ABSTRACT

The effect of different intensities of semen collection on semen characteristics, cations and fructose concentrations of the seminal plasma in West African dwarf bucks was studied. Twelve clinically healthy and matured bucks weighing between 25.6 – 35.7 kg were randomly allocated to four treatment groups in a completely randomized design (CRD). Semen quality (expressed as progressive motility and percentage of morphologically normal/life sperm cells) and sperm quantity (expressed as sperm concentration and semen volume), the cations (sodium, potassium, calcium, and magnesium) and fructose concentrations in the seminal plasma were the parameters evaluated in each buck. The highest sperm motility and percentage live sperm cells were observed when semen was ejaculated once per week. As compared with twice per week, three times per week and four times per week, the once a week ejaculations in semen concentration and volume were highest. The cations and fructose levels of the seminal plasma were highest at the once per week ejaculations. The results of this study indicate that once per week semen ejaculation enhances the fertility of West African dwarf bucks.

Key words: Bucks, West African Dwarf, ejaculation, frequency of semen

INTRODUCTION

The West African dwarf goat seldom measures more than 55 cm at the withers and weighs 20 – 30 kg on the average (Mecha, 1975), and the bucks have well-developed beard (Okere, 1983). The West African dwarf goat is crucial to the socio-economic status of Nigerian rural dwellers. The West African dwarf bucks has been noted for an outstanding sexual agility hence they have been

widely used for artificial insemination programmes (Iheukwumere, 2003). Semen quality and quantity are evaluated based on a number of parameters including semen volume, progressive motility of sperm cells, morphology of spermatozoa, proportions of live spermatozoa and sperm concentrations (Igboeli, 1974; Igboeli and Rakha , 1971 and Okere, 1983). There exist a number of information on the biochemistry of ejaculates of exotic bucks. Igboeli and Rakha (1971) and Igboeli (1974) have investigated the distribution of cations in the seminal plasma, whole semen and their effects on sperm metabolism in various breeds of goats. However, no such studies have been carried out on West African dwarf bucks. This study was, therefore carried out to determine the effect of frequency of ejaculation on semen quality, values for the buck cations (Na^{+}, K^{+}, Ca^{++}, Mg^{++}) and fructose in the seminal plasma of sexually intact West African dwarf bucks.

MATERIALS AND METHODS

Twelve sexually active and clinically healthy matured West African dwarf bucks bought from an open market and housed individually in pens were used for this study. The animals were dewormed and fed *ad libitum* with a mixture of hay and silage. A concentrate ration of maize and palm kernel cake was given at 30 g/kg per day. The animals were allowed a period of 2 hours daily to browse and exercise in fenced paddocks planted with pasture consisting of giant star grass (*Cynodom nlemfluensis)* and elephant grass (*Pennisetum purpureum).* Fresh drinking water and salt lick as mineral supplement were provided.

Experimental design

The twelve bucks were divided into 4 treatment groups consisting of 3 bucks in each group. The bucks were subjected to a 2-week conditioning period of semen collection using the standard Precision Electronic Model Electro ejaculator in a completely randomized design (CRD).

Semen collection and evaluation

Following the conditioning period, the bucks were ejaculated based on one (1T/WK), two (2T/WK), three (3T/WK) and four (4T/WK) times per week. The experiment lasted for 12 weeks during January to March. Ejaculates were collected into warm graduated tubes using an Electronic ejaculator according to Glossop (1991) in the morning hours 9 – 11 am each day. Semen evaluation involved determination of ejaculate volume, colour, viscosity, sperm motility and concentration. Sperm motility was recorded in percentage according to Okere (1983) and Umesiobi and Iloeje (1999). Sperm morphology was assessed by differential staining according to White (1974). Semen samples used for cation and fructose concentration estimates were centrifuged at 15,00 rpm for 15 minutes. The seminal plasma samples were immediately subjected to laboratory analysis. Sodium and potassium concentrations were determined with a flame photometer on samples suitable diluted with deionized water (Iheukwumere *et al.,* 2001), while calcium and magnesium concentrations were estimated by means of atomic absorption spectrophotometer on seminal plasma using the methods of Igboeli (1974). Fructose concentration in the seminal plasma was determined according to the procedure of Wilson *et al.* (1989).

Statistical analysis

Data on ejaculate characteristics, cation and fructose were subjected to analysis of variance according to the procedure described by Steel and Torrie (1980) and mean differences were separated by the Duncan's New Multiple Range Test as described by Obi (1990)

RESULTS AND DISCUSSION

As shown on Table 1, semen volume was highest in one (1T/WK) semen collection, but however, the values did not differ significantly ($P > 0.05$) from treatments 2T/WK, 3T/WK, but they differed significantly ($P < 0.05$) from 4T/WK semen volume. This result agrees with the reports of Igboeli (1974), Umesiobi and Iloeje (1999) and Iheukwumere *et al.* (2001), who noted that high frequency of ejaculation significantly affects the quantity of semen volume.

Table 1: Effect of intensity of ejaculation on semen characteristics of West African dwarf bucks

Parameters	Ejaculation frequency (Number of collections/wk)			
	1	2	3	4
Semen volume (ml)	1.40 ± 0.6^{a}	0.80 ± 0.2^{a}	0.80 ± 0.2^{a}	0.6 ± 0.4^{b}
Sperm motility (%)	83.0 ± 7.3^{a}	75.0 ± 3.3^{b}	59.0 ± 3.0^{c}	50.0 ± 3.6^{c}
Live sperm cells (%)	77.3 ± 4.3^{a}	74.2 ± 8.6^{a}	55.6 ± 3.2^{b}	41.4 ± 4.5^{b}
Normal sperm cells (%)	88.0 ± 8.7^{a}	$84.7 \pm 6/4^{a}$	82.3 ± 3.6^{a}	62.0 ± 5.6^{b}
Sperm conc/ejac (x 10^{9})	0.75 ± 0.05^{a}	0.60 ± 6.02^{b}	0.57 ± 0.05^{b}	0.21 ± 6.06^{c}

a b c: Means within row having different superscripts are significantly different ($P < 0.05$)

The value of motile sperm cells was highest for one 1T/WK and lowest in the 4T/WK semen collections. However, there was no significant difference ($P > 0.05$) between the 3T/WK and the 4T/WK groups. The results in this study compares favourably with the reports of Chiboka and Somade (1980), Iheukwumere and Okere (1990) and Iheukwumere *et al.* (2000) where the variously recorded low percentage sperm motility at high frequency of semen collection.

Percentage live spermatozoa differed significantly ($P < 0.05$) between frequencies of semen collection at 1T/WK, 3T/WK and 4T/WK frequencies. However, there was no significant difference ($P > 0.05$) between the 1T/WK and 2T/WK groups. The accessory sex glands secretions are observed to be produced more abundantly than sperm rich semen during high frequencies of ejaculation (Orguer and Signoret, 1984). It is suggested that semen from bucks with high frequency of ejaculation tend to have lower proportion of live spermatozoa. Szurop and Jocble (1985), Umesiobi and Iloeje (1999). These observations are in agreement with the findings in this study.

The percentage normal sperm cells was significantly different ($P < 0.05$) by frequency of ejaculation only at 4T/WK, with non significant differences ($P > 0.05$) observe`mjd between the 1T/WK and 3T/WK groups. This observation agrees with the findings of Williamson (1974), Chiboka (1980), Dauda (1984), Iheukwumere and Okere (1990), where they reported variously that frequent ejaculation leads to the distortion and subsequent damage to the neck of spermatozoa which is reported to be the most fragile part of the spermatozoa, hence the obvious reduction in the percentage of normal sperm cells following high frequencies of semen ejaculation observed in this study.

Frequency of ejaculation produced significant reduction ($P < 0.05$) on semen concentration per ejaculation only at 4T/WK, with no significant differences ($P > 0.05$) recorded between the lower levels 1T/WK, 2T/WK and 3T/K of semen collections. Carbonell and Novarro (1990), Umesiobi and Iloeje (1999) reported existence of high relationships between sperm concentration per ejaculate and percentage normal spermatozoa.

Table 2 shows the cations and fructose concentrations of the seminal plasma of West African dwarf bucks.

Table 2: Effect of intensity of ejaculation on cation and fructose levels of the seminal plasma of West African dwarf bucks

Parameters	Ejaculation frequency (Number of collections/wk)			
	1	2	3	4
Sodium (mg/100 ml)	163.30 ± 12.1^{a}	140.00 ± 10.0^{a}	95.00 ± 7.0^{b}	60.20 ± 6.3^{c}
Potassium (mg/100 ml)	38.10 ± 6.1^{a}	31.00 ± 3.2^{b}	10.40 ± 2.4^{c}	7.00 ± 0.5^{d}
Calcium (mg/100 ml)	8.30 ± 1.1^{a}	8.20 ± 2.1^{a}	5.20 ± 1.1^{b}	3.50 ± 1.0^{c}
Magnesium (mg/100 ml)	10.20 ± 2.0^{a}	8.50 ± 3.2^{a}	3.10 ± 0.7^{b}	3.10 ± 0.6^{b}
Fructose (mg/100 ml)	175.20 ± 11.2^{a}	163.10 ± 8.2^{b}	125.50 ± 7.4^{c}	116.40 ± 9.2^{d}

a b c d: Means within row having different superscripts are significantly different ($P < 0.05$)

There was no significant change ($P > 0.05$) in the seminal sodium concentration between the 1T/WK and 2T/WK semen collections frequency groups. However, at the 3T/WK and 4T/WK levels, there were significant differences ($P < 0.05$) in sodium levels

The seminal plasma cation levels observed in this study are in agreement with the findings of Igboeli and Rakha (1974) in goats and Iheukwumere *et al.* (2000) in rams. Highly significant ($P < 0.01$) reductions were recorded in potassium levels in the seminal plasma from 38.10 ± 6.1 mg/100 ml in the 1T/WK to 7.00 ± 0.5 mg/100 ml in the 4T/WK group. The calcium values of the seminal plasma did not differ significantly ($P > 0.05$) between 1T/WK and 2T/WK, however, they differed significantly ($P < 0.05$) between 3T/WK and 4T/WK frequencies of semen collection. The seminal magnesium values did not differ significantly ($P > 0.05$) between 1T/WK and 3T/WK,

however, they differed significantly ($P < 0.05$) between 3T.WK and 4T/WK frequencies of semen collections.

The seminal fructose concentration were significantly depleted ($P < 0.05$) at the various frequencies of semen ejaculation, with the least values recorded for the 4T/WK group. This result is in accordance with the previous reports of Igboeli (1974) and Chiboka (1980) where they indicated that most of the semen metabolites make detrimental adjustments whenever semen, was frequently harvested. These observations are in agreement with the findings of Mgbeoji and Orji (1984), Batahyal *et al.* (1985) and Iheukwumere *et al.* (2001). They reported that although males on high plane of nutrition produced high levels of fructose and cations in their seminal plasma, frequent ejaculations of semen tremendously retard the male's sexual drive (libido as well as fructose and cation concentrations of the seminal plasma.

CONCLUSION

The results of this study suggest that semen from West African dwarf bucks ejaculated at a frequency of once per week (1T/WK) is most suitable for use in artificial insemination (A. I.) programme. This suggestion is supported by the fact that bucks in this treatment (1T/WK) group produced semen with the highest semen characteristics exemplified by total semen volume, sperm motility, seminal sperm concentration per ejaculate, seminal fructose and cation concentrations s. On the other hand, frequent ejaculation of goats to as high as 4 times per week (4T/WK) produced the lowest quality and quantity of semen and cation concentrations in the seminal plasma with tremendous potential negative consequences on animal reproduction.

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