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EFFICACY OF ANTHELMINTICS:
SPECIFIC RECOMMENDATIONS FOR CANINES

Recommended for Implementation
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THIS GUIDELINE HAS BEEN DEVELOPED BY THE APPROPRIATE VICH EXPERT WORKING GROUP AND WAS SUBJECT TO CONSULTATION BY THE PARTIES, IN ACCORDANCE WITH THE VICH PROCESS. AT STEP 7 OF THE PROCESS THE FINAL DRAFT IS RECOMMENDED FOR ADOPTION TO THE REGULATORY BODIES OF THE EUROPEAN UNION, JAPAN AND USA.

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Introduction

The present guideline for canines was developed by the Working Group that was established by the Veterinary International Cooperation on Harmonization (VICH), Anthelmintic Guidelines. It should be read in conjunction with the VICH Efficacy of Anthelmintics: General Requirements (EAGR) which should be referred to for discussion of broad aspects for providing pivotal data to demonstrate product anthelmintic effectiveness. The present document is structured similarly to the EAGR with the aim of simplicity for readers comparing both documents.

The guideline for canines are part of the EAGR and the aim is: (1) to be more detailed for certain specific issues for canines and felines not discussed in the EAGR; (2) to highlight differences with the EAGR on data requirements and (3) to give explanations for disparities with the EAGR guideline.

It is important to note that technical procedures to be followed in the studies are not the aim of this guideline. We recommend that the sponsors refer to pertinent procedures described in details in other published documents, e.g. WAAVP Guidelines for Evaluating the Efficacy of Anthelmintics for Dogs and Cats, Veterinary Parasitology ***52***: 179-202, 1994.

A. General Elements

1. The evaluation of effectiveness data

The evaluation of effectiveness data is based on parasite counts (adults, larvae) in dose determination and dose confirmation studies; egg counts/larval identification is the preferred method to evaluate effectiveness in field studies.

The controlled test is the most widely accepted of the testing procedures for evaluation of anthelmintic drug effectiveness. However, the critical test may be appropriate for some intestinal species of parasites, e.g. ascarids.

Adequate parasite infection should be defined in the protocol according to regional prevalence or historic and/or statistical data.

2. Use of natural or induced infections

Dose determination studies should be conducted using induced infections with either laboratory or recent field isolates.

Dose confirmation studies should be conducted using naturally or artificially infected animals, however, at least one study should be conducted in naturally infected animals for each parasite claimed on the label. *Echinococcus* spp. and *Dirofilaria* spp. testing may be conducted using animals harbouring induced infections due to public health considerations for echinococcosis and the complexity of the claims for heartworm. Due to the zoonotic potential of *Echinococcus* spp. trials conducted using this genus should be carried out under high biosecurity provisions.

For the following helminths, induced infections may also be the only method to determine effectiveness of the product because of difficulties in obtaining a sufficient number of infected

animals*: Filaroides milksi*, *F. hirthi, Dioctophyma renale, Capillaria aerophila, C. plica, Spirocerca lupi, Physaloptera* spp*, Mesocestoides* spp. and *Crenosoma vulpis*. For claims against larval stages, only studies with induced infections are acceptable.

The history of the parasites used in the induced infection studies should be included in the final report.

3. Number of infective parasitic forms recommended for induced infections.

The number to be used is approximate and will depend on the isolate. The final number of larvae used in the infection should be included in the final report. Table 1 shows the range of numbers recommended for common helminths.

Table 1. Range of infective stages used to produce adequate infections in canines for anthelmintic evaluation.

Parasites	Range
Small Intestine	
Toxocara canis	100 - 500 *
Toxascaris leonina	200 - 3,000
Ancylostoma caninum	100 - 300
Ancylostoma braziliense	100 - 300
Uncinaria stenocephala	1,000 – 1,500
Strongyloides stercoralis	1,000 - 5,000
Echinococcus granulosus	20,000-40,000
Taenia spp.	5 - 15
Large Intestine	
Trichuris vulpis	100 - 500
Heart	
Dirofilaria immitis	30 – 100 **

* In suckling canines or canines less than 5 months of age.
** For adulticidal or microfilaricidal testing 5 to 15 pairs of adult worms can be transplanted.

4. Recommendations for the calculation of effectiveness

4.1. Criteria to grant a claim

To be granted a claim the following pivotal data should be included:
a) Two dose confirmation studies conducted with a minimum of 6 adequately infected non-medicated animals (control group) and 6 adequately infected medicated animals (treated group);
b) The differences in parasite counts between treated and control should be statistically significant ($p<0.05$);
c) Effectiveness should be 90% or higher calculated using transformed (geometric means) data. For some parasites with public health, animal welfare/clinical implications, e.g. *E. granulosus* and *D. immitis* , respectively, higher efficacy standards (i.e. up to 100%) may be imposed. The regulatory authority of the region in which the product is intended to be registered should be consulted;
d) The infection of the animals in the study will be deemed adequate based on historical, parasitological and/or statistical criteria;
e) Effectiveness against helminths will be evaluated examining for the presence or absence of parasitic elements in faecal material or blood. An *Echinococcus* spp. claim does not require field studies due to public health concerns.

4.2. Number of animals (dose determination and dose confirmation trials)

The minimum number of animals required per experimental group is a critical point. Although the number of animals will depend on the ability to process the data statistically according to the adequate statistical analysis it has been recommended, to achieve harmonization, that the inclusion of at least 6 animals in each experimental group is a minimum.

In cases where there are several studies, none of which have 6 adequately infected animals in the control group (for example, important rare parasites), the results obtained could be pooled to accumulate 12 animals in the studies; and statistical significance calculated.

If the differences are significant ($p<0.05$), effectiveness may be calculated and if the infection is deemed adequate, the claim may be granted. Sampling techniques and estimation of worm burden should be similar among laboratories involved in the studies to allow adequate and meaningful extrapolation of the results to the population.

4.3 Adequacy of infection

With respect to the minimum adequate number of helminths, the decision will be made when the final report is submitted based on historical data, literature review, or expert testimony. Generally the minimal number of nematodes in canines considered to be adequate is in the range of 5 to 20. Higher counts are to be expected with *A. caninum* and *U. stenocephala*.

4.4 Label claims

A claim for effectiveness against life stages of each parasite should refer to each stage in the case of natural infections, or age in days in the case of induced infection. Table 2 is provided as a guide for the recommended time of treatment of induced infections.

With the majority of parasites approximately 7 days is a sufficient time period from the termination of treatment until the animals are necropsied. The following parasites are the exception to the above general recommendation:

- *Physaloptera* spp., *S. lupi, C. plica, D. renale, E. granulosus, Taenia* spp., *D. caninum, Mesocestoides* spp.: 10 to 14 days;
- *C. vulpis*: 14 days;
- *F. milksi, F. hirthi*: 42 days;
- *F. osleri*: one-half of the animals at 14 days and the other half at 28 days;
- *D. immitis*: varies by trial design.

Table 2. Recommended time of treatment after infection.

Parasite	Adult Stages	Larval Stages
S. stercoralis	5 to 9 days	
T. vulpis	84 days	
A. caninum	> 21 days	6 to 8 days * (L4)
A. braziliense	> 21 days	6 to 8 days (L4)
U. stenocephala	> 21 days	6 to 8 days (L4)
T. canis	49 days	3 to 5 days (L3/L4) 14 to 21 days (L4/L5)
T. leonina	70 days	35 days (L4)
D. immitis	180 days	2 days (L3), 20 to 40 days (L4) 70 to 120 days (L5), 220 days (microfilariae)
E. granulosus	> 28 days	
Taenia spp.	> 35 days	

* For somatic larvae, treat within 2 days prior to parturition.

For claims against transplacental and/or transmammary transmission of *T. canis* somatic larvae of natural or artificially infected pregnant bitches should be treated prior to parturition and the efficacy checked by counting the larvae in the bitch milk and/or the adult worms in the small intestines of the litter.

5. Treatment procedures

The method of administration (oral, parenteral, topical), formulation and extent of activity of the product will influence the protocol design. It is advisable to consider the weather and animal relationship and bathing with regard to effectiveness of topical formulations.

For oral formulations, palatability studies should always be included in the evaluation of the effectiveness of the product. For products administered topically, the impact of weather (e.g. rainfall, UV light), bathing and coat length should be included in the evaluation of the effectiveness of the product.

6. Animal selection, allocation and handling

Approximately 6 month old canines are suitable for effectiveness studies. However there are exceptions:
- *S. stercoralis* : less than 6 months;
- *A.caninum, A. braziliense, A. tubaeforme, U. stenocephala* : 6 to 12 weeks;
- *T. canis, T. leonina* : 2 to 6 weeks;
- *D. caninum* : 3 months or older;
- *Mesocestoides* spp.: 8 weeks or older;
- *U. stenocephala* and *T. vulpis* : older canines can be used.

Naturally infected animals are selected based on egg output or expelled proglottids for gastrointestinal parasites, and parasitological and/or immunological methods for *D. immitis*. They should be assigned to each group and replicated using an adequate method that should be described in the final report. Replications should cover each factor that may have an impact on the final evaluation of the effectiveness of the formulation. Animal housing, feeding and care should follow strict requirements of welfare for canines. Animals should be acclimated for at least 7 days to the experimental facilities and personnel. Animals should be monitored daily to determine adverse reactions.

B. Specific Evaluation Studies

1. Dose Determination Studies

No species-specific recommendation.

2. Dose Confirmation Studies

No species-specific recommendation.

3. Field Efficacy Studies

Field (clinical) studies should not be conducted with canines infected with *Echinococcus* spp.

4. Persistent Efficacy

Due to the differing biologies for the helminths of canines and the lack of experience with persistent efficacy for these parasites, no recommendations can be provided.