**Efficacy of Panacur® AquaSol for Treatment of Pigs Infected with Whipworms (Trichuris suis)**

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**SUMMARY**

- **PANACUR® AquaSol** is the novel swine anthelmintic that provides potent efficacy in a convenient non-clogging formulation for administration via drinking water.

- A research study evaluated the efficacy of PANACUR AquaSol against natural *Trichuris suis* (whipworm) infections in pigs.

- Three days of treatment with PANACUR AquaSol reduced adult and pre-adult whipworm burdens by 93.5% compared to controls.

- Fecal counts of whipworm eggs were also dramatically reduced by PANACUR AquaSol treatment.

- The presence of PANACUR AquaSol in the drinking water had no impact on water consumption rates (highly palatable).

- PANACUR AquaSol offers a new option for *T. suis* control that is convenient and cost-effective.

**Introduction**

Internal parasites continue to pose a perpetual threat to profitable swine production. However, modern rearing practices have tended to limit concerns to 3 types of helminths: whipworms (*Trichuris suis*), large roundworms (*Ascaris suum*), and nodular worms (*Oesophagostomum* spp.).

Whipworms can be isolated on many swine farms and often impose significant economic impacts by impeding weight gains and feed efficiency. A common signal of possible whipworm infection includes several poor-performing animals within a group of pigs that appear to be growing normally. However, heavy infections can cause hemorrhagic diarrhea and emaciation, and may be confused clinically with swine dysentery or proliferative enteritis.

Adult whipworms (females 8 cm long, males 3-4 cm) burrow into the cecal and intestinal wall, disrupting nutrient absorption and allowing secondary bacterial and viral infections to infect the host. Female worms generate eggs that are passed in the feces and become infective in about 3 weeks. Upon ingestion by another pig, infective eggs hatch into larvae, travel to the cecum, and grow to adults that perpetuate the cycle. Notably, whipworm eggs are very hardy and can last up to 10 years in the environment, so shedding of *T. suis* eggs in the manure can result in long-term contamination of production facilities.

Unfortunately, not all anthelmintic agents offer good efficacy against *T. suis*, so careful evaluation of product activity spectrum (in addition to convenience) is critical when developing and implementing parasite control programs.
PANACUR® AquaSol Oral Suspension

PANACUR AquaSol is a novel anthelmintic for swine that provides potent efficacy against gastrointestinal nematodes via a convenient oral-suspension dosage form for administration in the drinking water. Fenbendazole (FBZ), the active ingredient of PANACUR AquaSol (200 mg/mL), is the reliable benzimidazole anthelmintic that has been effectively used for many years in a wide range of animal species (swine, cattle, sheep, goats, dogs, etc.). Compared to earlier water-administered formulations, PANACUR AquaSol employs an innovative wet-milling process that produces very fine and homogeneously distributed FBZ particles (20% w/v) that easily mix in water to stay suspended for 24 hours without agitation. This new formulation provides a higher bioavailability of drug to pigs while eliminating the problem of clogged pipes and filters that have often discouraged swine producers from using dewormers in the drinking water.

When administered in drinking water at the recommended daily dose of 2.5 mg FBZ/kg body weight (BW) for 2 days, PANACUR AquaSol is approved for the treatment and control of gastrointestinal nematodes in pigs infected with *Ascaris suum* (large roundworms; adult, intestinal, and migrating larval stages) as well as *Oesophagostomum* spp (nodular worms; adult stages). However, as a result of recent research by MSD Animal Health and approval by the European Commission, PANACUR AquaSol is now also approved for treatment and control of *Trichuris suis* (whipworms) when administered at the same dose (2.5 mg FBZ/kg BW/d) but for an additional day (3 days total).

A dose-confirmation efficacy study was conducted as part of the regulatory approval process that added *Trichuris suis* to the label indications for PANACUR AquaSol. A summary of that study follows, with results clearly demonstrating the excellent efficacy of PANACUR AquaSol against natural whipworm infections.

**Experiment Design**

The single-site, controlled, anthelmintic dose-confirmation study was conducted in Germany at the University of Leipzig, with the objective of evaluating PANACUR AquaSol efficacy against naturally acquired *Trichuris suis* infection when administered orally to pigs over 3 consecutive days via drinking water. The research study involved 54 Spotted Bentheimer pigs (average 36.6 kg BW, 3-5 months of age) from a commercial farm that were positive for *T. suis* eggs in fecal samples, or expected to begin egg excretion based on age-class and proximity to positive animals.

**FIGURE 1** Study design.
A summary of the experiment design appears in Figure 1. Study animals were transferred to the study site 7 days before trial initiation to allow acclimation to the study facilities. On study day -1, animals were assigned to 2 treatment groups according to a computer-generated randomized allocation plan based on descending rank of fecal egg counts. Because of housing space constraints, the study was conducted in 2 consecutive identical repetitions consisting of 22 pigs in the first study phase (11/group) and 32 in the second phase (16/group). Treatment groups were housed in 2 neighboring rooms with each containing 3 pens stocked with 3 to 6 pigs. Pigs in both rooms experienced the same housing conditions and environment, and received the same type of non-medicated feed (ad libitum). On the day of study initiation (day 0), the following treatments were applied:

- Control (untreated), n=27;
- PANACUR AquaSol via drinking water (2.5 mg FBZ/kg BW/d) for 3 days, n=27.

On treatment days 1, 2, and 3, study animals in the PANACUR AquaSol group received medication via the drinking water for ad libitum uptake over approximately 6 to 7 hours (1 drinking nipple/pen). The dose of PANACUR AquaSol was calculated based on group body weight obtained on day -1. A metered watering system allowed careful monitoring of water consumption, and samples of medicated drinking water were assayed to ensure the proper dose of FBZ was delivered to pigs.

Individual fecal samples were collected on study days 3 to 8 for determination of *T. suis* egg counts. Animals were observed daily for adverse events and general health until the day before euthanasia on day 9 when pigs were necropsied and the large intestines removed to enumerate adult and pre-adult *T. suis* in the lumen of the large intestine and those remaining in the mucosa. Personnel conducting fecal egg counts and worm enumerations were not aware of treatment group assignments.

Collected data were statistically analyzed using appropriate standard methods, with significance between treatments declared when *P* ≤ 0.05.

### Results

Worm count results (Table 1 and Figure 2) reveal that 3 days of PANACUR AquaSol treatment effectively moderated *T. suis* worm burdens. Geometric mean worm counts were significantly reduced 93.5% by PANACUR AquaSol compared to controls (*P* = 0.0008). The percentage of pigs harboring 1 or more whipworms fell from 89% in the control group to 59% in the group that received PANACUR AquaSol. Three days of treatment with PANACUR AquaSol clearly purged pigs of adult and pre-adult *T. suis*.

Mean fecal egg counts were comparable between treatment groups at 3 to 4 days before study initiation: 642 eggs per gram (epg) for controls, and 505 epg for the PANACUR AquaSol group. However, as summarized in Figure 3, a dramatic reduction of fecal egg counts.

### Table 1  Results of *Trichurus suis* worm counts.

<table>
<thead>
<tr>
<th>STUDY GROUP</th>
<th>n</th>
<th>PIGS WITH WORMS</th>
<th>WORM COUNTS</th>
<th>EFFICACY (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>MIN</td>
<td>MEDIAN</td>
</tr>
<tr>
<td>Control</td>
<td>27</td>
<td>24 (89%)</td>
<td>0</td>
<td>172</td>
</tr>
<tr>
<td>PANACUR AquaSol</td>
<td>27</td>
<td>16 (59%)</td>
<td>0</td>
<td>2</td>
</tr>
</tbody>
</table>

<sup>a</sup>*P* = 0.0008
counts was observed in animals treated with PANACUR AquaSol starting at day 4 (1 day after treatment), and egg counts approached 0 epg by day 5 (2 days after treatment). In contrast, non-medicated control pigs experienced an ongoing increase in *T. suis* egg shedding during the course of the study. These results demonstrate the excellent ability of PANACUR AquaSol to reduce whipworm egg excretion and contamination of the production environment.

No differences were detected in water consumption rates between treatment groups, indicating that drinking water containing PANACUR AquaSol was highly palatable. Assayed concentrations of FBZ in samples of medicated drinking water were within a range of -2.0% to +4.6% of the target FBZ concentration, a narrow range considered remarkably good.

No adverse events related to treatment were observed, suggesting that PANACUR AquaSol was very well tolerated by all study animals.

Conclusions

Outcomes observed in this dose-confirmation study document the potent efficacy of PANACUR AquaSol for the treatment of naturally occurring whipworm infections in swine. The administration of PANACUR AquaSol (20% w/v suspension of FBZ) at a dose of 2.5 mg FBZ/kg BW over 3 consecutive days in the drinking water significantly reduced worm counts by 93.5% compared to non-medicated controls and dramatically reduced counts of parasite eggs shed in the feces. PANACUR AquaSol was very well tolerated by the study animals and medicated water was highly palatable.

The novel PANACUR AquaSol formulation provides swine producers a fresh option for control of *T. suis* that is both convenient and cost-effective, thus helping pigs maintain optimal growth performance unhindered by profit-suppressing parasites like whipworms, large roundworms, and nodular worms.

References