

EFFECT OF UROMAIZ ON SPERM CHARACTERISTICS IN WEST AFRICAN DWARF BUCKS

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ABSTRACT

The effect of uromaiz, slow ammonia releasing urea product, produced by autoclaving and drying of germinated maize and urea on semen characteristics was investigated in twenty West African Dwarf (WAD) bucks in a completely randomized design experiment. The bucks were 11 and 13 months old and they weighed 9.26 ± 1.33 kg. The bucks were assigned to five treatment groups and fed 0, 25, 50, 75 and 100% uromaiz inclusion in the diet for eight weeks while data collection was carried out weekly at the last four weeks. The results showed that important semen characteristics such as semen volume, sperm motility, sperm concentration and Sperm number per ejaculate increased ($p < 0.05$) at 25 and 50% levels of inclusion and reduced at higher levels of 75% and 100%. Primary abnormality located in the head, midpiece and tail increased ($p < 0.05$) with increasing levels of uromaiz inclusion but values obtained were within the acceptable range for optimal fertility. The findings of this study indicate that uromaiz at 25% or 50% could be included in the diet of WAD bucks to enhance sperm quality.

Keywords: Bucks, Sperm characteristics, Uromaiz.

INTRODUCTION

West African Dwarf goats are usually left to scavenge and cater for their nourishment (Adeloye, 1985). They feed on wastes that are of poor nutritive values and exposed to poor management conditions, which could account for the low fertility and poor semen quality in this breed (Mack, 1983, Ademosun, 1987). The achievement of high levels of fertility and prolificacy in West African Dwarf goats' flocks depends not only on the female members but also upon their male consorts. As plane of nutrition affects semen quality in goats (Singleton and Belstra, 1997), poor quality of semen has been attributed to prolonged under feeding

(Mack, 1983; Ademosun, 1987) and the poor quality of this parameter might be seen as indirect indication of nutritional stress. Under these circumstances strategic supplementation with economic and readily available sources of digestible energy and nitrogen not only improve the growth rate, but also reproductive characteristics in goat. Mirza *et al.* (1988) reported that urea molasses blocks offer an economical source of supplementation under field conditions. Workers like Osuagwah (1992), Lindsay and Laing (1995) and Rafiq *et al.* (2007) found a significant improvement in fertility rate, body weight of ewes and does, and subsequent growth of kids and lambs, when they fed urea as source

of nitrogen and molasses as a source of readily available energy during drought conditions. Grains are generally low in protein, therefore supplementing them with protein from cheaper sources is necessary. Urea is a good source of non-proteinous nitrogen (NPN) which can be broken down by rumen microbes to synthesize body protein. Urea provides acceptable nitrogen source and its inclusion in diet has been reported to increase the growth rate of animal (NDSU, 1996). NDSU (1996) observed increase in body weight of animals when fed with urea-treated germinated grains.

However, diets with high levels of crude protein, nitrogen compounds or lack of a ruminal substrate for complete transformation of ammonia into bacterial protein may increase rumen and consequently plasma urea concentration. Plasma urea can reach the seminiferous tubules (Mann and Mann, 1981; Rodriguez-rigau and Steiberger, 1982) and the presence of testicular transporters (Tsukaguchi *et al.*, 1997) for urea suggests that it may play a role in spermatogenesis (Tsukaguchi *et al.*, 1997). Increased plasma urea concentration in humans due to renal insufficiency (Phadke *et al.*, 1970, Holdsworth *et al.* 1978; Netto *et al.*, 1980; Handelsman, 1985; Lim 1987) and in dairy cows (Carrol *et al.*, 1987; Calfield *et al.*, 1990; Elrod *et al.*, 1993; Ferguson *et al.*, 1993) due to high levels of nitrogen compounds in the diet, are considered to predispose to reduced fertility.

Uromalt, slow ammonia releasing urea product, produced by autoclaving and drying of germinated grains and urea, has been reported to contain 62.9% degradable nitrogen (Virk *et al.*, 1989), and can be used when molasses or other feed stuffs that are rich in rapidly fermentable carbohydrate are

not available. This study was therefore carried out to determine the effect of uromaiz, a product of autoclaving and drying of germinated maize and urea on sperm characteristics of West African Dwarf bucks.

MATERIALS AND METHODS

Location of Experiment

The experiment was carried out at the Small Ruminant Unit of Department of Animal Production, University of Ilorin, Ilorin lies between latitude 8°29'N and longitude 4°35'E with altitude of 305m above level in the Southern Guinea Savannah ecological zone of Nigeria.

Animals and Management

Twenty (20) West African Dwarf bucks were raised under intensive system of management. The bucks aged 13-15months and weighing 7-11 kg were fed with 500g/day of concentrate diet each and supplemented with Guinea grass *ad libitum*. The feed concentrate consisted of maize (20%), cassava peel (30%), groundnut cake (10%), wheat offal (20%), palm kernel cake (18%), bone meal (1%), premix (0.5%) and salt (0.5%).

Preparation of Uromaiz

Maize was soaked in some liters of water for about ten minutes, removed and spread in a room for 120 hours (Daramola and Adeloye, 2005). The germinated maize was then sun dried for four days to stop further growth of the rootlets and shoots. 2kg of urea was dissolved in 12.5 liters of water and thoroughly mixed with 50kg of germinated maize. The mixture was then toasted on fire in a big steel pot which allowed for proper stirring and turning for 30 minutes. A brown colour of the mixture was obtained. The mixture was further sun dried for 4 days and milled.

The trial

The bucks were randomly grouped into 5 dietary treatments consisting of 0, 25, 50, 75 and 100% uromaiz inclusion in the diet (Table 1). The bucks were fed these diets for 8 weeks. Semen was obtained once every week with Electro-ejaculator starting from 5th week after the commencement of the study for four consecutive weeks. The volume of the semen collected was read directly from graduated collection tube. Mass activity was determined within one minute of collection in a drop of concentrated semen without coverslip under low magnification (X4). The microscopic wave pattern was observed, ranging from slow to very rapid motion depending on the quality of the semen. The activities were graded as: 0= no mass activity; += slow wave motion; ++= rapid wave motion; +++= very-wave motion. Progressive sperm motility was determined with a drop of semen in a drop of Sodium citrate under coverslip at a magnification of X10 as the percentage of sperm moving straight forward over the microscopic field. The concentration was determined by the use of an improved Neubauer haemocytometer (Bearden and Fuquay, 1997). Semen was pipetted to the 0.5 mark on the pipette (using the red blood cell pipette) and this was made up to 1.01 marks on the pipette with normal saline. Normal saline serves both to dilute the semen and fix the spermatozoa present. The pipette was then introduced into pipette shaker and allowed to mix. About 2 to 3 drops of the diluents were discarded from the pipette before it was introduced into the counting chamber of the haemocytometer chamber for counting. The five squares that formed the diagonal segment of the square were counted. The spermatozoa morphology was determined by staining a drop of semen with a drop of eosin solution. These were

gently mixed together and a smear was made on another clean warm slide and air-dried. The slide was observed under a light microscope, ($\times 400$ magnifications) for the presence of abnormal sperm cells out of at least 600 sperm cells from several fields of the slides. The number of sperm cells and percentages of abnormal sperm cells were noted and recorded. Sperm cells that absorbed eosin solution were recorded as dead sperm cells. Semen colour was determined by visual assessment.

Statistical analysis

Data obtained from each buck were values of the mean of the four weekly observations. The data were subjected to analysis of variance in completely randomized design. Differences between means were separated using Duncan Multiple Range Test (Duncan, 1955).

RESULTS

The effect of different levels of uromaiz on semen characteristics of WAD bucks is presented in Table 2. The results showed marked variations among the different dietary treatments. Semen volume and progressive sperm motility increased ($p < 0.05$) with increasing levels of the uromaiz up to 50% and thereafter declined. Sperm concentration, number of sperm per ejaculate and the number of does the ejaculate could inseminate followed similar pattern with the highest values ($p < 0.05$) at 50% uromaiz inclusion. However, values obtained for mass activity were similar among the treatments.

The morphological characteristics of semen obtained from the bucks fed varied inclusion levels of uromaiz are shown in Table 3. The results showed that primary abnormality located in the head, midpiece and tail differed ($p < 0.05$). Treatments with 25 and 50%

Table 1: Percentage (%) composition of uromaiz in the diet

Diet	0(%)	25(%)	50(%)	75(%)	100(%)
Concentrate (%)	100	75	50	25	0
Uromaiz (%)	0	25	50	75	100

Table 2: Semen characteristics (Means \pm S.E) of West African Dwarf bucks fed different levels of uromaiz

Parameters	0%	25%	50%	75%	100%
Semen colour	Milky	White	Milky	Milky	White
Semen volume (ml)	0.46 + 0.11 ^c	0.52 + 0.21 ^b	0.76 + 0.29 ^a	0.34 + 0.35 ^d	0.23 + 0.07 ^e
Mass activity	1.67 + 0.47	0.96 + 0.67	1.17 + 0.34	1.25 + 0.50	0.83 + 0.58
Progressive sperm motility (%)	62.5 + 6.46 ^b	62.5 + 6.33 ^b	68.7 + 2.50 ^a	57.5 + 6.46 ^c	55.0 + 5.77 ^d
Sperm concentration (x10 ⁹ /ml)	1.00 + 0.05 ^b	1.02 + 0.09 ^b	1.14 + 0.06 ^a	0.98 + 0.03 ^b	0.98 + 0.03 ^b
Sperm no/ejaculate (x10 ⁹ /ml)	0.46 + 0.01 ^b	0.53 + 0.21 ^b	0.87 + 0.09 ^a	0.33 + 0.05 ^c	0.23 + 0.07 ^c
Doe breed/ejaculate	10.4 ^c	11.0 ^b	13.0 ^a	9.39 ^d	8.98 ^d

a, b, c, d, e Means (\pm S.E., n=4 bucks) in the same row with different superscripts differ ($p < 0.05$).

Table 3: Morphological characteristics (Means \pm S.E) of semen of West African Dwarf bucks fed different levels of uromaiz

Parameters (%)	0%	25%	50%	75%	100%
Abnormal head	1.56 + 0.32 ^b	1.08 + 0.28 ^c	1.06 + 0.24 ^c	2.55 + 0.76 ^a	3.25 + 0.91 ^a
Abnormal midpiece	0.63 + 0.43 ^b	0.06 + 0.13 ^c	0.00 + 0.00 ^c	0.94 + 0.83 ^b	1.24 + 0.54 ^a
Abnormal tail	2.55 + 0.57 ^b	2.55 + 1.28 ^b	1.94 + 0.37 ^b	4.95 + 0.42 ^a	4.81 + 0.72 ^a
Total abnormality	4.74 + 1.67 ^b	3.70 + 2.17 ^c	3.81 + 1.44 ^c	8.99 + 2.11 ^a	9.44 + 3.07 ^a
% abnormality	6.76 ^b	4.72 ^c	4.82 ^c	12.8 ^a	13.8 ^a

uromaiz inclusion had significantly ($p < 0.05$) lower abnormalities of head, midpiece and tail compared with 75 and 100% uromaiz inclusion. Treatments with 25 and 50% uromaiz inclusion had significantly ($p < 0.05$) lower primary abnormalities when compared with the control, 75 and 100% uromaiz inclusion.

DISCUSSION

Semen characteristics of the bucks were affected by dietary uromaiz. The results showed that important semen characteristics such as semen volume, sperm motility, sperm concentration, live sperm cells and number of sperm per ejaculate were improved at 25 and 50% levels of inclusion. Consistent with these findings, Awawdeh *et al.* (1998) in a production potential trial conducted with Awassi sheep showed similar improvement in traits of economic importance like fertility, weight at birth, weaning and milk production when they supplemented urea with concentrate at a rate of 500g/day. Similar improvement in responses of ruminants has been reported by Hussain *et al.* (2003), as also described by Azab *et al.* (1998), who detected an improvement in the physico-chemical characteristics of ram semen after feeding ammoniated rice straw with or without alfalfa hay compared with untreated rice straw and concluded that ammoniated rice straw with 3% anhydrous ammonia in the ration can be recommended for feeding growing rams without any harmful effect on semen quality.

However, these results were in contrast to those reported by Branton *et al.* (1947) and Castillo *et al.* (1987), who observed a significant reduction in fertility, weight at birth, weaning and milk production in bulls with increased amount of dietary protein. The results were also in contrast to observed

gonadal degeneration and infertility, with reduced sperm production and loss of libido, attributed to the increase in plasma urea levels (Phadke *et al.*, 1970; Holdsworth *et al.*, 1978; Netto *et al.*, 1980; Handelsman, 1985) in human patients with renal insufficiency. High dietary protein leads to elevated systemic concentrations of ammonia and urea, and these, in turn, have been associated with reduced fertility in cattle (Kenny *et al.*, 2002). Poor response to uromaiz could probably relate to higher hydrolysis rate of urea, which might not match the requirements of ruminal microbes in animals fed at the higher levels of uromaiz and wasted through ruminal walls (Rafiq, 1999). The low sperm characteristics in animals in the control could be attributed to reduced supply of nutrients for spermatogenic process from reduced glucose available (Gun *et al.*, 1992; Kelly *et al.*, 1992).

Primary abnormalities due to treatment have important consequences on quality of the spermatozoa and fertility. The abnormalities of the sperm cells observed in this study were far below the normal range of 20% reported by Oyeyemi *et al.* (2006) for effective fertility in West African Dwarf bucks. The abnormalities of the sperm cells observed in this study despite the urea increase in the diet may be associated to levels not high enough to become harmful to spermatogenesis. The low incidence of primary abnormalities show that inclusion of uromaiz at 25 and 50% in particular could ensure production of mature spermatozoa; acceptable sperm concentration and primary abnormalities, so the low uromaiz levels appear to favour sperm morphology. The abnormalities of the sperm cells observed at the higher levels of uromaiz inclusion tended to indicate that spermatogenic process was affected by this slight detrimental effect on spermatogenesis.

genic process and could probably be due to high nitrogen content of the diet (Kemp *et al.*, 1991). However, despite the higher levels of uromaiz inclusion, the values obtained were within the acceptable range for optimal fertility (Oyeyemi *et al.*, 2006), and could be attributed to levels of urea in the diet not high enough to become harmful (Cortadac *et al.*, 2000). This is in line with the report of Thompson *et al.* (1972) that the characteristics of fresh semen from Holstein bulls were not affected by dietary urea and ram fertility, as measured by percentage of ewes lambing to service during one estrous period and lambing rate of ewes served was not affected by the diet.

CONCLUSION

The results showed that important semen characteristics such as semen volume, sperm motility, sperm concentration and number of sperm per ejaculate were improved at 25 and 50% levels of inclusion and reduced at higher levels (75 and 100%) of inclusion. Primary abnormalities located in the head, midpiece and tail increased with increasing levels of uromaiz inclusion but values obtained were within the acceptable range for optimal fertility. The findings of this study therefore indicate that uromaiz at 25 or 50% could be included in the diet of WAD bucks to enhance sperm quality. The increase in sperm output without an increased proportion of abnormal spermatozoa implies that the treatment did not have adverse effects on the ultra structure of the spermatogenetic cells during the process of spermatogenesis especially at 25 and 50% inclusion levels. It is concluded from this study that dietary uromaiz up to 50% inclusion level could enhance sperm production in goat bucks without deleterious effects on sperm quality.

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