Efficacy of a topically applied formulation of metaflumizone on cats against the adult cat flea, flea egg production and hatch, and adult flea emergence

Abstract
This study was undertaken to evaluate the efficacy of metaflumizone applied to cats in a spot-on formulation (ProHeart® for Cats, Fort Dodge Animal Health) against adult fleas, flea egg production and hatch, and the development of fleas from eggs to adults. Male and female adult domestic shorthair cats were randomly assigned to either serve as non-treated controls or were treated topically with a minimum of 40 mg/kg metaflumizone in single spot on Day 0. On Days –2, 7, 14, 21, 28, 35, 42, 49, and 56, each cat was infested with approximately 100 unfed cat fleas, Ctenocephalides felis felis. On Days 1, 2, and 3, and at 48 and 72 hours after each posttreatment reinfestation, flea eggs were collected and counted. At approximately 72 hours after treatment or infestation, each cat was combed to remove and count live fleas. Egg viability was determined by examining hatched eggs after 5 days and adult emergence was determined 28 days after egg collection. Metaflumizone provided ≥99.6% efficacy for six weeks posttreatment and ≥99.9% reduction relative to nontreated cats. Where there were eggs to evaluate, metaflumizone treatment did not have any apparent effect on the hatching of eggs or on the development and emergence of adult fleas from the eggs produced by fleas from treated animals.

1. Materials and Methods

1.1. Animals
On Day –6, 19 purpose bred domestic shortair cats were infested with approximately 100 C. felis. On Day –4, flea counts were conducted to assess the ability of cats to maintain infestations. After counting, fleas were removed by combing each cat thoroughly for 10–40 min. The 16 (4 M: 12 F) 4-month-old, 2.6 to 4.8 Kg, used in the study were selected from these 19 cats based on highest pretreatment flea counts. These cats were ranked in descending order by flea count and gender and randomly allocated into two groups.

1.2. Experimental design
Cats (4M:4F) in Group A remained nontreated and served as controls. Cats (4M:4F) in Group B were treated with a metaflumizone formulation containing 40 mg metaflumizone/kg according to pretreatment body weight. The dose was applied to the skin at a single spot on the dorsal neck at the base of the skull. On Days –2, 7, 14, 21, 28, 35, 42, 49 and 56, each cat was infested with approximately 100 unfed cat fleas. On Days 1, 2, and 3, and at 2 and 3 days after each posttreatment reinfestation, flea eggs were collected from the pan under each cat cage. At approximately 72h after treatment or infestation, each cat was combed to remove and count live fleas. The fleas were not replaced on the animals following the 72 h count. Prior to the egg collections, cats were brushed vigorously by hand for ~20 seconds to dislodge any flea eggs from the cat’s hair coat, allowing the eggs to fall into the drop pan below the cage. Eggs were collected and counted. Viability of eggs was determined by attaching up to 50 flea eggs from each collection to the lids of glass Petri dishes. The lid was inverted and placed on a corresponding lower dish containing growth media and held in a growth chamber at approximately 75–80% R.H. and 27-28°C. Eggs were examined using a dissecting microscope 5 days after attachment to lids to determine hatch. Hatched larvae were allowed to continue development in the growth media. At 10–12 days after egg collection, pupae were sifted from the media and placed into plastic vials with lids. Adult emergence was determined by counting adult fleas at about 28 days after egg collection.

3.3. Calculation of efficacy
Percent efficacies on adult and egg fleas, relative to the non-treated control group and based on geometric means, were calculated as follows:

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\text{% Efficacy} = \frac{100}{\text{GMean Control} - \text{GMean Treated}} \times 100
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where GMean = geometric mean posttreatment flea counts and % Efficacy = percent reduction in mean relative to non-treated controls.

2. Results
All cats included in the study demonstrated adequate pretreatment flea retention with Day 4 flea counts ranging from 42 to 88. Untreated cats also maintained adequate flea infestations throughout the study with geometric mean flea counts ranging from 44.4 to 80.5. Treated cats showed significantly lower geometric mean adult flea counts than counts on nontreated controls throughout the entire 8 weeks of the study (P < 0.05). Treatment with metaflumizone provided ≥99.6% efficacy for six weeks posttreatment and then 91.7 and 86.5% at 7 and 8 weeks post-treatment, respectively – Graphic 1.

4. Discussion and Conclusions
Treatment of cats with a metaflumizone spot on almost completely halted flea production (99.2% reduction) within 48 h of application and provided 99.7% control of the existing flea burden within 72 h. Therefore, within 2 days of treatment, no egg dissemination should occur from treated cats. Currently available topical spot-on insecticide formulations such as fipronil-α-methoxyiminodibenzyl and selamectin are marketed to provide at least 30 days of effective flea control. A single application of metaflumizone provided greater than 99% control of adult cat fleas for at least 42 days after treatment and should provide highly effective flea control when used as a monthly treatment.

Following treatment, egg production was reduced by over 99% for at least 5 weeks. At 6 weeks posttreatment, the control of egg production at 48 hours after reinfestation was 96.5%, and 99.7% between 48 and 72 hours after reinfestation. In this study it was demonstrated that metaflumizone had a profound effect upon egg production. This indirectly indicates that metaflumizone is producing rapid toxicity and thus markedly reducing blood feeding by fleas. Where there were eggs to assess metaflumizone treatment appeared to have little effect on the hatchability of eggs or the survival and development of fleas from eggs recovered. Efficacy of a topically applied formulation of metaflumizone on cats against the adult cat flea, flea egg production and hatch, and adult flea emergence this may not truly reflect a treatment effect as these comparisons were based on only a small number of eggs from treated animals.