokoto bucks.

| Parameter | Mean ± Standard deviation (right) | Mean ± Standard deviation (left) | Mean ± Standard deviation (right and left) |
|---|---|---|---|
| Age (months) | 44.7 ± 9.9 | - | - |
| Weight (kg) | 12.7 ± 2.3 | - | - |
| Scrotal circumference (cm) | 17.5 ± 1.4 | - | - |
| Testicular weight( g) | 52.6 ± 10.4 | 52.1 ± 9.6 | 52.3 ±9.9 |
| Testicular diameter (cm) | 10.9 ± 1.0 | 11.0 ± 0.8 | 10.9 ± 0.9 |
| Testicular length (cm) | 5.1 ± 0.6 | 5.1 ± 0.8 | 5.1 ± 0.7 |
| Epididymal length (cm) | 8.0 ± 1.0 | 8.0 ± 1.0 | 8.0 ± 1.0 |
| Gonadal motility (%) | 24.4 ± 19.5 | 18.3 ± 17.6 | 21.4 ± 18.5 |
| Gonadal sperm viability | 86.3 ± 5.6 | 87.7 ± 6.0 | 87.0 ± 5.8 |
| Extra-gonadal motility (%) | 54.2 ± 31.4 | 56.1 ± 32.3 | 60.1 ± 34.2 |
| Extra-gonadal sperm viability | 94.6 ± 2.8 | 94.8 ± 4.1 | 94.7 ± 3.4 |

Means are not significantly different at P < 0.05.

**Table 2.** Correlations of age, weight, scrotal circumference, testicular weight, testicular diameter, testicular length, epididymal length, Gonadal and extra-gonadal sperm motility and viability of Red Sokoto buck.

| Parameter | A | B | C | D | E | F | G | H | I | J | K |
|---|---|---|---|---|---|---|---|---|---|---|---|
| A | 1 | -0.322 | 0.085 | 0.256 | 0.287 | 0.153 | 0.197 | -0.352* | 0.119 | 0.044 | 0.152 |
| B | -0.322 | 1 | 0.470** | 0.507** | 0.390* | 0.188 | 0.333* | 0.370* | -0.097 | 0.286 | 0.275 |
| C | 0.085 | 0.470** | 1 | 0.781** | 0.544** | 0.232 | 0.521** | 0.039 | -0.137 | -0.168 | 0.090 |
| D | 0.256 | 0.507** | 0.781** | 1 | 0.898** | 0.363* | 0.635** | 0.084 | -0.006 | -0.109 | 0.036 |
| E | 0.287 | 0.390* | 0.544** | 0.898** | 1 | .395* | 0.514** | 0.007 | 0.121 | -0.185 | 0.056 |
| F | 0.153 | 0.188 | 0.232 | 0.363* | 0.395* | 1 | 0.696** | -0.244 | -0.183 | -0.128 | -0.115 |
| G | 0.197 | 0.333* | 0.521** | 0.635** | 0.514** | 0.696** | 1 | -0.090 | -0.312 | -0.054 | -0.040 |
| H | -.352* | 0.370* | 0.039 | 0.084 | 0.007 | -0.244 | -0.090 | 1 | 0.163 | 0.322 | 0.325 |
| I | 0.119 | -0.097 | -0.137 | -0.006 | 0.121 | -0.183 | -0.312 | 0.163 | 1 | 0.003 | 0.419* |
| J | 0.044 | 0.286 | -0.168 | -0.109 | -0.185 | -0.128 | -0.054 | 0.322 | 0.003 | 1 | 0.278 |
| K | 0.152 | 0.275 | 0.090 | 0.036 | 0.056 | -0.115 | -0.040 | 0.325 | 0.419* | 0.278 | 1 |

*****Correlation is significant at the 0.05 level. **Correlation is significant at the 0.01 level. A: Age (months), B: Weight (kg), C: Scrotal circumference (cm), D: Testicular weight (g), E: Testicular diameter (cm), F: Testicular length (cm), G: Epididymal length (cm), H: Gonadal sperm motility (%), I: Gonadal live-dead ratio (%), J: Extra-gonadal motility (%), K: Extra-gonadal live-dead ratio (%).

bucks were positively correlated at 0.395 ($p<0.05$), the testicular diameter and the epididymal length of the bucks were positively correlated at 0.514 ($p<0.01$), the testicular length and the epididymal length of the bucks were positively correlated at 0.696 ($p<0.01$), the epididymal length and the gonadal sperm viability were negatively correlated at 0.312 ($p<0.05$), the gonadal sperm viability and the extra- gonadal sperm viability were positively correlated at 0.419 ($p<0.05$) (Tables 1 and 2).

The sperm morphological abnormalities showed that tail-less head (primary abnormality), headless tail (secondary abnormality), bent tail (secondary abnormality), curved tail (secondary abnormality), bent mid-piece (tertiary abnormality) and curved mid-piece (secondary abnormality), total sperm abnormalities and total cellcount were found to be significant at $p<0.01$ in the left testis compared to the right (Table 3).

## DISCUSSION

It was observed in this study that as the weight of the animal increased, the scrotal circumference, testicular weight, testicular diameter, epididymal length and gonadal sperm motility also increased. As the testicular weight increased, the testicular length also increased. This is in agreement with the report of Raji and Njidda (2014) which stated that testicular weights have a high correlation with sperm reserves in the testes and epididymis and this is a direct reflection of testicular integrity for sperm production. Testicular weight has also been reported to highly correlate positively with body

**Table 3.** Testicular sperm morphological abnormalities of Red Sokoto bucks.

| Parameter | Sample | Mean ± Standard deviation |
|---|---|---|
| Tail-less head | Right | 1.8 ± 1.6 |
| | Left | 4.5 ± 2.5* |
| Headless tail | Right | 1.7 ± 1.4 |
| | Left | 3.2 ± 1.9* |
| Rudimentary tail | Right | 1.9 ± 2.6 |
| | Left | 3.1 ± 2.3 |
| Bent tail | Right | 5.0 ± 4.5 |
| | Left | 8.8 ± 5.9* |
| Curved tail | Right | 8.5 ± 4.2 |
| | Left | 13.4 ± 4.5* |
| Bent mid-piece | Right | 2.8 ± 1.9 |
| | Left | 5.0 ± 2.3* |
| curved mid-piece | Right | 4.6 ± 2.0 |
| | Left | 6.7 ± 3.2* |
| Looped tail | Right | 1.1 ± 0.9 |
| | Left | 1.8 ± 1.9 |
| Coiled tail | Right | 0.5 ± 0.8 |
| | Left | 0.6 ± 1.1 |
| Twin head | Right | 0.1 ± 0.3 |
| | Left | 0.8 ± 2.0 |
| Total abnormal cells | Right | 27.4 ± 15.2 |
| | Left | 47.8 ± 17.5* |
| Total count | Right | 235.7 ± 196.0 |
| | Left | 674.1 ± 149.8* |

*****Mean values are significant at the 0.01 level.

weight (Butswat and Zaharaddeen, 1998). There was a high correlation (P<0.01) between the testicular weight and scrotal circumference. This conforms to the report of Willet and Ohm (1957). There was also correlation (P<0.01) between testicular diameter and testicular weight. This also agrees with the report of Land and Carr (1975).

The values of the left and right testicular weights obtained from the present study were similar though it was observed that the right testis was heavier than the left testis. However, the values obtained were higher to that reported by Raji and Njidda (2014) but similar to that reported by Raji et al. (2008) who reported value of 55.00 g for Red Sokoto bucks of age less than one year. The right testis being heavier than the left testis is not in agreement with the reports of Raji and Njidda (2014) in which the left testis was found to be heavier than the right testis. The epididymal length observed was lower than that reported by Raji and Njidda (2014). These contrasts might be attributed to differences in age, system of management and level of nutrition of the experimental animals used in this study.

The presence of abnormal forms of spermatozoa in this study is consistent with the report of Moss et al. (1979) that a number of abnormal forms are normally encountered in all ejaculates and that their presence in large numbers is often associated with impaired. The left testis fertility and epididymis had significantly increased the number of sperm abnormalities. This supports the report of Dunn (1980).

## Conclusion

Age, weight and scrotal circumference of Red Sokoto buck were positively correlated to its testicular and epididymal parameters and therefore are potentially useful in the evaluation of the breeding soundness of the Red Sokoto bucks. Thus, it is therefore recommended that the age, weight and scrotal circumference of animals should be part of breeding soundness examination in the Red Sokoto bucks.

## Conflict of interests

The authors declare that they have no conflicts of interest.

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