A NOVEL NUTRITIONAL ESSENTIAL OIL DIETARY SUPPLEMENT IN CANINE GASTROINTESTINAL PARASITIC INFESTATION: A PILOT FIELD STUDY

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†Disclaimer: Candace M Hoke has entered a MND agreement with Young Living Essential Oils to develop a proprietary blend. The proprietary blend ingredients and its formulation have been donated by her to Aromatherapy Health Association, (AHA), a 501(c)(4) educational organization. She is a board member of AHA. The completed product was donated by AHA to Adkins Alaskan Huskies, Jean Wise and Terry O. Adkins, DVM only for the purpose of this study.

AW — All wormer product
CO — Syzygium aromaticum or Clove
EO — tested essential oils blend
EPG — egg per gram
FO — Foeniculum vulgare or Fennel
GC — gas chromatography
GC–MS — gas chromatography coupled with mass spectrometry
ITO — Tanacetum vulgare or Idaho Tansy
LO — Laurus nobilis or Bay Laurel
MO — Melaleuca alternafolia or Tea Tree
NO — Myristica fragrans or Nutmeg
OO — Origanum compactum CT carvacrol or Oregano CT carvacrol
OTC – over-the-counter product
VO- Vetiveria zizanoides or Vetiver

Abstract

A small pilot placebo-controlled field study of 22 canines was conducted to evaluate the efficacy of a plant-based, essential oil functional food blend (EO) against naturally occurring canine gastrointestinal parasitic infestations. The initial testing pool was 48 canines. Of those original 48 dogs, 22 were positive for roundworm, whipworm, hookworm or other parasites based on a modified Wisconsin Sugar Flotation Method fecal analysis showing at least 1 egg per gram (EPG) of feces analyzed. This method of counting is a modification of the Stoll technique.

The 22 positive dogs were divided into 2 groups for comparable results. The field study goal was to demonstrate relative safety and efficacy of incorporating essential oils in helminth infestation in a kennel setting. A blend of essential oils (EO) was presented to each canine as a novel nutritional dietary supplement. Tables are presented to illustrate dosage, duration of action of both products and results. Further field trials and case studies are indicated to duplicate results to further develop the evidence base for this proposed therapy (EO).

Introduction

Helminth infections are a major concern of breeders and owners of canine performance athletes. Naturally occurring infestations affect weight gain, lead to nutritional deficiencies, anemia and reduced growth rates. Infestation also has the potential to alter performance capacity and even lead to death. Additionally, there is a potential for zoonosis. This study observed EPG of *Toxocara canis* (roundworm), *Trichuris vulpis* (whipworm), *Ancyllostoma caninum* (hookworm) and *Unicaria stenocephala* (northern canine hookworm).

Current chemotherapeutic treatment of gastrointestinal parasitic infestation consists of synthetic anthelmintics such as levamisole, morantel, fenbendazole and ivermectin. Most treatments are more parasitostatic than parasitocidal (5). The emergence of anthelmintic resistance may decrease the future efficacy of such synthetic programs (1–3). Thus, it seems clear that the "Global Worming approach that has taken hold over the past 40–50 years must change, and...must develop a new vision for parasite control and sustainability of production" (4). Kaplan further states some synthetic drugs are dose dependent and interval dependent on the parasitic species targeted. This field study also looked into this matter.

IUPAC (International Union of Pure and Applied Chemistry) has chemical nomenclature rules for naming compounds (6). Based on these rules, one is able to identify constituents of both organic and inorganic constituents of a substance. Some of these agents follow:

Oxantel Embonate,3-[(E)-2-(1-Methyl-5,6-dihydro-4H-pyrimidin-2-yl)ethenyl]phenol (IUPAC), chemical formula C13H16N2O, is currently considered safe for use in humans and animals for whipworm infestation. It is commonly known as Oxantel. It is available without prescription for non-food animal usage when provided by a suitable qualified person. It has been shown to affect algae, earthworms and honeybees due to bio-concentration factors (7).

Pyrantel Embonate (European Pharmacopoeia) or Pyrantel pamoate (US Pharmacopoeia), 4-[(3-Carboxy-2-hydroxynaphthalen-1-yl) methyl]-3-hydroxynaphthalene-2-carboxylic acid; 1-methyl-2-[(E)-2-thiophen-2-ylethenyl]-5,6-dihydro-4H-pyrimidine (IUPAC), chemical formula C34H30N2O6S, is used in the deworming treatment of *Ancyclostoma or Uicanaria spp.* and roundworm (*Ascaris lumbricoides*) in domesticated species including dogs, cats, cattle, sheep and horses. It is listed in the World Health Organization's List of Essential Medicines as one of the most important medications needed in a basic health care systems (8). It works similarly to levamisole and pyrimidine morantel to cause spastic muscle paralysis in parasites. It is not unusual to find it paired with praziquantel for tapeworms. It is commonly found in monthly chewable heartworm (*Dirofilaria immitis*) prevention treatments. In humans, the drug is rated a Pregnancy category C drug based on possible fetal injury (9).

Praziquantel is also listed in the World Health Organization's List of Essential Medicines (8). It is an anthelmintic used in both humans and animals for infestation of tapeworms and flukes. It is FDA approved for schistosomes and liver fluke (*Echinococcus granulosus*). The drug is used to treat dogs and cats infected with *Dipylidium caninum* or *Taenia solium* (pork tapeworm) as well as Hydatid disease caused by larval stages of *Echinococcus* (tapeworm species found in humans and dogs). It also is used in the treatment of *Toxocara cati* (ascarids or roundworms in cats), *Toxascaris leonina* (ascarids found in dogs and cats), and lung and intestinal flukes found in humans, dogs and cats.

Praziquantel side effects are rare, but may occur as parasites release their contents due to the host's immune reaction. Heavy parasitic involvement often results in stronger and more frequent reactions. The side effects include, but are not limited to: central nervous system responses of dizziness, drowsiness, fatigue, headache, malaise, neck stiffness, photophobia, somnolence and a worsening of pre-existing neurological issues such as seizures. Corticosteroid treatment is recommended to reduce symptoms. Recipients may have abdominal pain or cramping. Vomiting, sweating or bloody diarrhea may occur. Colic may be severe. Cardiac arrhythmia, hypotension, low back pain and myalgia are also listed as sensitivity reactions. Further side effects may be transient increased values of AST and ALT (liver enzymes) though no permanent liver damage has been shown to date. Eosinophilia in white cell counts, rash, pruritis and urticara have been shown. Side effects from this synthetic combination are reported to be rare at recommended dosage of 1 tablet up to 22 pounds (2.3 mg/lb) of canine body weight. Fasting is not needed prior to administration.

Treatment repetition is helminth species dependent (10):

1. Hydatid tapeworm infestation: dogs should not be fed raw meat species of any sorts. Such dogs should be treated every 6 weeks if housed in areas of known infestation.
2. Dogs with other forms of tapeworms should be treated every 3 months.
3. Roundworm and hookworm infestation: beginning at age 2 weeks with repetitions at 4, 8 and 12 weeks of age. It is recommended to administer from then on every 3 months of life.
4. Whipworm infestation is treated every 6–8 weeks beginning at 3 months of age.

Based on these instructions, many researchers are concerned repetitive treatment may result in increased parasitic resistance to synthetic products over time (1, 3, 11). These instructions contribute to Kaplan's findings.

Herbal medicine has a long history as prehistoric people "looked to wild and domestic animals for sources of herbal remedies. Both folklore and living examples provide accounts of how medicinal plants were obtained by observing the behavior of animals. Animals also learn about the details of self-medication by watching each other" (12). Through the exploration of traditional literature one may presume to identify plant-based nutrients with anti-parasitic chemical constituents. This effort carries on in modern times through the subject of ethnobotany.

Many natural plant-based products are being "rediscovered." Phytomedicine has been used for centuries (13–16). Traditional healers have successfully accessed plant-based nutritional supplementation for parasitic infestations (17).

There is a widespread resurgence in natural products in the place of synthetic drugs. Public perception that synthetic chemicals are the only health and disease control mechanisms is being replaced with an increasing interest in phytotherapy (13). Many current day commercial medicines and OTC products were originally plant-based.

There is a need for scientific validation of claims made for the efficacy of plant-based nutrients when used in anthelmintic infestation control (14–16). There are approximately 200,000 plant species which haven been studied biochemically. An even smaller amount have been studied for their anthelmintic and anti-protozoal activity (14, 18, 19). Controlled and field studies are needed on plants lacking the clinical data to establish anthelmintic properties. The lack of clinical data is a major obstacle to the integration of plant-based essential oils into conventional animal usage (3, 14, 15). Some active compounds in plant-based essential oils are known to have anthelmintic, anti-fungal and anti-protozoal properties. There is much discussion on the properties of thymol, carvacrol, limonene, p-cymene, 1,8 cineol, eugenol, B-caryophyllene, and terpinen-4-ol. These constituents have been shown to exhibit beneficial bioactivity in vitro and/or in vivo (5, 14, 18, 20–26, 28–34).

Based on prior published studies, the essential oils selected for this study are the volatile oils from the plants *Origanum compactum* CT carvacrol, or Oregano CT carvacrol (OO), *Foeniculum vulgare* or Fennel (FO), *Syzygium aromaticum* or Clove (CO), *Melaleuca alternafolia* or Tea Tree (MO), *Myristica fragrans* or Nutmeg (NO), *Laurus nobilis* or Bay Laurel (LO), *Tanacetum vulgare* or Idaho Tansy (ITO), and *Vetiveria zizanoides* or Vetiver (VO). These essential oils with specific major chemical constituents were blended together to form a new novel nutritional dietary supplementation described as EO.

Few plants will produce various chemotypes. A chemotype is a chemically different entity in a plant with different chemical compositions. Those plants which do produce various chemotypes must be grown, cultivated and/or harvested at specific locations, elevations or seasons to extract the desired chemical constituents. There is a concern about the efficacy of essential oils with little or unknown sourcing and major chemical constituents. Quality and purity of essential oils are essential to present similar constituents on a routine basis

(15, 31, 37). At present, there is no set standards except the reference standard.

It is to be expected that main ingredient percentages of essential oils may vary year to year. The variation may occur based on factors of climatic environmental changes and distillation processes (15, 36). Determination of which essential oils to utilize must be considered based upon gas chromatography (GC) and gas chromatography coupled with mass spectrometry (GC-MS) instrumental analysis among other things. Analysis is necessary to provide expected quality and thus expected efficacy of essential oils in repeated field trials.

There is some concern plant-based compounds may negatively affect the gastrointestinal tract due to inhibition of food intake affecting performance (16). The essential oils chosen have known anti-ulcer activity, gastro-protective and hepato-protection mechanisms (20, 38, 39). In this study, there were no obvious outward signs of such possible side effects in the majority of EO supplemented canines.

Some parasites are soil-transmitted. It was not unexpected to find several canines in both the control and EO group exhibiting continued helminth infestation. Furthermore, the soil at the campus where canines are housed has been utilized over 30 years. Thus, there is an increased propensity of re-exposure and/or continued infestation.

Materials and Methods

For the purpose of this field study, microscopic examinations were performed prior to dietary supplementation to determine egg per gram (EPG) of feces. Additional testing was performed after treating the control group and EO group.

The control group of 11 canines were administered AW (a) for dogs and puppies. AW contains 542 Oxantel Embonate, 143 mg Pyrantel Embonate, 50 mg Praziquantel (10). This product is suggested for "total protection from all 11 intestinal worms (including roundworm, whipworm, hookworm, tapeworm and hydatid tapeworm." More specifically, the product is recommended for *Toxocara canis, Toxascaris leonina, Ancylostoma caninum, Ancylostoma braziliense, Uncinaria stenocephala, Trichuris vulpis, Dipylidium caninum, Taenia ovis, Taenia hydatigena, Taenia pisiformis* and *Echinococcus granulosis.*

The 11 canines chosen for the EO group were known to historically present positive EPG for helminth infestation. Dog ID 20 had a 2-year-old full brother which was deceased due to historic whipworm presentation in the gastrointestinal tract resulting in blockage. There appears to be a familial consistency in the inability to provide an immunity to whipworm. There is also a familial predisposition to have seizures in some of the lineages. These lineages were also included in the EO group.

A proprietary blend, EO, was developed by combining 8 oz. fractionated coconut oil with an essential oil mix of 57% OO, 29% FO, 4% LO, 3% VO, 2% MO, 2% NO, 2% CO, and 1% ITO. The essential oil mix was a total of 437 drops. Only 1 of the ingredients, ITO, in mix was not GRAS (generally regarded as safe, according to the FDA). EO was placed into

Table 1. Control group EPG results prior to AW therapy and Day 11 retesting results

Dog ID	Sex*	Hookworm or other	Round worm	Whip worm	# tab given	# days given	Day 11 Retest P/N**
1	F	1			2	1	N
2	F		2		2	1	N
3	F		33		2	1	N
4	F		45	13	2.5	1	N
5	M		94		2.5	1	N
6	F			1	2.5	1	N
7	F			1	2	1	N
8	F			2	2.5	1	N
9	F			34	2	1	N
10	F			133	2	1	N
11	F		25	279	2	1	N

* F is intact Female. M is intact Male. ** N stands for EPG negative test result.

Table 2. EO group EPG results prior to therapy with specific number of blend drops fed daily for a specific number of days and retesting results on day 10

Dog ID	Sex*	Hookworm or other	Round worm	Whip worm	# drops fed	# days given	Day 10 Retest P/N**
12	F	1			2	4	N
13	F		1		2	4	N
14	F	3	11	4	2	4	N
15	M		500		4	7	N
16	N			1	2	4	N
17	M		1	4	2	4	N
18	M			5	2	4	N
19	F			9	2	4	N
20	F		3	11	2	4	2
21	F			120	4	7	2
22	F			151	4	7	2

* F is intact Female. M is intact Male. N is neutered male. ** N stands for negative test result.

multiple 15 ml amber bottles with neck size 18–415. A black euro-cap contained an orifice reducer inside the cap. One 15 ml bottle was distributed to the kennel. EO was supplemented by top dressing daily rations at a rate of 2 to 7 drops for a duration of 4 to 7 days. The pharmaceutical standard drop, or 0.05 milliliter (ml), was used to determine 1 drop as dispensed by the orifice reducer. Determination to increase dosage was based on slide presentation of infestation of EPG. The purpose of the varied amount given was to determine minimum effective dosage.

EO was applied to canine rations. The daily nutritional rations of these performance athletes remained the same in both control and essential oil supplementation dogs. Every morning, each canine was given nutritional supplementation of raw meat. The raw meat source varied. Sources included whole chicken, ground or whole salmon, wild elk, beaver and heart, liver or fat from beef or pork. Dogs received a commercial dry food every evening. Once every 3 weeks, the kennel was given a cooked meal of rice and other vegetables. Based on raw supplementation, these canine athletes may often be exposed to naturally occurring parasitic infestation.

Table 3. Selected EO canines given additional therapy based on Day 10 positive EPG testing. Retesting on Day 17 indicated only 1 dog indicated parasitic presence.

Dog ID	# Drops Given	# Days Given	Day 17 Retest P/N*
17	2	4	N
20	4	4	N
21	12	4	2 whipworm
22	7	4	N

* N is a negative EPG result.

Results and Discussion

The Control group were examined for EPG results prior to receiving AW (**Table 1**, *see page 50*). Each dog was given 1 dose consisting of 2 to 2.5 tablets. On Day 11, the Control group was retested. None of the dogs indicated parasitic infestation based on the Modified Wisconsin Sugar Flotation Method. The EO group was examined for EPG results using the same method (**Table 2**). The number of drops and number of days to be supplemented on the food rations depended upon amount of EPG. A high EPG was used to determine number of drops and days of supplementation. On Day 10, the EO group was retested. Dog ID 20, 21 and 22 continued to exhibit positive parasitic infestation. On day 11, only 4 selected canines in the EO group were again given supplementation of the novel nutritional blend (**Table 3**). Selection for 3 dogs was based on positive tests results shown on day 10. An additional selection for repeat dosage, Dog ID 17, was selected as housed with positive Dog ID 20.

EO dosages remained the same or were increased based on severity of chronic infestation history. Dosage for an additional 4 days was as follows:

Dog ID 17 and 22 received the original number of drops, 2 and 7, respectively.

Dog ID 20 received twice the original amount of 2 drops as it was positive for whip worm on Day 10.

Dog ID 21 received 12 drops daily based on its chronic history of

Table 4. Control group and essential oils group retesting results on day 60.

Dog ID	AW Group P/N*	Dog ID	EO Group P/N*
1	N	12	N
2	N	13	2 whipworm
3	1 hookworm 14	N	N
4	N	15	2 whipworm 1 roundworm
5	2 whipworm 16	N	N
6	N	17	N
7	2 whipworm 18	N	N
8	1 roundworm 19	2 whipworm	N
9	N	20	N
10	N	21	N
11	N	22	N

* N is a negative EPG result.

food allergy with gastrointestinal impaction and familial history. These selected canines were retested on Day 17. Only Dog ID 21 continued to show positive EPG for whipworm. Dog ID 22 was reported to exhibit a positive change in coat.

Further testing on EPG was performed on Day 60 post treatment with both AW and EO (**Table 4**).

The AW control group indicated positive EPG as follows:
Dog ID 3 positive for 1 hookworm EPG
Dog ID 5 and 7 positive for 2 whipworm EPG each, and
Dog ID 8 positive for 1 roundworm EPG.
The essential oil indicated positive EPG as follows:
Dog ID 13 and 19 positive for 2 whipworm EPG each, and
Dog ID 15 positive for 2 whipworm EPG and 1 roundworm EPG.

It was further noted that Dog IDs 13, 15 and 19 were not included in the EO reapplication and did retest positive for whipworm eggs on Day 60. Dog ID 15 also retested positive for roundworm eggs.

Another round of therapy was administered on Day 61 for all EO canines. All canines were given 5 drops of the nutritional blend for 5 days. On Day 10 after therapy began, all dogs retest results were negative for helminth eggs.

Only those canines in the AW control group which had positive retest results on Day 60 received an additional round of therapy. Dog ID 3 and 7 received 2 tablets for 1 day. Dog 5 and 8 received 2.5 tablets for 1 day. Dosage was determined by manufacturer's suggestions. On Day 10 after therapy given, all dogs retest results were negative for helminth eggs.

This pilot study indicates EO holds potential as part of an integrated management plan for the control of canine gastrointestinal helminth infestation comparable to the use of synthetic drugs.

EO administered daily at a dose of 2 to 7 drops yielded a reduction in total EPG counts. Results have been shown to be dose-dependent based on parasitic load and subjected to bioavailability.

An unexpected finding was stoppage of seizures in genetically predisposed dogs. One canine was being considered for euthanasia prior to trial enrollment. Great improvement in seizure status has now removed the decision to euthanize. More research needs to be completed to determine causation of this side effect of EO supplementation. More research is needed to determine dosage, supplement duration, supplementation intervals, etc. before plant-based products will become widely used and accepted as an alternative to synthetic anthelmintic drugs. A study of this size cannot comment regarding efficacy. Additional in vivo field studies are needed to determine the efficacy of EO and/or other essential oils as an efficient feed additive at an anthelmintic dosage. Continued studies and field trials will further assist in validating the efficacy of plant-based anthelmintic usage.

Product Names

a. Aristopet All Wormer for Dogs and Pupplies, Aristopet, 874 Kingsford Smith Drv., Eagle Farm, Queensland, Australia, 4009. *www.aristopet.com.au* was purchased for usage by Adkins Alaskan Huskies on a routine basis.

Essential oils of *Origanum compactum* CT carvacrol, *Foeniculum vulgare*, *Syzygium aromaticum*, *Melaleuca alternafolia*, *Myristica fragrans*, *Laurus nobilis*, *Tanacetum vulgare*, *Vetiveria zizanoides* and fractionated coconut oil were purchased by Candace M Hoke, distributor, from Young Living Essential Oils, 3125 W Executive Parkway, Lehi, UT 84043. www.youngliving.com.

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