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Influence of Human Chorionic Gonadotropin on the Fertility Rate in Artificially Inseminated Rabbit Does

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Target audience

Abstract

An experiment was carried out on the influence of human chorionic gonadotropin hormone (hCG) on the fertility rate of rabbit does under artificial insemination. The rabbit does (7-8 months old) were used for the trial. The hCG was administered to the rabbit does at varying doses: 0, 50, 100 and 150 I.U representing treatments 1 (control), 2, 3 and 4, respectively. Twenty four does were randomly allotted to the four treatments with six does per treatment in a completely randomised design and the study lasted 5 weeks. The does were inseminated with semen harvested from proven bucks. The results showed that does on 0 and 50 I.U hCG had 0% conception rate, while does on 100 and 150 I.U hCG showed 16.67% conception rate. This implies that hCG at 50 i.u was not enough to initiate ovulation in rabbit does. There were no significant differences ($p>0.05$) in the weight of doe after parturition, gestation length and litter size among the treatments. Total Litter weight and average litter weight were significant ($p<0.05$) higher in does administered 150 I.U hCG than those treated with 100 I.U. This study suggested that hCG induced ovulation and influenced the fertility rate of rabbit does when administered with at least 100 I.U to artificially inseminated rabbit does.

Keywords: Human chorionic gonadotropin, Conception rate, Rabbit, artificial insemination

Description of Problem

The improvement of reproductive performance on farms is conditioned by the use of methods enabling the induction and synchronization of oestrus. This concerns hormonal treatments or non-hormonal alternative methods. Infertility afflicts rabbits, but the underlying causes have not been yet closely examined (1). A number of tools and steps are needed to enhance reproductive performance, such as using exogenous hormone, nutritional and mechanical techniques (2). Of the methods widely used in rabbit husbandry practice for increasing

reproductive potential, exogenous hormone injection is perhaps the most important technique that has proved to be exceedingly effective for breeding rabbit especially when used with artificial insemination (AI) (1). The knowledge of the hormones that regulate the female reproductive activity and its mode of action can help to improve reproductive management in order to increase receptivity and reproductive efficiency.

Artificial insemination which is the introduction of a male sperm into the female genital organs with special instruments for its fertilization is carried out in farm animals for the intensive use of valuable males in order to improve the breed and productive qualities of animals. For practical application, rabbit AI is usually carried out with fresh diluted semen within 6-12 hours of collection resulting in conception rates as high as those of natural mating (1).

The success of AI technique in rabbits depends mainly on the parity number; physiological status and sexual receptivity at the moment of insemination (2). When using AI, in the absence of a male, ovulation has to be induced by artificial hormonal stimulation. Overtime, the use of hormones are employed to synchronise and induce ovulation in rabbit does and the ovulation inducing method most frequently used is an intramuscular application of GnRH (3).

Gonadoreline, Buserelin, Fertirelin Acetate, and Desloreline hormones are highly potent, synthetic analogue of gonadotropin releasing hormone used in rabbit for synchronization and ovulation induction (4). Alternatively, Luteinizing hormone (LH) or hCG can be used to induce ovulation in rabbit breeding programme to enhance fertility (5). In addition, it was found that GnRH and its analogues can be used repeatedly without interfering with the immune response of hosts (6, 7). The potential of these hormones in both synchronization and induction of ovulation in rabbit in the tropics has not been adequately documented. This prompted the design of this work to assess the influence of human chorionic gonadotropin hormone on the fertility rate of artificially inseminated rabbit does.

Materials and Methods

Experimental Site

This experiment was carried out at the Rabbitry Unit of Teaching and Research Farm of the University of Ibadan, Oyo state, Nigeria.

Experimental animals and management

Thirty female rabbits (does) were used for this experiment consisting of twenty four rabbit does and six proven bucks. The rabbits were purchased from reputable farms in Ibadan. The animals were allowed an acclimatization period of two weeks and were later randomly allotted to five treatments with six replicates per treatment. The animals were housed in individual wooden hutch (55cm x 40cm x 40cm), managed and fed *ad libitum* with commercial feed that contains 17.78% CP, 7.55% CF and 2525.2kcal/kg metabolizable energy.

Experimental Layout

The experimental rabbits were randomly allotted to four treatments with six replicates per treatment. All

does were inseminated with 0.4ml of pooled fresh semen in the lordosis position. Human Chorionic gonadotropin hormone was administered to the rabbits does Just before insemination at varying dosages of 0, 50, 100 I.U and 150 I.U to animals in treatments 1, 2, 3 and 4, respectively.

Semen collection and Evaluation

Semen was collected from the six proven bucks A to F using artificial vagina (8). Semen with yellow and abnormal colour samples was discarded to avoid deleterious seminal products. The ejaculates from the bucks were evaluated before use. The semen was evaluated in Animal Physiology Laboratory of the Department of Animal Science, University of Ibadan for the quality characteristics. The temperature of freshly collected semen from bucks was measured with a digital thermometer and volume of the semen was measured through the use of tuberculin syringe and graduated test tubes. Sperm motility was done by adding a drop of semen on the slide and one drop also of sodium citrate to disperse the sperm cells. This was covered with a cover slip and place on the microscope and observed the sperm cells are motile. Sperm motility was identified at a magnification of x400. It is expressed as the percentage of sperm cells that demonstrated progressive motility, from 0 to 100 %. Only samples that showed high motility (>80%) were used for on farm insemination

This was done by diluting semen with formal saline (v/v) for the sperm cells to be easy to count under microscope using haemocytometer and expressed as number of spermatozoa per mL of semen (8). Collective movement of spermatozoa of freshly collected semen was evaluated at room temperature in (x400) magnification under the microscope to determine the mass activity of the sperm cells and it is indicated by a +, ++, +++ symbol which indicates how active the sperm cells are depending on the activity. The classification of semen was made on the basis of waves, eddies and swirls formation. Sperm livability was determined by putting a drop of semen on glass slide and stained with a drop of eosin- negrosin, then it was mixed gently and smeared on a slide, air dried and viewed under the microscope at magnification of x400. Any sperm cells that absorb the stain gave a pink colouration which indicates that those sperm cells are dead, while the living sperm cells will not absorb the stain (8).

Fertility Rate Evaluation

The percentage conception rate was determined by the numbers of animals that were pregnant in a treatment divided by the total number of animals in the treatment multiply by100 and recorded in percentage. Gestation length was measured as the period of conception to period of parturition in rabbit does. It was recorded in days. Litter size was also determined by adding the total number of kits that was kindled by the rabbits does. It was expressed in numbers of kits per doe per treatment. The weight of kits was measured by weighing the kits using a weighing scale and the value was recorded in grams. Weight of the overall kits was divided by the number of kits to get average kit

weight in gram. Number of kits that was alive at the time of kindling was considered as number of live kit at birth.

Experimental Design and statistical analysis

The experimental design was a complete randomized design. Data collected were analysed using descriptive statistics and Analysis of variance (9) and means were separated using Duncan Multiple Range Test of the same software.

Results and Discussion

Semen characteristics of bucks used for AI are presented on Tables 1 and 2. The semen temperature ranges from 34.1-38.2^{0}C. The sperm motility was recorded in percentage and it ranges from 75-85%. The sperm concentration of buck C recorded the highest value while the sperm livability of rabbit buck E recorded the highest value with the average sperm concentration of 1.85x10^9 sperm cells/ml.

Table 1 : Semen characteristics of rabbit bucks used for artificial insemination

Bucks	Temperature (^{O}C)	Volume (mL)	Mass activity	Sperm motility (%)	Concentration (sperm cells/mL)	Livability (%)
A	37.0	0.81	3	85	1.00 x 10^9	95.46
B	34.1	0.3	3	80	1.022 x 10^9	93.46
C	36.1	0.81	2	70	3.54 x10^8	91.00
D	38.2	1.46	2	70	2.78 x 10^8	94.88
E	35.7	1.02	3	85	1.69 x 10^9	97.21
F	35.6	0.86	3	80	1.06 x 10^9	97.92

The influence of human chorionic gonadotropin hormone on the fertility rate of artificially inseminated rabbit does is presented on Table 3. The gestation length of does in Treatment 3 was not significantly different from does in treatment 4. It was observed that none of the does on treatments 1 and 2 conceived. The conception rate of the does in treatments 3 and 4 was 16.67%. The gestation length of the rabbit does range between 32 and 35 days, while the litter size was 7 for does on treatments 3 and 4. The litter weight was significantly ($P<0.05$) higher in does on treatment 4 than treatment 3, while weight of doe after birth was significantly ($p<0.05$) higher in does in treatment 3 than treatment 4. The apparently highest gestation length and average litter weight were obtained in does administered 150 I.U hCG.

Table 2: Mean of semen parameters used for artificial insemination

Parameters	Mean ±SD
Semen Temperature (^{o}C)	36.1±1.40
Semen Volume (mL)	0.88±0.37
Mass Activity	2.67±0.52
Sperm Motility (%)	78.33±6.83
Sperm Concentration (x10^{9}sperm cells/mL)	1.85±1.07
Livability (%)	94.99±2.53

In this study, it was observed that there was no conception in does on treatment 1 (without hormone) and treatment 2 treated with 50 I.U hCG. This could be attributed to the low level of hormone and absence of the exogenous hormone administration in treatment 2 and the control, respectively. This implies that artificial insemination in rabbit does require hormonal stimulation to synchronize the oestrus and or induce ovulation at a level higher than 50i.u for hCG provided semen quality is not impaired due environmental stressors. It has been reported that the reproductive quality of rabbit buck can be greatly influenced by environmental stress (10). Findings from this study are in contrast to those reported by Adams (7) and El-Garfary *et al.*(11) which stated that injecting does with 50 I.U hCG significantly decreases the number of services per conception, but increased the litter size at birth, litter weight and litter weight gain. The result obtained for conception rate of rabbit does administer 150 I.U of hCG was 16.67%. Also, the values obtained for litter size and number of live kits at birth corroborates that of Lavara *et al.* (12) who reported no significant differences for litter size at birth and live-born kits when synthetic PGF2alpha analogue (cloprostenol) was used. Pimenta *et al.* (13) obtained the same results after using natural PGF 2alpha and Mollo *et al.* (14) in comparison to does treated with PMSG or untreated does.

Table 3: Influence of hCG on fertility rate of artifi cially inseminated does with un -extended semen

Parameters	**T1(0 i.u)**	**T2(50 i.u)**	**T3(100 i.u)**	**T4(150 i.u)**
Weight of doe after birth(g)	-	-	1855.00±7.07	1699.50±6.36
Gestation length (days)	-	-	32.00±1.41	35.50±0.71
Weight of doe before birth (g)	-	-	2156.00±7.07^{a}	1929.00±2.83^{b}
Avera ge Litter size	-	-	7.00±0.00	7.00±0.00
Total Litter weight(g)	-	-	278.00±4.24^{b}	312.00±2.83^{a}
Average litter weight(g)	-	-	39.72±0.60^{b}	44.58±0.40^{a}

a,b,c: Means along the same row with different superscript are significantly different ($P<0.05$)

The trend of values obtained for litter weight, weight of doe after birth and the average litter weight that were significantly different across the treatments could probably be attributed due to influence of the hormone. Gestation length recorded in this study was within the range reported in different breeds of rabbits which is between 28 to 36 days (**15)**. However, rabbit does normally kindle 31-33 days after mating or artificially inseminated (**16)**.

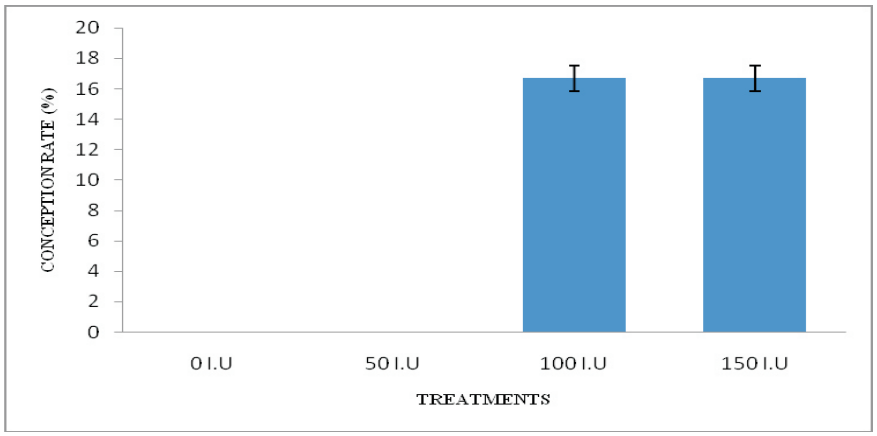

Figure 1: Conception rate of artificially inseminated rabbit does administered human chorionic gonadotropin hormone

Conclusion and Application

It can be concluded that

1. Conception in rabbit is impossible without exogenous hormonal induction.
2. However, the use of hCG to induce ovulation will result in conception with optimal dose of 100 I.U.

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