

Management of Deer Populations by the Use of Contraceptives

Introduction:

In many urban and suburban areas there is an overpopulation of deer. Not only are they a nuisance to the communities by destroying gardens and ornamental plants, but according to the U.S. Department of Transportation white-tailed deer kill an estimated 130 Americans each year due to vehicle/deer collisions. Deer also carry ticks that can transmit Lyme disease to both humans and their pets. Furthermore, there are so many deer per square mile that they are destroying their own natural resources and forests.

Before the arrival of European settlers, the deer population was kept in check by their natural predators like wolves and bears, along with Native American hunters. The settlers began market hunting, where they would kill and sell the deer to butchers, and around 1900 the population fell from 28 million to about 400,000 animals. Due to the large decline in population size, the federal Lacey Act was passed which prohibited the interstate traffic of wild game. Some states restocked deer and prohibited the hunting of does and the deer population began to recover, rising to about 27 million deer today. Although this number was sustainable before the time of the settlers, it is considered an overpopulation today because the same amount of territory has to be shared with humans.

Hunting has been one way in which people have tried to control the deer population size. However, in many urban and suburban areas this is an unacceptable and dangerous management method. Many people also find hunting to be cruel and oppose the killing of deer. By trying to control the fertility of does through the use of contraceptive methods, the population size may be controlled without having to kill any animals. Effective control of reproduction in female deer can occur by interfering with neuroendocrine processes at several different steps: estrus, ovulation, conception, implantation, maintenance of pregnancy and parturition. By preventing estrus, the buck will not receive the appropriate signals that would inform him of the ovulation. Additional effective methods of contraception are the prevention of ovulation, conception and implantation. Inducing abortion is effective but may be considered inhumane and preventing parturition and retention of fetuses can cause harm to the doe. (*ref. 4*)

Lots of research has been done to find appropriate fertility control for animals, but for the method to be useful it must be easy to administer, economical and controllable. Four different contraceptives are tested for their effectiveness in preventing pregnancy in deer. In the first experiment they use silastic implants containing levonorgestrel (LNG). In the next, silastic rods containing melengestrol (MGA) are compared to silastic rods containing levonorgestrel (LNG). In the final experiment a gonadotropin-releasing hormone agonist called Leuprolide is tested.

Methods & Results:

Experiment 1:

Six sexually mature white-tailed does and six sexually immature fawns were implanted with either six or nine silastic rods impregnated with 36 mg levonorgestrel (LNG) each. Two of the mature females and two of the fawns served as the controls and were left untreated. The deer were sedated and the rods were placed subcutaneously during a 15 minute procedure where an incision was made, rods were placed into the small skin pocket created and sutured closed. Blood samples were taken to measure the level of LNG levels in the body through-out the next several months.

Reproductive effects of LNG varied for each adult female. Following implantation, one adult female continued cycling but never became pregnant, and the other adult females all became pregnant. One of the adults became pregnant 2 months later than the other females even though copulation occurred at the same time. All the treated females that had the implants removed became pregnant the next year as yearlings or adults. Although the implantation of LNG rods in deer was a safe procedure resulting in no mortalities, it was found that there were health problems associated with the LNG implants. Some of the deer had voluntarily reduced food consumption and later two of these deer died of malnutrition and respiratory failure. A significant release of LNG after subcutaneous implantation was observed. However, LNG was not effective as a contraceptive at the levels detected in adult white-tailed deer. Implantation of LNG did not appear to affect puberty attainment. Levonorgestrel levels detected in this study did not affect the length of gestation or parturition. Therefore, the use of LNG in white-tailed deer is not effective. (ref. 2)

WHITE ET AL.-LEVONORGESTREL IN WHITE-TAILED DEER

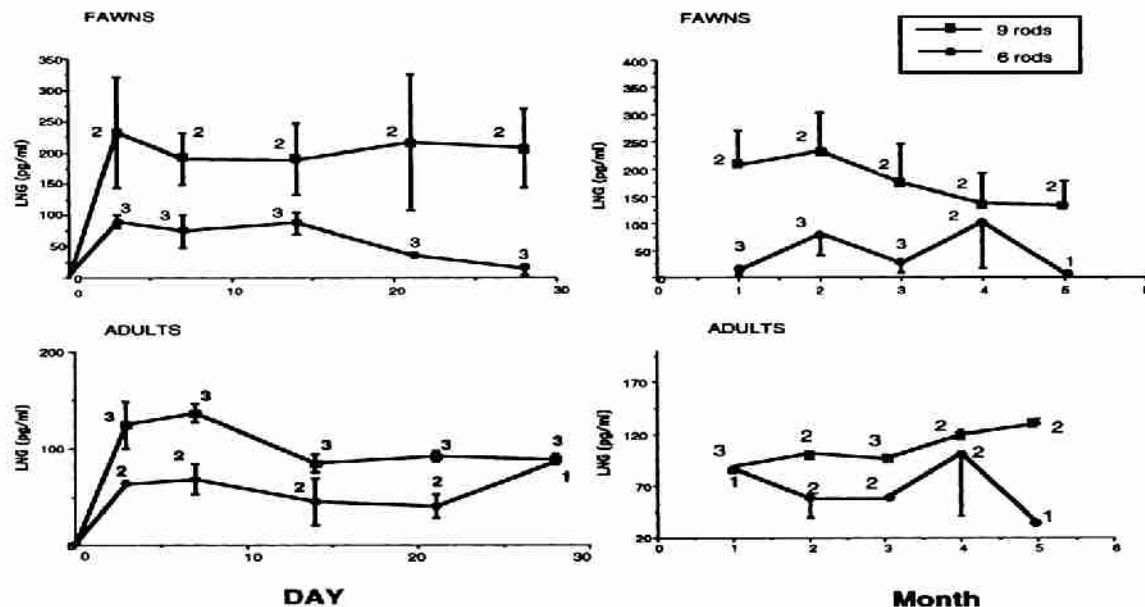


FIGURE 1. Mean and SE (vertical bars) serum levonorgestrel (LNG) concentrations for Days 0 to 28 and Month 1 to 5 post-implantation in captive adult and fawn female deer treated with either six or nine LNG rods during the 1990 to 1991 breeding season. The numbers at each data point are the number of deer sampled.

(ref. 2)

Experiment 2:

Three groups of sexually mature white-tailed does were placed into an enclosure with three mature bucks each. In the first group there were five does that were implanted with the 800 mg melengestrol acetate (MGA) impregnated silastic rods. In the second group there were five does that were implanted with the 200 mg levonorgestrel (LNG) impregnated silastic rods, and the third group served as the control. The does in the third group were placed under the same conditions, but were not given any form of contraceptive. The silastic rods were implanted in the beginning of September, before the breeding season. The does were sedated and a 20 mm incision was made subcutaneously in the neck in front of the shoulders. Blood was collected in the months of January, February and March and progesterone levels were measured to determine whether ovulation occurred. During the fawning season the pens were examined every other day and the number, sex and mother of the fawns were recorded. The three control does ovulated, conceived and delivered three normal fawns the first year and five normal fawns the second year. One of the MGA treated does died from unrelated causes in March during the first winter and a second doe also died during March of the second year. The ovaries of the two does were examined after death and no evidence of mature follicles, ovulation or corpus luteum formation was present. None of the other three MGA treated does had elevated serum progesterone levels indicative of ovulation or produced fawns during the first or second breeding season following implantation of the contraceptive.

Two LNG animals did not ovulate, based upon serum progesterone concentrations. The other three LNG treated animals ovulated and became pregnant. Two of the does delivered normal fawns and one of the does died during mid-pregnancy and was carrying normal appearing twin. The studies confirm the effectiveness of a single 800 mg MGA implant through two years as a contraceptive agent in female white-tailed deer, while LNG containing implants were ineffective at the 200 mg dose used although the amount was effective in women. (ref.1)

SHORT COMMUNICATIONS

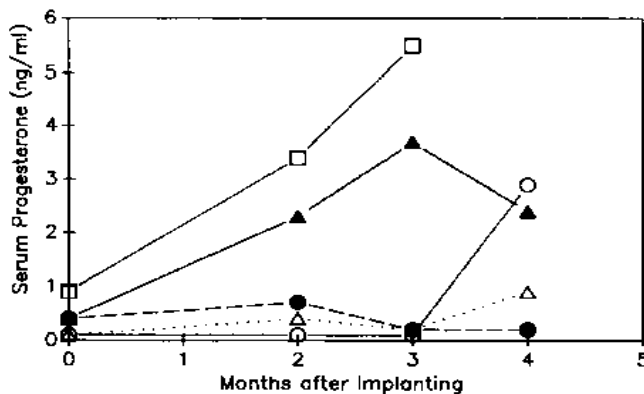


FIGURE 1. Serum progesterone (P4) concentrations before and after implanting silastic rods containing 200 mg levonorgestrel (LN). Each line and symbol represents an individual animal. Implants were put in place during September before the breeding season.

(ref.1)

Experiment 3:

Thirteen adult female mule deer and two intact male mule deer were used in the experiment to test the effectiveness of leuprolide as a contraceptive in deer. Five female deer (group A) received 10 mg of leuprolide. Five female deer (group B) served as controls for comparing the effects of leuprolide on pregnancy rates and reproductive behavior. The other three deer (group C) were kept separate from direct contact with male deer to serve as a non-pregnant control group. The five deer in group A were sedated and were given a dose of leuprolide injected subcutaneously using a needle and syringe. Blood samples were taken and the LH and progesterone levels were measured from all three groups. The prolonged release of the leuprolide formulation prevented pregnancy in all treated female mule deer (group A) and no fawns were born to this group. The control females (group B) all had normal pregnancy and fawning rates. In the following breeding season the treated females (group A) regained normal ovarian function and gave birth to normal fawns. When the fawns birth rates were compared between the treated deer (group A) and the untreated deer (group B), it was found that they were very similar. The normal birth weights confirmed the reversibility of leuprolide treatments.

Leuprolide prevented pregnancy in treated deer by suppressing LH levels for the duration of one breeding period. The lowered blood progesterone levels in the treated females showed the suppressive effects of leuprolide on corpus luteum formation. Treated females regained normal ovarian function the following breeding season, became pregnant, and gave birth to fawns that were similar in body mass and general health to those born to untreated deer. (ref. 3)

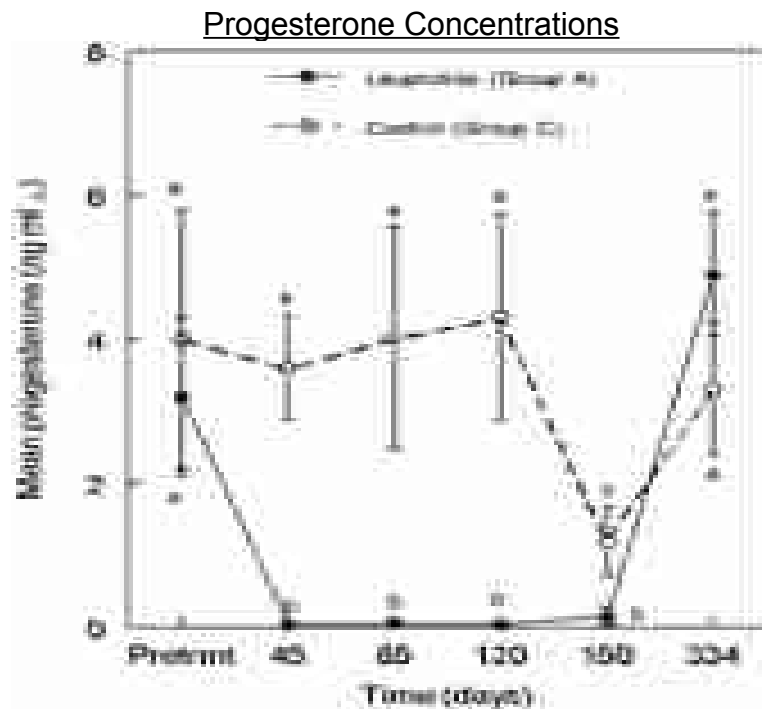


FIGURE 2. Longitudinal profiles of mean progesterone concentrations (ng ml^{-1}) in control female mule deer (group C) and females treated with a sustained release formulation containing 10 mg of leuprolide (group A). Results are shown as means \pm SE. Different lowercase letters indicate significant differences between means among treatment time intervals ($P \leq 0.05$). (ref. 3)

Discussion:

LGN was ineffective in preventing pregnancy and also had detrimental side effects on the does. MGA was effective as a contraceptive, but its method of administration was time costly and complicated. The leuprolide proved to be the best contraceptive method out of the above experiments because it was the most effective steroid in preventing pregnancy and it had the least time consuming method of administration. Leuprolide's effects were fully reversible with no side effects, which allows this contraceptive to be easily controlled, and in turn, the deer population can also be carefully regulated. However, there are several complications associated with the use of injectible contraceptives: marking which deer have received the treatment; locating enough deer to treat; funding for the expense of the drug; finding people to administer the treatment and preventing the introduction of other females from outside herds. All of these problems can be managed in captive herds of deer, but these contraceptive methods appear to be infeasible on the large scale for the use on wild deer populations. If only a few females receive the treatment, the population size will still increase only in smaller increments. The decline in population growth will not be significant enough to allow the use of the contraceptive method alone.

Many questions still remain in reference to the use of these contraceptives. Research must still be done on the effects the drugs may have on non-target organisms, such as natural predators or hunters, who may consume the meat. Also, the effect the treatment may have on the reproductive behavior of the deer and the population dynamics. The treatment may extend the rutting period which can cause males to be highly territorial and reproductively active. Males could experience higher mortality rates because of this exhausting change in behavior. (*ref. 5*) Although contraceptive methods do not currently appear to be a feasible alternative to hunting, with more research, contraceptives could be the most practical solution to deer population control in the future.



References:

- (1) Plotka E. D. & Seal U. S. (1989). Fertility Control in Female White-tailed Deer. *Journal of Wildlife Diseases*, 25(4), pp. 643-646.
- (2) Lisa M. White, Robert J. Warren, & Richard A. Fayer-Hosken (1994). Levongestrel Implants as a Contraceptive In Captive White-Tailed Deer. *Journal of Wildlife Diseases*, 30(2), pp. 241-246
- (3) Dan L. Baker, Margaret A. Wild, Mary M. Connor, Harish B. Ravivarapu, Richard L. Dunn & Terry M. Nett (2004). Gonadotropin-Releasing Hormone Agonist: A New Approach To Reversible Contraception In Female Deer. *Journal of Wildlife Diseases*, 40(4), pp. 713-724
- (4) Ronald Bailey (2001). North America's Most Dangerous Mammal: How best to deal with the menace of Bambi. Reason Online.
- (5) Robert J. Warren, Lisa M. White (1993). The Applicability and Biopolitics of Contraceptive Techniques for Deer Management. Sixth Eastern Wildlife Damage Control Conference.

