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The Effects of Age, Breed, Sire, Body Weight and the Ejaculate Characteristics of Rabbit Bucks

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Abstract: The aim of this research is to analyse the semen of different breeds of rabbits and to determine the effects of age, breed, sire, generation and body weight on the ejaculate characteristics of rabbit bucks. Twenty rabbit bucks comprising of three breeds (New-Zealand White 8, Chinchilla 6 and Californian White 6) between the ages of 6-9 months were used to investigate the effect of age, breed, sire and generation on body weight and ejaculate characteristics of the bucks. The experiment was carried out at the Animal Science departmental farm, Ahmadu Bello University, Zaria. Parameters considered include semen colour, semen volume, semen ejaculate volume, semen concentration, semen pH, sperm motility, body weight and age. The mean for semen ejaculate volume, semen concentration, pH, sperm motility, body weight and age were 0.5 mL, 325.5×10^6 sperm cells/mL, 7.5, 86.6, 2.0 and 7.6% months, respectively. Age, breed and sire had ($p \leq 0.05$) effect on ejaculate characteristics but breed and sire had higher significant ($p<0.01$) effect on body weight. However, generation had no significant effect on the body weight and ejaculate characteristics except on semen pH ($p<0.05$). The ejaculate characteristics of the rabbit bucks were influenced by age, breed and sire. The values obtained were within the normal standards for rabbits-bucks. New Zealand White bucks proved superior in terms of ejaculate characteristics.

Keywords: Age, body weight, breed, ejaculate, rabbit bucks, sire

INTRODUCTION

In the past two decades, the World population has increased greatly and especially that of the developing countries in which approximately two third of the World's population live and continue to increase (FAO 1978). Serious and important concerned has been expressed at the very low level of animal protein supply in developing nations especially among rural dwellers that constitute more than 70% of the population and the low income group generally (Awonorin *et al*., 1994).

The Food and Agricultural Organization (FAO) as cited by Aduku and James (1990) has estimated an annual 5-7% growth rate for meat consumption. The human population of Nigeria was estimated to be approximately 140 million (NPC, 2006). Rapid human population growth and low protein intake are some of the major problems that developing countries face. Ogbona and Adebowale (1993) reported that an average Nigerian consumes 7.5 g of animal protein as against 28 g consumed by an average Briton. The animal requirement of Nigerians can hardly be met by large animals due to slow production cycles. Rabbits and other micro livestock have been suggested for use in the protein shortage problems in developing countries (Vietmeyer, 1985). Rabbits have high fecundity and prolificacy, short gestation period and most importantly they have shorter generation interval than most farm animals (Cheeke, 1986; Yahaya, 1993).

Research on rabbits in recent years in Nigeria has been mostly in the effect of diet, or growth performance, meat chemical composition and quality, (Awonorin *et al*., 1994)*. The assessment of the seminal characteristics of rabbits gives an excellent indication of the reproductive capacity of the animals. It is important to understand and improve the reproductive performance of rabbits in Nigeria, in order to select bucks of high fertility and for the purpose of using ejaculate that can be relied upon to give a high conception rate for raid artificial insemination programme and increased productivity.

Conventional semen analysis includes the measurement of a particular aspect of spermatozoa. According to Rumbullaku and Agostini (2007), this includes morphology, motility, volume, concentration and pH. Normal values of semen parameters generally used as reference by the WHO (1992) includes semen volume (0.5 or more), sperm concentration (200×10^6 mL or more), semen motility (50%) or more with rapid forward progression) and semen pH (7.2-8). The assessment of the seminal characteristics of the rabbits gives an excellent indication of the reproductive capacity of the animal. Therefore the aim of this research is to analyse the semen of different breeds of rabbits and to determine the

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effects of age, breed, sire, generation and body weight on the ejaculate characteristics of rabbit bucks.

MATERIALS AND METHODS

This research was conducted at the Rabbitry unit of the Department of Anila Science, Faculty of Agriculture, Ahmadu Bello University Zaria between February and June 2009. Zaria is located on a plateau at a height of about 22,100 feets above sea level. It is located on latitude 11º33″N and 7º42′E and have a tropical continental climate with marked period of rainfall ranging from 1102 to 1904 mm. The mean temperature ranges between 18ºC (65ºF) in the wet and 31ºC (88ºF) Twenty healthy bucks of New Zealand White (8), Californian White (6) and Chinchilla (6) breed between the ages of 6 to 9 months were used in this study. Semen was collected twice a week from each buck using the artificial vagina technique of semen collection from each buck. Collection of semen was done either early in the morning or late in the evening. Immediately after collection, each ejaculate was evaluated.

Total ejaculate volume was read directly from the graduated tubes with which the samples were collected. Ejaculate colour was recorded as either creamy or milky as it comes out from the ejaculatory duct and the collection tube. Percentage progressive motility was rated on a scale of 0 (no motility) to 100 (vigorous motility) using a field microscope. The motility was then recorded as a percentage based on the rate of movement of spermatozoa in each sample while sperm concentration was estimated using the Veubauer haemocytometer. Fresh semen from each buck was diluted in the ratio of I: 100 using buffer formal saline solution. Using a Pasteur pipette, a small drop of semen was allowed to flow on both sides of the haemocytometer in to the chamber and under the cover ship. After the semen had settled, spermatozoa in five diagonal squares were counted and the total was summed up. The value derived was multiplied by the multiplication factor and solution factor to give the sperm concentration per mole. The sperm concentration per ejaculate was then calculated by multiplying the concentration per mole by the ejaculate volume. The data obtained were subjected to Analysis of Variance (ANOVA) of SAS (2000). Tests of significance at 0.5% were carried out using Duncan Multiple Range Test (Steel and Torrie 1980).

RESULTS AND DISCUSSION

Table 1 presents the summary statistics of body weight and ejaculate characteristics of rabbit bucks. It reveals a low level of variability in motility (6.8%), semen pH (12.3%), Age (14%) and body weight (14.7%). However, semen concentration and ejaculate volume were highly variable with values of 24.8 and 44.2%, respectively. The mean semen concentration, semen pH, motility and ejaculate volume obtained in this study agrees with the mean volume set as reference by the WHO (1992) and also with the study of Agostini and Lucas (2005). The high percentage of coefficient of variability observed for semen concentration and ejaculate volume indicate that variability exists in these traits amongst the population of breeds of bucks used. Hence these traits can be improved upon through selection. Age was found to significantly ($p<0.05$) influence body weight and ejaculate characteristics of the rabbit bucks (Table 2). Bucks of 6 months of age proved to be superior to bucks of the other ages (7, 8 and 9 months, respectively) in terms of sperm motility (87.27%), semen concentration (353.82) and body weight (2.l2 kg). They also had an ideal semen pH (7.09). Rabbit bucks of 8 months old

Table 1: Summary statistics of body weight and ejaculate characteristics of rabbit bucks

Characteristics	N	Mean±SE	CV (%)
Age (months)	51	7.6±0.15	140.0
Ejaculate vol. (m:)	51	0.5±0.03	44.2
Motility (%)	51	86.6±0.82	6.8
Semen concentration	51	325.5±11.29	24.8
Semen pH	51	7.5±0.13	12.3
Body weight (kg)		2.0±0.04	14.7

N: Number observations

Table 2: Effect of age on body weight and ejaculate volume characteristics of rabbit bucks

Months	6	7	8	9	SEM	LOS
No. of animals	(11)	(10)	(19)	(11)		
Characteristics:						
Ejaculate vol (mL)	0.50^{b}	0.46^{b}	0.58^{a}	0.40^{c}	0.030	*
Sperm mobility (%)	87.27^{a}	87.00^{ab}	86.58^{ab}	85.46^{ab}	0.843	*
Semen concentration	353.82^{a}	272.70^{c}	335.05^{ab}	328.45^{b}	10.938	*
SemenpH	7.09^{C}	7.50^{b}	7.89^{a}	7.27^{bc}	0.125	*
Body weight (kg)	2.12^{a}	1.77^{c}	1.98^{b}	2.00^{b}	0.039	*

*a,b,c: Means with different superscript in the same row differ significantly ($p<0.05$) from each other; SEM: Standard error of means; LOS: Level of significance

Table 3: Effect of breed on body weight and ejaculate characteristics of rabbit bucks

Breeds	New zealand	Chinchilla	California	SEM	LOS
No. of animals	27	7	17		
Characteristics					
Ejaculate vol. (cmL)	0.6^{a}	0.5^{a}	0.46^{b}	0.03	*
Sperm motility (%)	87.4^{a}	84.3^{b}	86.2^{a}	0.82	*
Semen concentration	344.5^{a}	307.4^{b}	302.7^{b}	11.29	*
Semen pH	7.6^{a}	7.1^{ab}	7.5^{a}	0.13	*
Body weight (kg)	2.0^{b}	2.3^{a}	1.8^{c}	0.04	*

*a,b,c: Means within the same row with different superscript differ significantly ($p<0.05$ or $p<0.01$)

Table 4: Effect of generation on body weight and ejaculate characteristics of rabbit bucks

Generation	Generation 1	Generation 2	SEM	LOS
No. of animals	21	30		
Characteristics:				
Ejaculate vol. (mL)	0.48	0.51	0.043	NS
Sperm motility (%)	87.14	86.17	1.154	NS
Sperm concentration	315.19	322.63	11.745	NS
Semen pH	7.29^{b}	7.67^{a}	0.136	*
Body weighty (kg)	1.95	1.99	0.053	NS

NS: Not significant; *: Significant at (p<0.05); SEM: Standard Error of Mean; LOS: Level of Significance

Table 5: Effect of sir on body weight and ejaculate characteristics of rabbit bucks

Sire	1	2	3	4	5	6	7	8	9	10	SEM	LOS
No. of animals	4	2	7	3	4	5	3	2	3	8		
Characteristics:												
Ejaculate vol. (mL)	0.53^{b}	0.65^{a}	0.27^{c}	0.33^{c}	0.33^{c}	0.33^{c}	0.34^{c}	0.35^{c}	0.35^{c}	0.48^{b}	0.029	*
Sperm motility (%)	91.25^{a}	80.00^{f}	86.43^{cd}	85.00^{d}	86.43^{cd}	87.00^{c}	81.67^{c}	87.50^{c}	83.33^{d}	89.38^{b}	0.811	*
Sperm concentration	237.75^{d}	368.50^{a}	320.71^{b}	261.33^{c}	334.79^{b}	335.80^{c}	319.00^{b}	315.50^{b}	330.67^{b}	336.88^{a}	11.204	*
Semen pH	7.75^{a}	8.00^{a}	7.14^{bc}	6.67^{d}	7.93^{a}	7.80^{a}	7.33^{b}	7.00^{c}	8.00^{a}	7.00^{c}	0.125	*
Body weighty (kg)	1.150^{h}	2.85^{a}	1.69^{g}	2.10^{c}	1.97^{c}	2.00^{d}	2.30^{b}	2.20^{b}	1.80^{f}	2.05^{d}	0.017	**

SEM: Standard error of mean; LOS: Level of Significance; a,b,c: means within the same row with different superscript differ significantly at (p<0.05 or p<0.0I)

had higher ejaculate volume (0.58 mL) and semen pH (7.89) but had moderate sperm motility (86.58%) and body weight (1.98 kg). Bucks of 7 months old had lower semen concentration (272.70) and body weight (1.77 kg). The significant (p<0.05 effect of age on body weight and ejaculate characteristics found in this study agrees with the report of Omeje and Marire (1990). According to Marini and Goodman (1969), the age of the onset of semen production and maximum volume of semen obtainable from a buck depends to some extent on strain and breed. Breed had a significant (p<0.05) effect on body weight and ejaculate characteristics (Table 3). New Zealand White bucks had higher ejaculate volume, sperm motility, semen concentration and semen pH. Significant effect of breed on ejaculate volume had been reported by Ezekwe and Machebe (2004). A highly significant effect of breed on body weight (p<0.01) obtained in this study corroborate the earlier reports of Afifi *et al*. (1994) and Abdul-Ghani *et al*. (2000). A relatively high ejaculate volume, motility percentage, semen concentration, semen pH and moderate body weight observed in New Zealand White bucks suggest its high reproductive potentials. Generation had a non-significant effect on ejaculate characteristics (Table 4) except for semen pH (p<0.05) where there was a high semen pH in generation I. however, the values recorded is in line with the standard set by WHO (1992). Sire was found to significantly (p<0.05 to p<0.01) influence ejaculate characteristics and bodyweight of rabbit bucks (Table 5). Bucks from sire two group exhibits superiority for ejaculate volume, sperm concentration, body weight and maximum pH compared to bucks from the other sire groups. Lebas *et al*. (1986) stated that the breed of bucks used had effect on either birth number of young weaned, total weight of weaned either and on average weight of weaned rabbits.

CONCLUSION

The bucks show significant differences in the semen characteristics and body weight with respect to age, breed and sire.

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