Reproductive Control of Vampire Bat (*Desmodus rotundus*): An Environmentally Friendly Alternative

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ABSTRACT: Vampire bat control strategies have not changed in México for more than 40 years. Anticoagulants and strychnine are frequently used to reduce bat populations and the prevalence of rabies. Despite these control efforts, vampire bat-borne rabies continues to have a significant economic impact. A new control method is being developed that takes advantage of the reproductive changes induced by phytoestrogens in mammals. In this study, we fed bats the phytoestrogen coumestrol, for 30 days and examined its effect on the reproductive organs of male and female vampire bats in laboratory tests. For males, coumestrol resulted in an increase in weight and loss of the typical histological structure of testes. Treated females had no corpora lutea in their ovaries and fewer primordial folliculi were observed. These results suggest that coumestrol might be a candidate replacement for anti-coagulants used for vampire bat control.

KEY WORDS: bat control, coumestrol, *Desmodus rotundus*, fertility control, reproductive control, vampire bat

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INTRODUCTION

Vampire bat (*Desmodus rotundus*) control strategies in México have not changed in 40 years, with anticoagulants and strychnine commonly used. Despite control efforts, the economic impact of cattle rabies continues to grow. Bovine paralytic rabies is the main vampire bat-bite derived disease (McColl et al. 2000). New control techniques are required to complement present procedures.

A new control method that takes advantage of the reproductive changes induced by phytoestrogens such as coumestrol in mammals (Burroughs 1995, Medlock et al. 1995) is being developed and tested for vampire bat control. The aim of this strategy is to reduce vampire bat populations by reducing their reproductive rate. Such a strategy would decrease vampire bat populations but not affect other species, thereby keeping the ecological niches occupied and avoiding their occupancy for other newcomer rabid vampire bats.

MATERIALS AND METHODS

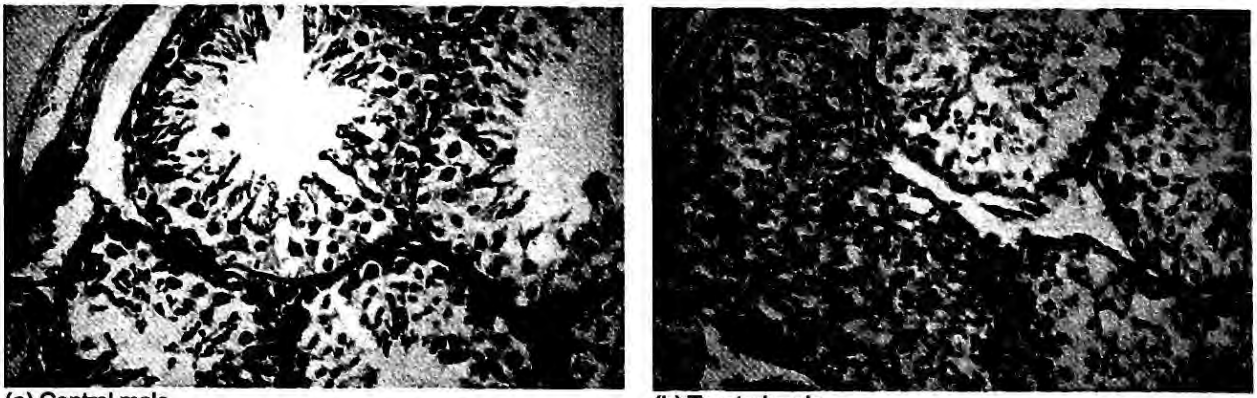
Three males and 3 females were assigned randomly into either a control group (1 male and 1 female) or to the experimental group (2 males and 2 females). We fed experimental animals a 15-ml mixture of coumestrol (200 µg) dissolved in dimethyl sulfoxide (DMSO), and bovine defibrinated blood daily for 30 days. The control group was fed 15 ml of bovine defibrinated blood and DMSO.

After treatment, all animals were sacrificed by anesthesia and heart puncture, and the reproductive organs were analyzed for gross anatomical and cytological changes. All animals were from our rabies-free breeding colony. All animals were maintained in individual containers in an environment-controlled room (26°C, 60% humidity, 20 hours of darkness) in our animal facility.

RESULTS

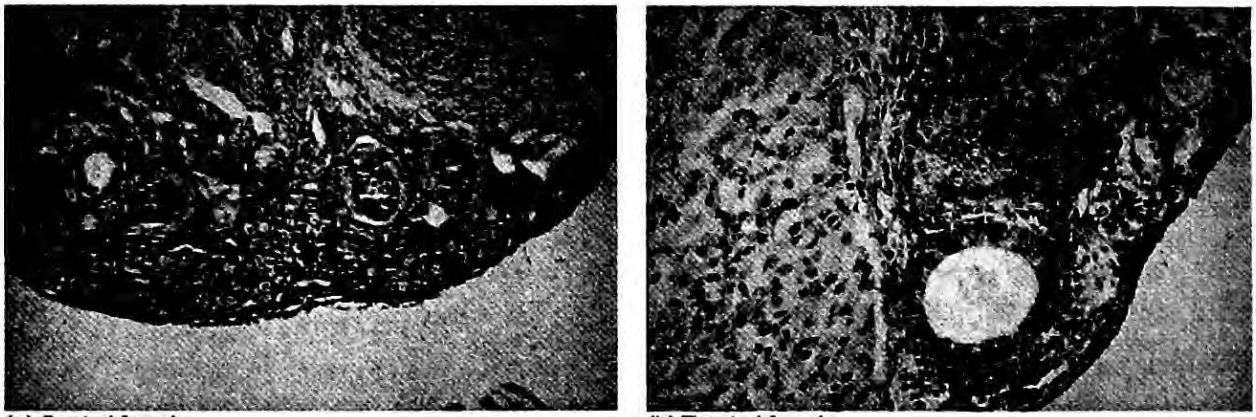
Testes of treated males were heavier (160 ± 18 mg) than those of the control male (139.1 mg). We did not observe any other macroscopic differences in the reproductive organs of males. Treated males did not have the typical histological structure, and interstitial Sertoli and sperm cells were no longer structured. The untreated male had well-structured seminal tubules with sperm cells in different maturation steps (Figure 1).

The mean ovary weight of treated females was higher in treated females (105 ± 6.5 mg) than the untreated



(a) Control male (b) Treated male

Figure 1. Histological changes in the seminiferous tubuli of testes in male vampire bats treated with 200 µg coumestrol/day compared to the control male. The control male had well structured seminal tubules with sperm cells in different maturation steps. Treated males have lost the typical architecture, and interstitial Sertoli and sperm cells are no longer structured.



(a) Control female (b) Treated female

Figure 2. Histological changes in the ovary structure induced by coumestrol in treated female vampire bats compared to the control female. In the control female, a conspicuous luteum body occupies most of the image but some folliculi can also be seen. Treated females have no corpora lutea in their ovaries and fewer primordial folliculi are observed.

female (95 mg). Coumestrol also induced a reduction in uterus weight (98.4 ± 1.4 mg) compared to the untreated female. Vaginal smears of treated bats indicated a continuous estrous. Treated females had no corpora lutea in their ovaries and fewer primordial folliculi were observed (Figure 2). In the untreated female, a conspicuous luteum body occupied most of the image although some folliculi were observed.

DISCUSSION

A more effective, specific, and environmentally-safe alternative to the current anticoagulant strategy for vampire bat population control in México and other countries is needed. In this study we have explored the potential of phytoestrogens to impair the reproductive capacity of vampire bats. Our results indicate that the phytoestrogen coumestrol induced gross anatomical and cytological changes in both male and female reproductive organs. These results indicate that a phytoestrogen-based strategy may be a potentially useful alternative for vampire bat population control. Further studies are needed to asses the reproductive impact of coumestrol on biochemical and endocrine processes of vampire bats, and to further develop this concept to provide a more effective, specific, environmentally-safe and acceptable strategy for vampire bat population control in México and other countries.

LITERATURE CITED

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