EFFECTS OF TOMATO LYCOPENE ON SEMEN CHARACTERISTICS AND LIBIDO OF RABBIT BUCKS

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ABSTRACT

A total of 15 mature mongrel rabbit Bucks were randomly divided into five treatments at the Abubakar Tafawa Balewa University Farm, Bauchi, Nigeria. The experiment lasted for a period of 16 weeks. The Bucks were allowed 4 weeks for stabilization and acclimatization, 4 weeks for training with a teaser doe and 8 weeks for oral administration of graded levels of tomato lycopene (0.00g, 0.25g, 0.50g, 0.75g, and 1.00g). Semen was collected once a week from all 15 Bucks and analyzed. The result showed that while lycopene doses at 0.75g and 1.00g significantly reduced ($P<0.01$) reaction time (seconds) it also resulted in greater ($P<0.01$) semen volume (ml), sperm cell concentration/ml ($n\times10^7$), total sperm Count ($n\times10^7$) and libido score (mounts/minute) while live sperm cells (%) was not significantly affected by all doses of lycopene administered. The result also showed significant improvement ($P<0.05$) for Sperm motility (%)of Bucks administered 0.50g and 0.75g lycopene. From the finding of this study it was concluded that lycopene significantly influenced semen characteristics and libido of rabbit bucks. This study therefore recommends that lycopene at 0.75 grams per day for eight weeks should be used to improve the semen quality and libido of rabbit Bucks used for breeding. Further research should be carried out so as to widen the scope and utilization of lycopene in animal science.

Keywords: Lycopene, Tomato, Semen, Sperm, Libido

INTRODUCTION

Rabbit farming is becoming more attractive to many animal breeders due to its high fecundity, high mothering ability, adaptability to a wide range of conditions, high genetic variability, high roughage utilization and low cost of production (Das, S.K *et al.*,2007; Zarrouki, N *et al.*,2004). The economic efficiency of a rabbitry depends mainly upon the reproductive performance of the doe, which in turn is affected by fertility of the buck (Castellini C *et al.*,2003). Male rabbits are undoubtedly the basis of reproductive success, given that farm profitability depends not only on the female's fertility but also upon the buck. Male fertility is also an interesting trait in rabbit breeding, because together with the doe it determines reproductive and productive success. Moreover, due to the fertilising capacity of semen, the male can influence not only fertility and conception but also the productivity of the does (Berchiche *et al.*, 2000; Zerrouki *et al.*, 2005a). Lycopene has antioxidant properties and imparts the red-coloured pigment in both fruits and vegetables. Poor semen production is a factor that hinders efficient reproductive performance in rabbit Bucks. In the tropics, male rabbits are used for breeding purposes from about 6 months of age and expected to produce semen consistently from this age (Wang *et al*., 2010). This is not so in many tropical breeds and their crosses as a result of the extreme conditions in the tropics which causes oxidative stress even in period of abundant feed supply. Antioxidants, especially lycopene which is an antioxidant carotenoid compound have not been widely used to improve rabbit semen. This study was therefore designed to evaluate the influence of lycopene on semen characteristics of rabbit Bucks.

MATERIALS AND METHODS

This study was carried out at Abubakar Tafawa Balewa University Teaching and Research Farm, Bauchi, Bauchi state, Nigeria. It is located in the north eastern part of the country and has a tropical climate. Lycopene used for this experiment was obtained by extraction from tomato. Fifteen Mature mongrel rabbit Bucks of breeding status were randomly assigned to different treatments in a complete randomized design. The experiment lasted for a period of 16 weeks comprising 4 weeks of stabilization and acclimatization, 4 weeks of training with a teaser doe and 8 weeks for oral administration of graded levels of tomato lycopene.

Reaction Time

A teaser doe was introduced to each buck every week to measure reaction time. This was the time it takes the rabbit buck to sniff, groom and mount the doe and it was recorded with a stop watch.

Libido Score

A teaser doe was introduced every week to measure sex drive, this was the number of time each buck attempted to mount the doe in a minute.

Semen Collection

Semen was collected from the Bucks with the aid of an artificial vagina (AV) as described by Herbert and Adejumo (1995). Prior to semen collection the AV was warmed for a few minutes in warm water at a temperature slightly above body temperature and thereafter drained. The semen was collected between 8:00am and 9:00 am, this was to ensure that good quality semen was obtained.

Semen Colour and Semen Volume

Semen colour was noted visually immediately after collection. The volume of semen collected was measured using graduated collection tube.

Sperm Motility

To determine the motility of the sperm cells, a drop of undiluted semen mixed with a drop of slightly warmed diluents (sodium citrate) was placed on a sterile slide, covered with a cover slip and observed under the microscope at ×400 magnification and scored within a rating of 0-100% as described by Ewuola and Egbunike (2010).

Sperm Cell Concentration (per ml)

Sperm cell concentration per ml of semen was evaluated by visual count under the microscope using the improved Neubauer haemocytometer. A mixture of sodium bicarbonate (5g), formalin (1ml) and distilled water (100ml) was used as diluents to arrest the activity of sperm cells in the sample. The mixture was uniformly mixed and through capillary action allowed to run under the cover slide placed on the haemocytometer. After few minutes the sperm cells were counted within the five smaller squares. The total count was obtained by adding the counts from the five smaller squares multiplied by the dilution factor and the multiplication factor.

Live Sperm Cells Count

Live sperm cells determination was done by placing a drop of semen on a glass slide, mixed with one drop of eosin negrosin, smeared and observed under the microscope. The unstained cells represented the live cells while the stained cells are the dead ones.

Total Sperm Count

The total sperm count was obtained by multiplying the sperm concentration by the volume of semen per ejaculate.

Statistical Analysis

All data obtained were subjected to analysis of variance (ANOVA). Treatment means were separated and compared with the control using Least Significant Difference (LSD).

RESULTS AND DISCUSSION

Results for semen characteristics and libido score are elaborated in table 1

Reaction Time

From the result of this study it can be observed that animals in treatment 4 (0.75g) and 5 (1.00g) had lower reaction time (3.62 and 3.65 seconds) this implies that for Bucks in this group it will only take 3.62 or 3.65 seconds to realize that a doe has been brought to them and attempt to mount.

Libido score

The result from this study indicate that animals in treatment 4 (0.75g) and 5 (1.00g) attempted to mount the doe more times in a minute than animals in treatment 2 (0.25g), 3 (0.50g) and the control (0.00g). It is also noteworthy to state that from the results obtained it was noticed that reaction time and libido score are inversely related, the lower the reaction time the higher the libido score.

Semen colour and Semen Volume

Semen colour for all the treatments and the control were observed to be milky. Semen volume was significantly influenced by lycopene in treatment 4 (0.87ml) and 5 (0.90ml) this was a significant improvement when compared with the control in treatment 1 (0.47ml). With this improvement it is therefore safe to say that lycopene at 0.75g and 1g will improve semen volume significantly.

Sperm Motility

Motility which is best described as the progressive forward movement of sperm cells is important for the transport of spermatozoa in the reproductive tract and oocyte penetration (Holt and Van Look, 2004). The result obtained from this study indicates that the most motile sperm cells were observed in treatment 3 (79.50%) and treatment 4 (78.63%), it is therefore note worthy to mention that as the level of lycopene increased in treatment 5 (1.00g) the motility of sperm cells reduced.

Sperm Cell Concentration (per ml) and Total Sperm Count

The high percentage of live sperm cells observed in this study is an indication of the viability of sperm cells with possibly higher fertilizing capacity. Sperm concentration was significantly influenced by lycopene in treatment 4 (38.88×10^7 /ml) and 5 (48.13×10^7 /ml). Although testosterone was not a parameter in this study, the result of this study suggests that lycopene has a positive influence on testosterone since it increased sperm concentration. The total sperm count was also observed to be significantly affected by treatment 4 (31.54×10^7 /ml) and 5 (46.30×10^7 /ml) which were the highest observed in this study. ***Live Sperm Cells***

The result from this study revealed that lycopene did not affect or influence the percentage of live sperm cells in the semen, this also indicate that the volume of semen did not influence the percentage of live sperm cells but influenced the total number of sperm cells as semen of higher volume resulted in higher sperm cells, this is further authenticated by the fact that all semen collected demonstrated a consistent colour.

Table 1: Semen characteristics and libido score of rabbit Bucks administered graded levels of lycopene

	Lycopene						
Parameters	T1 (0.00)	T2 (0.25)	T3 (0.50)	T4 (0.75)	T5 (1.00)	LSD	LOS
Reaction time (seconds)	9.30±0.85	9.35±1.03	10.23±0.13	3.62±0.48**	3.65±0.40**	3.31	P<0.01
Semen colour	Milky	Milky	Milky	Milky	Milky		
Semen volume (ml)	0.47±0.03	0.49±0.05	0.47±0.10	0.87±0.17**	0.90±0.16**	0.24	P<0.01
Sperm motility (%)	73.00±3.72	76.58±1.56	79.50±4.30*	78.63±1.65*	77.04±1.75	4.72	P<0.05
Sperm cell Conc/ml ($\times10^7$)	17.75±1.28	18.25±1.39	18.13±1.46	38.88±4.94**	48.13±11.69**	12.85	P<0.01
Total sperm Count ($\times10^7$)	8.66±1.67	9.60±1.92	9.00±1.43	31.54±11.89**	46.30±15.72**	19.82	P<0.01
Live sperm cells(%)	71.46±3.72	72.96±2.07	75.54±4.09	74.50±1.49	73.63±1.81	4.71	P<0.05
Libido score (mounts/minutes)	3.10±0.90	5.04±1.29	8.96±3.26	15.29±7.41**	16.50±7.67**	11.20	P<0.01

Treatment 2 to 5 within each row were compared with treatment 1 which is the control using LSD

± (standard deviation)

**Significant at (P<0.01)

* Significant at (P<0.05)

CONCLUSION AND RECOMMENDATIONS

Based on the findings of this study Lycopene up to 0.75g and 1.00g improved semen quality and libido of rabbit Bucks. Lycopene up to 0.75g administered every day for eight weeks (56 days) should be used to boost semen quality and libido of rabbit Bucks used for breeding. Further research should be carried out so as to widen the scope and utilization of lycopene in animal science.

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