



**Veterinary
Medicines
Directorate**

**United Kingdom
Veterinary Medicines Directorate
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NATIONAL PROCEDURE

**PUBLICLY AVAILABLE ASSESSMENT REPORT FOR A VETERINARY
MEDICINAL PRODUCT**

Vetworm Plus Tablets for Dogs

MODULE 1

PRODUCT SUMMARY

Name, strength and pharmaceutical form	Vetworm Plus Tablets for Dogs
Applicant	Healthspan UK Ltd Witan Gate House 500-600 Witan Gate West Milton Keynes United Kingdom
Active substance(s)	Praziquantel Pyrantel (pyrantel embonate) Febantel
ATC Vetcode	QP52AA51
Target species	Dogs
Indication for use	Treatment of mixed infections by nematodes and cestodes of the following species Nematodes: Ascarids: <i>Toxocara canis</i> , <i>Toxascaris leonina</i> (adult and late immature forms). Hookworms: <i>Uncinaria stenocephala</i> , <i>Ancylostoma caninum</i> (adults). Whipworms: <i>Trichuris vulpis</i> (adults). Cestodes: Tapeworms: <i>Echinococcus</i> species, (<i>E. granulosus</i> , <i>E. multilocularis</i>), <i>Taenia</i> species, (<i>T. hydatigena</i> , <i>T. pisiformis</i> , <i>T. taeniformis</i>), <i>Dipylidium caninum</i> (adult and immature forms).

MODULE 2

The Summary of Product Characteristics (SPC) for this product is available on the Veterinary Medicines Directorate website (www.vmd.defra.gov.uk)

MODULE 3

PUBLIC ASSESSMENT REPORT

Legal basis of original application	Application in accordance with Article 13 (3) of Directive 2001/82/EC as amended.
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I. SCIENTIFIC OVERVIEW

Vetworm plus tablets for dogs is authorised for use in dogs for the treatment of mixed infections by nematodes and cestodes of the following species: Nematodes, ascarids: *Toxocara canis*, *Toxascaris leonina* (adult and late immature forms). Hookworms, *Uncinaria stenocephala*, *Ancylostoma caninum* (adults), and whipworms, *Trichuris vulpis* (adults). Cestodes, tapeworms: *Echinococcus* spp. (*E. granulosus*, *E. Multilocularis*), *Taenia* spp. (*T. hydatigena*, *T. pisiformis*, *T. taeniformis*), *Dipylidium caninum* (adult and immature forms).

The product contains praziquantel 50 mg/tablet, pyrantel 50 mg/tablet (equivalent to 144 mg pyrantel embonate) and febantel 150 mg/tablet as active substances and excipients lactose monohydrate, microcrystalline cellulose, magnesium stearate, colloidal anhydrous silica, croscarmellose sodium, sodium laurilsulfate and pork flavour. The recommended dose rates are: 15 mg/kg bodyweight febantel, 5 mg/kg pyrantel (equivalent to 14.4 mg/kg pyrantel embonate) and 5 mg/kg praziquantel. This is equivalent to 1 tablet per 10 kg (22 lbs) bodyweight. The tablets can be given directly to the dog or disguised in food.

This hybrid application was made in accordance with Article 13 (3) of Directive 2001/82/EC as amended. The reference product is Drontal Plus marketed by Bayer Limited. The reference product has been authorised in the UK for more than 10 years. Vetworm plus tablets for dogs has the same qualitative and quantitative composition in terms of the active substances as the reference product, and has the same pharmaceutical form.

The product is produced and controlled using validated methods and tests which ensure the consistency of the product released on the market. It has been shown that the product can be safely used in the target species; the slight reactions observed are indicated in the SPC¹. The product is safe for the user and for the environment, when used as recommended. Suitable warnings and precautions are indicated in the SPC. The efficacy of the product was demonstrated according to the claims made in the SPC. The overall benefit/risk analysis is in favour of granting a marketing authorisation.

¹ Summary of Product Characteristics

II. QUALITY ASPECTS

A. Composition

The product contains the active substances febantel, praziquantel and pyrantel (as pyrantel embonate); and excipients lactose monohydrate, microcrystalline cellulose, magnesium stearate, colloidal anhydrous silica, croscarmellose sodium, sodium laurilsulfate and pork flavour. The choice of the formulation and the absence of preservative are justified.

The product is presented in individual strips composed of aluminium foil 30 µm/30 gsm extruded polythene, containing 2, 4, 6, 8, 10, 12, 14, 16, 18 or 20 tablets, or in individual blisters composed of 45 µm, soft temper aluminium foil and 25 µm hard temper aluminium foil, containing 2 or 8 tablet. The strips or blisters are packed into cartons containing either 2, 4, 6, 8, 10, 12, 14, 16, 18, 20, 24, 28, 30, 32, 36, 40, 42, 44, 48, 50, 52, 56, 60, 70, 80, 84, 90, 98, 100, 104, 106, 120, 140, 150, 180, 200, 204, 206, 250, 280, 300, 500 or 1000 tablets.

The particulars of the containers and controls performed are provided and conform to the regulation.

The products are an established pharmaceutical form and the development of them is adequately described in accordance with the relevant European guidelines.

B. Method of Preparation of the Product

The product is manufactured fully in accordance with the principles of good manufacturing practice from a licensed manufacturing site. Process validation data on the product have been presented in accordance with the relevant European guidelines. Validation of the manufacturing process were carried out on a suitable number of batches

C. Control of Starting Materials

The active substances are febantel, praziquantel and pyrantel (as pyrantel embonate). All are established active substances and are monographed in the European Pharmacopoeia (Ph. Eur.). The active substances are manufactured in accordance with the principles of good manufacturing practice.

The active substance specifications are considered adequate to control the quality of the material. Batch analytical data demonstrating compliance with these specifications have been provided.

All excipients are monographed in the Ph. Eur. Certificates of Analysis demonstrating compliance with the relevant monograph are provided for each excipient.

D. Specific Measures concerning the Prevention of the Transmission of Animal Spongiform Encephalopathies

There are no substances within the scope of the TSE Guideline present or used in the manufacture of this product.

E. Control on intermediate products

There are no tests on intermediate products.

F. Control Tests on the Finished Product

The finished product specification controls the relevant parameters for the pharmaceutical form. The tests in the specification, and their limits, have been justified and are considered appropriate to adequately control the quality of the product. Satisfactory validation data for the analytical methods have been provided. Batch analytical data from the proposed production sites have been provided demonstrating compliance with the specification. Control tests on the finished product are tests for appearance, average weight, friability, hardness, moisture, dissolution, assay, uniformity of dosage units and microbial purity.

G. Stability

Stability data on the active substance have been provided in accordance with applicable European guidelines, demonstrating the stability of the active substance when stored under the approved conditions.

Stability data on the finished products have been provided in accordance with applicable European guidelines, demonstrating the stability of the product throughout its shelf life.

H. Genetically Modified Organisms

Not applicable.

J. Other Information

Shelf-life:

Shelf-life of the veterinary medicinal product as packaged for sale: 3 years

Discard any unused divided tablets.

Special precautions for storage:

This veterinary medicinal product does not require any special storage conditions.

III. SAFETY AND RESIDUES ASSESSMENT (PHARMACOTOXICOLOGICAL)

III.A Safety Testing

Pharmacological Studies

A number of published references were submitted for praziquantel, pyrantel and febantel with regard to pharmacological studies.

Pharmacodynamics

Praziquantel

Praziquantel is a pyrazinoisoquinoline. Both isomers of praziquantel have essentially the same toxicity but the levo (-) isomer is active against schistosomes. Praziquantel causes spastic paralysis of the musculature in cestodes and trematodes. Some species are more susceptible than others. The mode of action is due to a depolarising effect on the cells of the parasite, causing damage to the integument and disturbances in membrane function.

Pyrantel

Pyrantel is an imidazothiazole and has a broad spectrum of activity against nematodes. It is a cholinergic agonist and acts by inducing neuromuscular blockade via an excitatory effect at nicotinic receptors in the parasite.

Febantel

Febantel is a probenzimidazole with a broad spectrum of activity against nematodes. Its activity is mainly due to its metabolism to fenbendazole and oxfendazole which is subsequently metabolised to the inactive oxfendazole sulfone. The benzimidazoles act by binding to tubulin, resulting in interference to membrane and microtubule structure and glucose transport and metabolism. The parasite's energy generating mechanism (via ATP) is affected by inhibition of fumarate reductase.

Pharmacokinetics

Praziquantel

Praziquantel is rapidly and extensively absorbed in a number of species including the dog. Praziquantel is eliminated rapidly (within 24 hours) and is excreted via bile and GI mucosa as well as via urine. The (-) trans isomer of the 4-hydroxy metabolite has been found to be as effective as the (-) isomer of unchanged praziquantel against schistosomes *in vitro*. Praziquantel crosses the placenta in very small amounts, and only very small concentrations are found in the foetus. In women, the amount of drug excreted in milk is also very small.

Pyrantel

Pyrantel embonate is poorly soluble in water leading to low absorption from the GI track in dogs. A high proportion of the dose remains in the GI track to exert its activity in the large intestine. The absorbed fraction is quickly broken down to a number of inactive metabolites. Pyrantel is mostly eliminated via faeces.

Febantel

The applicant has submitted published pharmacokinetic data relating to administration of fenbendazole to dogs in various formulations. There was considerable variation in AUC², C_{max}³ and T_{max}⁴ depending on the formulation and method of administration. Plasma concentrations of fenbendazole and oxfendazole were below the LOQ⁵ by 48 hours after a single dose. Elimination is virtually completed in 3-7 days.

Toxicological Studies

The applicant provided a number of references to support this section.

Single Dose Toxicity

Praziquantel is of low toxicity in a wide variety of species. Oral LD₅₀⁶ in rabbit is approximately 1050 mg/kg. Acute toxicity studies in dogs were limited by emesis, which occurred at 100 mg/kg. No deaths occurred at oral doses up to 400 mg/kg.

Pyrantel is very well tolerated in various species. LD₅₀ value in rats and dogs was >5000 and >690 mg/kg respectively.

Febantel is of low toxicity. LD₅₀ in rabbits was 1250 mg/kg and in dogs and other laboratory species was >10,000 mg/kg.

Repeated Dose Toxicity

Praziquantel

Praziquantel has low toxicity when given repeatedly to laboratory species and dogs orally. The administration of up to 180 mg/kg daily for 13 weeks led to no drug related effects in dogs. Doses of 5x and 10x the recommended dose of 5 mg/kg given twice at 2 week intervals led to occasional vomiting and diarrhoea but mostly there were no effects. In rats of up to 1000 mg/kg /day for 4 weeks or 250 mg/kg / week for 104 weeks led to no drug related effects.

Pyrantel

Pyrantel when administered to dogs at 207 mg/kg for up to 90 days produced no drug related morphological changes. In young greyhounds, repeated doses of 5 mg/kg produced an initial decline in serum alkaline phosphatase which then stabilised and remained constant at maturity. In another study, adverse effects

² Area under the curve

³ Maximum (or peak) concentration

⁴ Amount of time that a drug is present at the maximum concentration in serum.

⁵ Limit of quantification

⁶ Dose that kills half (50%) of the animals.

occurred in dogs administered 50 mg/kg/day for 90 days, but no adverse effects occurred at 20 mg/kg/day.

Febantel

Doses of 4x - 8x the recommended dose daily for 10 days can cause transient diarrhoea in horses. Data on the metabolite fenbendazole showed no toxic signs in dogs given 250 mg/kg/day for 30 days or 125 mg/kg/day for 90 days.

Reproductive Toxicity

The applicant has submitted a review of published literature to support this section.

Praziquantel

There was no effect on fertility, conception, foetal development or pregnancy in dogs at doses up to 26.8 mg/kg during critical stages of reproduction. In 3-generation and other fertility tests, there was no effect in laboratory species at doses up to 300 mg/kg, except diarrhoea and salivation in some pregnant dams.

Pyrantel

No teratogenicity, foetotoxicity or toxic effects on fertility, gestation, viability or lactation were found in rats when treated at up to 90 mg/kg/day from day 14 prior to mating. No adverse effects on foetuses occurred in rabbits dosed from day 7 – 17 of gestation with up to 90 mg/kg/day but an increase in the incidence of resorption was seen. Following treatment of pregnant bitches at various intervals after breeding to cover the major period of organogenesis, and males treated from 2 – 127 days prior to service, no teratogenic or other effects were observed. Extensive clinical studies on dogs including pregnant and lactating bitches have not revealed any evidence of toxic effects.

Febantel

Febantel and its metabolite oxfendazole are teratogenic in rats at doses of 50 – 100 mg/kg. In sheep febantel is teratogenic at doses of 45 mg/kg given on day 17 of pregnancy. Pregnant mares given 2x the recommended dose, from 40 days before conception to 148 days after, delivered normal foals. No evidence of teratogenicity has been found in dogs and a variety of other species.

Mutagenicity

Praziquantel

A number of published references were provided which indicated that praziquantel is not mutagenic.

Pyrantel

From the CVMP Summary Report for pyrantel embonate (EMA/CVMP MRL Summary Report), it was noted that pyrantel can not be considered as a mutagenic compound.

Febantel

Many benzimidazoles are known to have effects on mitosis, causing aneuploidy but mutagenicity data from febantel, fenbendazole and oxfendazole showed no clear evidence of genotoxicity. Although fenbendazole and other metabolites led to positive results in the mouse lymphoma forward mutation study, this occurred only in the presence of metabolic activation. Fenbendazole produced negative results in 2 *in vitro* and 2 *in vivo* mutagenicity tests.

Carcinogenicity

Praziquantel

Published oral toxicity studies in rats and hamsters were provided which indicated that no treatment-related effects in tumour incidence, latency and multiplicity occurred when praziquantel was given orally at doses of 0, 100 and 250 mg/kg body weight once weekly for 104 or 80 weeks.

Pyrantel: The long term feeding studies in rats (93 weeks) and dogs (2 years) using the tartrate concluded that the NOEL⁷ was 3 mg/kg/day for both species.

Febantel: No reports were provided.

Observations in Humans

Praziquantel

Praziquantel is used in humans for the treatment of schistosomiasis and cestode infections. There are no serious short-term or long-term side-effects associated with the use praziquantel.

Pharmacokinetic data in man showed that radiolabelled praziquantel is rapidly and almost completely metabolised. Following oral administration of C-praziquantel at doses of 14 - 46 mg/kg body weight the radioactivity was eliminated from serum with a half life of approximately 4 hours. The major metabolites in serum and urine were isolated and identified as predominantly hydroxylation derivatives of praziquantel, containing one or two hydroxy groups. Doses up to 50 mg/kg body weight in man were well tolerated with no clinically relevant changes. Therapeutic doses in man range from single oral dose of 5 mg/kg body weight to 60 mg/kg body weight, multiple oral doses of 3 x 25 mg/kg body weight for up to 3 days, to 50-60 mg/kg body weight for 15 days.

Pyrantel:

Pyrantel has been used in human medicines for over 20 years. It is normally administered as pamoate salt at oral doses of 10 to 20 mg/kg/ body weight /day for 1 to 3 days. The reported adverse effects in humans in case of overdose include gastro-intestinal disturbances, central nervous system effects and skin reactions. The values of serum asparatate aminotransferase and serum alanin aminotransferase were elevated in 1.8% of patients.

⁷ No observed effect level

Febantel:

Febantel is not used in human medicine, nor its metabolites fenbendazole and oxfendazole.

User Safety

The applicant has provided a satisfactory user risk assessment, identifying the users of the product and the potential routes of exposure for the operator. The risks have been identified and appropriate warnings are included in the SPC and product literature. These are:

- In case of accidental ingestion, seek medical advice and show the package leaflet to the physician.
- In the interests of good hygiene, persons administering the tablets directly to the dog, or by adding them to the dog's food, should wash their hands afterwards.
- Echinococcosis represents a hazard for humans. As echinococcosis is a notifiable disease to the World Organisation for Animal Health (OIE), specific guidelines on the treatment and follow-up, and on the safeguard of humans, need to be obtained from the relevant competent authority.

Ecotoxicity

The products are only intended for administration to dogs. A Phase I environmental risk assessment was satisfactorily carried out in accordance with VICH and CVMP guidelines. Data provided have demonstrated that exposure of these products to the environment will not be extensive and the assessment can end at Phase 1.

IV CLINICAL ASSESSMENT (EFFICACY)

IV.A Pre-Clinical Studies

Pharmacology

Pharmacodynamics

The applicant provided published data for praziquantel, pyrantel and febantel. In this fixed combination, pyrantel and febantel act against all relevant nematodes (ascarids, hookworms, and whipworms) in dogs. In particular, the activity spectrum covers *Toxocara canis*, *Toxascaris leonina*, *Uncinaria stenocephala*, *Ancylostoma caninum* and *Trichuris vulpis*. This combination shows synergistic activity in the case of hookworms and febantel is effective against *T. vulpis*.

The spectrum of activity of praziquantel covers all important cestode species in dogs, in particular *Taenia* spp., *Dipylidium caninum*, *Echinococcus granulosus* and *Echinococcus multilocularis*. Praziquantel acts against all adult and immature forms of these parasites.

Praziquantel is very rapidly absorbed through the parasite's surface and distributed throughout the parasite. Both *in vitro* and *in vivo* studies have shown that praziquantel causes severe damage to the parasite integument, resulting in the contraction and paralysis of the parasites. There is an almost instantaneous tetanic contraction of the parasite musculature and a rapid vacuolization of the syncytial tegument. This rapid contraction has been explained by changes in divalent cation fluxes, especially calcium.

Pyrantel acts as a cholinergic agonist. Its mode of action is to stimulate nicotinic cholinergic receptors of the parasite, induce spastic paralysis of the nematodes and thereby allow removal from the gastrointestinal system by peristalsis.

Within the mammalian system, febantel undergoes ring closure, forming fenbendazole and oxfendazole. It is these chemical entities which exert the anthelmintic effect by inhibition of tubulin polymerisation. Formation of microtubules is thereby prevented, resulting in disruption of structures vital to the normal functioning of the helminth. Glucose uptake in particular is affected, leading to depletion in cell ATP. The parasite dies upon exhaustion of its energy reserves, which occurs 2 – 3 days later.

Pharmacokinetics:

Perorally administered praziquantel is absorbed almost completely from the intestinal tract. After absorption, the drug is distributed to all organs. Praziquantel is metabolized into inactive forms in the liver and secreted in bile. It is excreted within 24 hours to more than 95% of the administered dosage. Only traces of non-metabolised praziquantel are excreted. Following administration of the product to dogs, peak plasma concentrations of praziquantel were achieved by approximately 2.5 hours.

The pamoate salt of pyrantel has low aqueous solubility, an attribute that reduces absorption from the gut and allows the drug to reach and be effective against parasites in the large intestine. Following absorption, pyrantel pamoate is quickly and almost completely metabolized into inactive metabolites that are excreted rapidly in the urine.

Febantel is absorbed relatively rapidly and metabolized to a number of metabolites including fenbendazole and oxfendazole, which have anthelmintic activity. Following administration of the product to dogs, peak plasma concentrations of fenbendazole and oxfendazole were achieved by approximately 7-9 hours.

Tolerance in the Target Species of Animals

The applicant submitted bibliographic references and conducted one tolerance study in puppies using Vetworm plus tablets for dogs. A suitable number of dogs of various sizes were divided into different groups and dosed accordingly. No indication of toxicity or intolerance was found. The study concluded that Vetworm plus tablets for dogs was well tolerated when administered at doses up to five times the recommended treatment dose or when administered at the recommended treatment dose for up to three days.

Resistance

The available information suggested that the active substances in Vetworm plus tablets for dogs are effective against target canine pathogens with limited reports of resistance. The product has the same composition, in terms of active substances as the reference product, and the proposed conditions of use are identical. Therefore, it is assumed that Vetworm plus tablets for dogs are unlikely to present any greater risk for resistance emergence than that posed by the reference product.

IV.B Clinical Studies

The product has the same composition, in terms of active substances as the reference product, and the proposed conditions of use are identical. The applicant has submitted an extensive bibliographic data to support the efficacy of the individual active substances when used individually or in combination. This is considered acceptable and no further data were required.

V OVERALL CONCLUSION AND BENEFIT– RISK ASSESSMENT

The data submitted in the dossier demonstrate that when the product is used in accordance with the Summary of Product Characteristics, the benefit/risk profile for the target species is favourable and the quality and safety of the product for humans and the environment is acceptable.

MODULE 4

POST-AUTHORISATION ASSESSMENTS

The SPC and package leaflet may be updated to include new information on the quality, safety and efficacy of the veterinary medicinal product. The current SPC is available on the Product Information Database of the Veterinary Medicines Directorate website.

www.gov.uk/check-animal-medicine-licensed

The post-authorisation assessment (PAA) contains information on significant changes which have been made after the original procedure which are important for the quality, safety or efficacy of the product.

The PAA for this product is available on the Product Information Database of the Veterinary Medicines Directorate website.

www.gov.uk/check-animal-medicine-licensed