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# Effect of successive ejaculations on the spermiogram of West African dwarf goats (*Capra hircus* L.)

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**OYEYEMI, M. O., M. O. AKUSU, O. E. OLA-DAVIES: Effect of successive ejaculations on the spermiogram of West African dwarf goats (*Capra hircus* L.). Vet. arhiv 70, 215-221, 2000.**

**ABSTRACT**

Twenty healthy adult male (bucks) West African dwarf goats (WADG) aged between 2 to 4 years and with a mass of from 16 to 20 kg were used in this study. They were randomly assigned into four groups of five bucks per group. In group A, semen was collected once a week for a period of eight weeks, while in group B semen was collected twice a week for a period of eight weeks, once a day for 21 days in group C, and twice daily at an interval of five hours for 21 days in group D. Live body masses, height at withers, scrotal length and scrotal circumference were not affected by successive ejaculations. The ejaculate volume decreased as the frequency of ejaculations increased, although the decrease was not significant (Group A 0.44±0.07, B 0.41±0.08, C 0.38±0.07 and D 0.36±0.08 ml) while the ejaculate colour was either milky or creamy. Mass sperm movement showed swirling waves and scored 4 in all groups, while the percentage progressive motility ranged between 88.7±3.10 and 94.54±3.00%. Percentage of live spermatozoa (Group A 96.57±2.40, B 96.24±2.53, C 96.10±2.28 and D 96.10±2.50%) was not affected by successive ejaculations although a decrease in sperm concentration was observed as the number of successive ejaculations increased. There was a significant increase ($P<0.05$) in abnormal spermatozoa as frequency of ejaculation increased.

**Key words:** ejaculation, spermiogram, fertility, goats, *Capra hircus*, Nigeria

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## Introduction

The West African dwarf goat (WADG) is the predominant breed of goat found in the southern part of Nigeria. The breed has a remarkable ability to make maximum use of roughage. Its preference for browsing on a wide variety of vegetation, its ability to withstand the extremes of the tropical climate and its relative trypanotolerance account for its widespread distribution throughout West, Central and East Africa, India and Fiji (OPPONG, 1965; SACKER and TRAIL, 1966; UPTON, 1985)

Reports of base-line data of semen characteristics have been documented (PHILLIPS et al., 1943; HIROE et al., 1960; AUSTIN et al., 1968; IGBOELI, 1974), while OKERE et al. (1986), and OYEYEMI et al. (1996) reported on the effect of frequent ejaculations on semen characteristics. The increasing need for the use of artificial insemination in WAD goats has created a greater demand for semen from superior progeny tested sires. Sexual preparation prior to ejaculation and high ejaculation frequencies increase sperm output (HALE and ALMQUIST, 1960).

The aim of this study was to determine the level of morphological abnormalities that may occur following successive ejaculations. It is hoped that such information will be a useful guide in semen collection for artificial insemination.

## Materials and methods

Twenty healthy male West African dwarf goats (WADG) aged from 2 to 4 years and with masses of 16 to 20 kg were used in this study. They were randomly assigned to four groups of five bucks per group after equalization of weight. All animals were clinically examined and confirmed to be free from any obvious abnormalities of the palpable reproductive organs. They were housed in pens with concrete floors covered with wood shaving as litter.

They were allowed to graze in the morning (7 a.m. to 3 p.m.) on pasture consisting of carpet grass (*Axonopus compressors*) guinea grass (*Panicum maximum*), elephant grass (*Pennisetum purpreum*) and dried Cassava (*Manihot esclentum*) and peelings supplemented with a corn-based concentrate ration in the evening. Water was provided *ad libitum*. Routine medication consisted of de-worming with Albendazol® (Phenix, Belgium) at a dosage of 2ml/10kg body mass, and vaccination against PPR using Tissue Culture Rinderpest Vaccine (NVRI, Vom, Nigeria). Animals were weighed weekly using a spring balance, and scrotal circumference was determined at the widest part of the scrotum weekly.

*Semen collection*

Semen was collected by the electro-ejaculation (EE) method. In group A, semen was collected once a week for a period of eight weeks, while in group B semen was collected twice a week for a period of eight weeks, once a day for 21 days in group C, and twice daily at an interval of five hours for 21 days in group D. The pH of each ejaculate was determined using a pH-meter.

*Semen examination*

Colour and consistency were determined by visual assessment and volume of ejaculate read from a graduated collecting tube. Sperm concentration was determined using the improved Neubauer haemocytometer after dilution in 0.05% formol-saline. Sperm mass activity; progressive motility, live-dead ratio and morphology were determined by conventional methods (ZEMJANIS, 1970). Acrosomal integrity was determined in wells and Awa-stained smears.

Morphological aberrations were determined from a total count of 400 spermatozoa in smears obtained with Nigrosin and Eosin for live-dead count. Sperm abnormalities were classified as described by BLOM, 1972.

*Data analysis*

Data obtained was subjected to students 'T' test and chi-square test for the establishment of significance (SNEDECOR and COCHRAN, 1973).

## Results

Results of body masses, scrotal circumference and the spermiogram are summarized in Table 1. The body condition of the animals was not significantly influenced by the frequency of collection. Colour of ejaculates was white/creamy at the start of treatment in all groups.

There was no change in ejaculate colour in groups A and B, but tended to be somewhat watery in groups C and D at the end of the experiment. There was no significant difference between the groups in ejaculate volume and mass activity although volume tended to decrease with increase in rate of ejaculation. The percentage progressive motile spermatozoa decreased as the frequency of ejaculation increased. Percentage of live spermatozoa was not affected by treatments.

Concentration per ml of spermatozoa was affected by treatment, with group D being inferior ($P<0.05$) to other groups, the latter showing no difference between them. As was anticipated, the total number of

spermatozoa in the ejaculate followed the same trend as observed in concentration.

Table 1. Physiological characteristics of semen of West African dwarf goats (Mean±SE)

| Semen characteristics | Group A | Group B | Group C | Group D |
|---|---|---|---|---|
| Body mass (kg) | 18.2±1.1 | 18.6±1.2 | 18.2±2.10 | 18.6±1.2 |
| Height at withers (cm) | 75.1±2.1 | 77.2±2.4 | 76.2±2.3 | 77.6±2.4 |
| Scrotal length (cm) | 16.0±0.6 | 16.4±0.8 | 16.2±0.6 | 16.8±0.7 |
| Scrotal cicumferences (cm) | 20.6±1.1 | 20.4±1.2 | 20.0±1.2 | 20.6±1.1 |
| Number of ejaculation | 8 | 16 | 21 | 42 |
| Ejaculated colour | WC | WC | WC | WC |
| Ejaculate volume (ml) | 0.44±0.07 | 0.41±0.08 | 0.38±0.07 | 0.36±0.08 |
| Wave motion (0-4) | 4 | 4 | 4 | 4 |
| Progressive mobility (%) | 94.59±3.00 | 90.32±3.40 | 89.70±3.52 | 88.7±3.10 |
| Percentage live spermatozoa | 96.57±2.40 | 96.24±2.53 | 96.58±2.28 | 96.62±2.50 |
| Semen concentration ($\times 10^9$/ml) | 2.62±0.8 | 2.60±0.7 | 2.41±0.8 | $1.86\pm0.40^b$ |
| pH | 6.6 | 6.7 | 6.7 | 6.8 |
| Total sperm cell ($\times 10^9$) | $1.15\pm0.38^a$ | $1.06\pm0.41^a$ | $0.92\pm0.32^a$ | $0.68\pm0.28^b$ |

a, b=Values along the horizontal column differently superscripted differ significantly ($P<0.05$); WC=White creamy

Table 2. Morphological characteristics of semen of West African dwarf bucks

| Parameter | | Group A | Group B | Group C | Group D |
|---|---|---|---|---|---|
| Primary abnormalities | Twin head | 0 | 9 | 10 | 15 |
| | Dag deffect | 2 | 5 | 12 | 10 |
| | Abnormal head | 3 | 11 | 11 | 17 |
| | Proximal cytoplasmic droplet | 0 | 0 | 2 | 5 |
| | Distal cytomlasmic droplet | 0 | 10 | 14 | 20 |
| Secondary abnormalities | Tail coiled around head | 15 | 49 | 74 | 185 |
| | Tail coiled around mid piece | 15 | 45 | 53 | 127 |
| | Tail coiled below head | 18 | 36 | 62 | 85 |
| Tertiary abnormalities | Detached head | 7 | 46 | 49 | 131 |
| | Simple bent tail | 12 | 71 | 66 | 187 |
| Total number of abnormal cells | | 72 | 282 | 353 | 782 |
| Mean of the abnormalities | | $7.20\pm6.79^a$ | $28.20\pm26.92^b$ | $35.30\pm26.44^c$ | $78.20\pm70.40^d$ |

a, b, c, d=Value along the horizontal column differently superscripted differ significantly ($P>0.05$)

Table 2 summarizes the morphological aberration to treatments. Group A, with only a weekly collection, showed least abnormalities,

especially head abnormalities. An increase ($P<0.05$) in abnormalities as a consequence of increased ejaculation was observed, particularly in groups C and D.

## Discussion

The study showed that semen collection/ejaculation had no effect on live weight or on height at withers irrespective of frequency of collection. Scrotal circumference has been used as an index of sperm production (SMITH and SOMADE, 1994). While treatments affected some other indices of sperm quality and quantity, the similarity of scrotal circumference could be due to similarities in the mass of testicular parenchyma. The relative stability in pH values could have resulted from the production capacities of the accessory sexual glands, whose secretions are responsible for the buffering capacity of semen.

The effects of treatment on other parameters of ejaculation were as predicted. Frequent ejaculation was expected to affect ejaculate colour, mass activity, motility, volume, concentration and total spermatozoa in the ejaculate. These parameters are dependent upon viability of spermatozoa (HAFEZ, 1980) and the number of spermatozoa in the ejaculate (IGBOELI, 1974). It should be noted that treatment had no effect on the percentage of live spermatozoa, indicating that frequent ejaculation may not have any deleterious effect on the testes or epididymides, such as testicular degeneration or spermatozoa (BLOM, 1972, 1973; AKUSU, 1985).

Morphological abnormalities as a consequence of frequent ejaculation will have important effects on fertility. The rise in primary abnormalities, especially proximal cytoplasm droplets, indicated that frequent ejaculation resulted in the rapid release of immature spermatozoa (OYEYEMI and AKUSU, 1998). This factor was largely responsible for the significant reduction in sperm concentration/total spermatozoa in group D and would suggest that semen collection in bucks should not exceed two ejaculations in a week. This will ensure the harvesting of mature spermatozoa and acceptable concentration and morphology.

## References

AKUSU, M. O. (1985). Differences in morphology of bull spermatozoa from normal and pathological testis during epididymal transit. Nigerian Vet. J. 14, 30-32.

AUSTIN, J. N., R. B. LEIDY, G. M. KRISE, E. E. HUPP (1968): Normal values for semen. In: Veterinary Reproductive and Obstetrics (ARTHUR, G. H., Ed.). Williams Cloves and sons Ltd. Beccles and London.

BLOM, E. (1972): The ultrastructure of some characteristic sperm defects and a proposal for a now classification of bull spermiogram. Ahi del VII syposio International de zootechnia, Milano. pp. 125-139.

BLOM, E. (1973): The ultrastructure of some characteristic sperm defects. Nord Vet. Med. 25, 283

HAFEZ, E. S. E. (1980): Reproduction in Farm Animals. 4th ed. Laea and Febiger. Philadelphia.

HALE, E. B., J. O. ALMQUIST (1960): Relation of sexual behavior to germ cell output in farm animals. Dairy Sci. 43 (suppl. 145).

HIROE, K., Y. TOMIZUKA, Y. WAIDE, J. MASCAKI (1960): Biochemical studies on the semen of domestic animals; on chemical composition of seminal plasma goats. Japanese J. Anim. Reprod. 6, 28-31.

IGBOELI, G. A. (1974): Comparative study of the semen and seminal characteristics of two breeds of goats. East Afri. Agric. J. 40, 132-137.

OKERE, C., O. CHIKBOKA, G. MONTAMA (1986): Effect of frequent ejaculation of West African Drvarf goat on semen characteristics. Anim. Prod. Sci. 11, 249-258.

OPPONG, E. N. N. (1965): A note on goats in Ghana with reference to the need to develop goat husbandry to improve the nation's diet. Ghana Fmr 9, 144-148.

OYEYEMI, M. O., M. O. AKUSU (1998): Short-term effect of hemi-orchidectomy testicular and ejaculate characteristics of West African Dwarf Bucks. Small Run. Res. 31, 75-78.

OYEYEMI, M. O., M. O. AKUSU, M. O. OLAOYE, O. T. OMOBOWALE (1996): Effect of frequent ejaculation on the semen characteristics of West African Dwarf Bucks. Trop. Vet. 14, 71-75.

PHILIPS, R. W., R. G. SCHOTT, O. N. EATON, V. L. SIMMON (1943): Seasonal variation in the semen of sheep and goats. Cornel Vet. 33, 227-235.

SACKER G. D., J. C. M. TRAIL (1966): Production characteristics of head of East African Mubende goats. Trop. Agric. Fri. 43, 43-51, 1966.

SMITH, O. B., B. SOMADE (1994): Interaction between nutrition and reproduction in farm animal. Proceeding of IFS JAN 17-21. pp. 7-25.

SNEDECOR G. W., W. G. COCHRAN (1980): Statitistical Methods. 6th ed. Iowa State University Press. Amess, USA.

UPTON, M. (1985): Returns from small ruminants production in South West Nigeria. Agric. Syst. 17, 65-84.

ZEMJANIS, R. (1970): Collection and evaluation of semen. In: Diagnostic and Therapeutic Technique in Animal Reproduction. 2nd ed. The Williams and Wilkins Company. Baltimore.

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**OYEYEMI, M. O., M. O. AKUSU, O. E. OLA-DAVIES: Učinak uzastopnih ejakulacija na spermiogram zapadno-afričkih patuljastih koza (*Capra hircus* L.). Vet. arhiv 70, 215-221, 2000.**

**SAŽETAK**

U ovim istraživanjima rabljeno je 20 zdravih odraslih jaraca zapadno-afričkih patuljastih koza (*Capra hircus* L.) u dobi od 2 do 4 godine i mase 16 do 20 kg. Jarci su nasumično podijeljene u 4 skupine po 5 životinja. U skupini A, ejakulat se uzimao jednom tijedno tijekom osam tjedana, dok se u skupine B uzimao dva puta tjedno tijekom osam tjedana. U skupine C ejakulat se uzimao jednom dnevno tijekom 21 dana, a u skupine D dva puta dnevno u razmaku od pet sati, tijekom 21 dana. Uzastopne ejakulacije nisu utjecale na živu tjelesnu masu, visinu u grebenu, te na duljinu i opseg mošnje. Volumen ejakulata se smanjivao s povećanjem učestalosti ejakulacija, ali to smanjenje nije bilo značajno (skupina A

0,44±0,07; skupina B 0,41±0,08; skupina C 0,38±0,07 i skupina D 0,36±0,08 ml). Ejakulat je bilo mliječne ili krem boje. Gibanja spermija su bila u kružnim valovima i ocijenjena su sa 4 u svim skupinama jaraca, dok je postotak progresivnog kretanja bio u rasponu od 88,7±3,10 do 94,54±3,00%. Na postotak živih spermija nije utjecala učestalost ejakulacija (skupina A 96,57±2,40; skupina B 96,24±2,53; skupina C 96,10±2,28 i skupina D 96,10±2,50%, iako je uočen pad koncentracije spermija s povećanjem broja uzastopnih ejakulacija. S povećanjem broja uzastopnih ejakulacija uočen je značajan ($P<0,05$) porast broja abnormalnih spermija.

**Ključne riječi:** ejakulacija, spermiogram, plodnost, koza, *Capra hircus*, Nigerija