

Biotechnology Techniques for Improving Fertility in Rabbits (*Oryctolagus cuniculus*).

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Abstract

The present study was designed to evaluate some biotechnological techniques for improving fertility of rabbits at the teaching and research farm of the Abubakar Tafawa Balewa University, Bauchi. The trial was conducted on a total of 50 rabbits of two breeds (predominantly New Zealand white and its reciprocal crosses). The experiments were carried out to investigate differences in semen characteristics and fertility following artificial insemination for the treated with hCG and natural mating as control. The results revealed that the ejaculate volume, sperm concentration, total sperm per ejaculation % live sperm, % abnormal sperm and %sperm motility were significantly (<0.05) higher in favour of the improved breeds values as follows: 0.62 ± 0.14 vs 0.49 ± 0.16 ; 98.11 ± 1.12 vs 91.71 ± 1.28 ; 60.60 ± 1.37 vs 60.65 ± 1.56 respectively for the improved and local breeds. It was also shown that gel volume was the only semen variable not statistically affected by breed. The results also revealed that no significant differences were observed between breeds in receptivity, fertility rates, kits kindled alive, death and stillborn, calculated kit birth weight and does body weight after kindling. However, the conception rates were significant ($P < 0.05$) in favour of the improved breed to the local breed for the hCG treatment 85% verses 75.0% respectively. Rabbits responded well to exogenous administration of hormones, and artificial insemination was possible at a pre-established time after synchronizing ovulation. hCG protocol gave a satisfactory conception rate comparable to those achieved in rabbits inseminated at natural estrus. It was therefore found that hCG stands as a valuable and reliable protocol for enhancing receptivity and conception.

Key words: Artificial Insemination, Ovulation Induction, fertility and Rabbit

Introduction

Artificial insemination has been employed in rabbits since 1920s (Adams,1961).The technique is useful aid to colony management (batch parturition and batch weaning),besides AI offers the same benefit for rabbit breeding as in other species in the control of genetic diversity, rapid upgrading of stock, establishment of pregnancies in females which refuse to mate and avoidance of the spread of venereal

diseases(Morrell,1995).Unfortunately there is still paucity of information on AI in rabbits in Nigeria. Particularly lacking is information on reliable techniques to induce and synchronize oestrus leading to sexually receptive behavior. Therefore, the present study was designed evaluate semen characteristics of rabbits and oestrus synchronization for improving fertility in local and improved breeds of rabbits.

Materials and Methods

The study was conducted from April 2007 to July 2008 at the Research and Teaching farm of the Abubakar Tafawa Balewa University, Bauchi. Bauchi is located in guinea savanna and the location and climate are described by Butswat and Choji (1995).

The trial was conducted on two breeds of rabbits, improved and locals two stimulation approaches (hCG and natural method as control). The improved breeds were predominantly New Zealand white and their reciprocal crosses Data were generated from 40 rabbits does that were assigned randomly and 10 bucks; 5 each of improved and local breeds with does body, weight between 1.652 and 1.951kg, and the bucks weighing 2.726kg with an average of 26 weeks the rabbits were obtained from the National Veterinary Research Institute, Vom, Bauchi State Agricultural Development Programme BSADP and reputable farmers. The breeds were distinguished clearly by their coat colour, body weight and size, head shape and size, ears other basic indices. The rabbits were housed individually in a flat cages measuring 0.56 x 0.4m equipped with plastic water and feed troughs. All cages were equally kept in a naturally ventilated building in a shed roofed with asbestos having windows to enhance ventilation. The rabbits were fed *ad-libitum* with 18% crude protein concentrate. The feed was supplemented by serving then with *Tridax procumbent*,

Amaranthus spp, Cabbage. Before the commencement of the trial, the rabbits were kept for three weeks to adopt to the local environment.

Semen Collection and Evaluation

Bucks were engaged into training period for semen collection and responses were noted 24 days after the commencement of the training. Ejaculates were collected using an improvised homemade artificial vagina as described by Naughton *et al.*, (2003). All ejaculates were collected and wrapped in cotton wool and were transported immediately to the laboratory and evaluation was performed within 15 minutes after collection all assessment were done according to Zahraddeen *et al.*, 2006.

Artificial Insemination Procedures

Does were restrained by a research assistant individually in a supine position and inseminated 6cm deep into vagina using a sterilized diabetic syringe (1ml) with 0.5ml semen. (Rodriguez-Delara *et al.*, 2007). This ensured that each doe received at least 15×10^6 ml live sperm per dose. Insemination was done 24 hours after the administration of the appropriate treatment phenyl^(R) a synthetic analogue of hCG.

Pregnancy test was done by abdominal palpation 14 days post insemination to establish the presence of pregnancy. Non-pregnant does were not re-inseminated. However, nesting day pots were provided barely 3 days to the expected

kindling date. The kids were examined and counted shortly after kindling using hand gloves.

Data generated were subjected to an analysis of variance (ANOVA) according to the generalized linear model procedure contained in the statistical package for social science (SPSS). Software 1996.

Results and Discussion

The overall results of the seminal characteristics for the two breeds are depicted in Table I. The improved breeds was generally superior to the indigenous breeds ($P < 0.05$). Similar values for the overall results reported here are within the same range (Mathur *et al.*, 1989; Herbert and Adejumo, 1993 Herbert and Acha,

1995 and Zahraddeen *et al.*, 2006;2007). These results however were in consonance to the earlier reported; but however contradicts the report of (Chiroma, 2004) that mongrel rabbits were superior to the exotic breed. The parameter for gel free volume exhibited higher value than those reported Herbert and Acha (1995), and lower in concentration for the same experiment. The value obtained for the gel volume was lower than those reported by Zahraddeen *et al.*, (2006). These differences in results could not only be attributed to genetic and environmental factors, but also by the application of different criteria for the evaluation of sperm abnormalities and the use of different sperm processing technologies and handling methods.

Table I: Seminal Characteristics of two breeds of rabbits

Semen traits	Improved breed mean \pm SE	Local breed mean \pm SE	Overall total mean \pm SE
Semen Volume (ml)	0.62 \pm 0.14 ^a	0.49 \pm 0.16 ^b	0.55 \pm 0.10
Sperm Concentration ($\times 10^6$ /ml)	98.11 \pm 1.12 ^a	91.71 \pm 1.28 ^b	94.91 \pm 0.81
Gel Volume (ml)	0.06 \pm 0.13 ^a	0.04 \pm 0.14 ^a	4.75 \pm 0.10
Total Sperm per ejaculate ($\times 10^6$)	60.60 \pm 1.48 ^a	44.67 \pm 1.69 ^b	52.63 \pm 1.12
Live Sperm (%)	71.39 \pm 0.93 ^a	63.00 \pm 1.06 ^b	67.19 \pm 0.71
Abnormal Sperm (%)	28.80 \pm 0.97 ^a	36.71 \pm 1.10 ^b	32.75 \pm 0.73
Sperm Motility (%)	70.34 \pm 1.37 ^a	60.65 \pm 1.56 ^b	65.49 \pm 1.00

ab Means on the same row having different superscripts are significantly different from one another ($P < 0.05$).

Table 2 shows effect of the treatment on induction of ovulation in the two breeds of rabbits. The receptivity rates in this study for natural method (control) and treated does were not significant. Favourable conception rates

($P < 0.05$) was achieved at doses equal to 25mg/doe of hCG. The response to super ovulation treatment depends not only on the type of hormone and method of administration, but also differs between rabbit breeds (Bolet *et al.*,

2000). Improved breed of rabbits does treated with hCG had 84.2% kindling rate, the least was kindling was observed in the local with natural method (62.2%). The non-significant difference in kindling rate could probably be due to the quality of diet and good management given to the local breed and poor adaptation to the

environment by the improved breed. The significantly higher number of rabbits per litter in this experiment was in good agreement with the findings made by Perrir *et al.*, 2000, but opposed to the conclusion drawn by Quintela *et al.*, (2004). This might be due to differences in hormonal response by breed.

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Table 2: Induction of ovulation in two breeds of rabbit does

	Natural Mating		hCG	
	Improved	Local	Improved	Local
Number of does per Treatment	10	10	10	10
Insemination/mating no.	1	1	1	1
Sexual Receptivity rate (%)	45.4	42.9	54.4	42.45
Conception rate (%)	72.0 ^{ab}	64 ^a	85.7 ^b	75.0 ^{ab}
Kiddling rate (%)	71.3	62.2	84.2	74.4
Litter size	4.5 ^{ab}	4.0 ^b	6.5 ^a	6.0 ^a
Kits kiddled alive (n)	23	15	27	20
Kits kiddled dead/stillborn (n)	0.3	0.3	0.1	0.2
Calculated kit birth wgt(g)	564	552	691	673
Does body wt after Kiddling(g)	4019	4013	4509	4306

* P<0.05; ** P<0.01 a,b means in the same row within a subset having different superscripts are significantly different

Conclusion

In general, it may be stated that rabbits respond well to exogenous administration of hormones, and artificial insemination is possible at pre-established time: after synchronizing ovulation. hCG protocols stands is a reliable and valuable protocol for enhancing receptivity and conception

rates. hCG treatment and improved based excelled the other protocol.

References

- Adams, C.E., (1961). Artificial insemination in the rabbits. *Journal of Reproduction and Fertility*, 2:521-522.
- Bolet, J M., Bourn M., momerate, F., Abeni, C., arnal, J., Arnold, D., Bell, G., Bergolig, U., Besen Felder, S., Bosze, S., Boucher, N., Chantered, M.C., Ducourable, M., Durand – Tardif, P.J., Esteves, N., Ferrand, A., Gauter, C., Haas, G., Hewitt, N., Jell, T., Joly PF; Koehl, T., Laube, S., Lechevestrier, M., Lopez, G., Masoero, J.J., Menigoz, R., P. CCining, G., Quaney, G., Sleit, A., Surridge, Van Der Loow, J.S., Vincent, MP., Viudes de castro, J.S., VIrang and Zimmermann. (2000). Evaluation and conservation of European rabbit (*Orytolagus cuniculus*) genetics resources. First results and inferences. Proceedings of 7th world rabbit congress, Vol A Valencia,
- Butswat, I.S. R., and Choji G.F., (1995). Constraint to adoption of articial insemination techniques in livestock production in Bauchi LGA. *Nigerian Journal of Animal Production*. 22 (1): 28-31
- Chiroma, A. E. (2004). Seasonal variations in semen characteristics and microbial evaluation of two rabbit breeds. M.Sc. Thesis Animal production. Abubakar Tafawa Balewa University, Bauchi.
- Herbert, U., and Acha, C. O., (1995). Preliminary observation on the seminal characteristics of rabbits raised in two locations in South – eastern Nigeria *Journal of Animal Production*, 22:(2) 108 – 112.
- Herbert, U., and Adejumo, D. O., (1993). An artificial vagina for collecting semen in the tropics. Paper Presented at the 18th annual conference of Nigerian Society of Animal Production, Federal. University of Technology, Owerri, Nigeria, March, 21 – 25P.
- Mathur, A. K., Srivastava, R.S., Rawat, P.S., and Kaira D.B., (1989). Seasonal variation in the semen characteristics of soviet Angora Bucks. *Animal Reproduction Science*, 19:293-298
- Morrell, J.M., (1995). Artificial insemination in rabbits. *British Veterinary Journal*. 151:477-488.
- Naughton, C.K., Nelson D.R., and Thomas A.J., (2003). Development of an inexpensive artificial vagina for semen collection. *Journal of Andrology* 24:1-5.
- Perrier, G., Theau-Clement, M., Jouanno, M. and Drobet, J. P. (2000), Reduction of the GnRH dose and inseminated rabbits does reproductive performance. In: 7th World Rabbit Congress Valcencia, Spain.
- Quintela, L.A., Pena, A.I., Vega, M.D., Gullon, J., Prieto, C., Barrio, M., Becerra, J.J., Maseda, F. Herradon, P.G. (2004). Ovulation induction in rabbit does submitted to artificial insemination by addition of buserelin to the seminal close. *Reproduction Nutrition and Development*. 44:79 – 88.
- Rodriguez – De Lara, R., Herrera – Corredor, C.A., Fallas – Lopez, M., Rangel – Santos, R., Mariscal-Aguayo, V., Martinez – Hernan, P.A., and Garcia – Muniz, J.G., (2007). Influence of supplemented dietary sprouted wheat on reproduction in artificially inseminated doe Rabbits. *Animal Reproduction Science*, 99:145-155.

SPSS (1996). Statistical Package for Social Science, general linear Model Procedure, Standard Version Inc. Iowa U.S.A.

Zahraddeen, D., Butswat, I. S. R., and Mbap, S. T. (2006), Ejaculate characteristics and artificial insemination in rabbits (*Cryptolagus cuniculus*) following ovulation induction using teaser bucks. *JORMAR* 3(1): 12-20.

Zahraddeen, D., Butswat, I. S. R., and Mbap, S. T. (2007), Effect of collection period on semen characteristics of two breeds of rabbits raised in Bauchi, Nigeria. *International Journal of Natural and Applied Science*.3(3): 279-283.