The Inactivity of Fresh Pineapple Juice as an Anthelmintic in Vivo[1]

By FEDERICO HERNÁNDEZ MORALES and CONRADO F. ASENJO

From the Departments of Clinical Medicine and Chemistry, School of Tropical Medicine, San Juan, Puerto Rico

IT HAS BEEN experimentally demonstrated by Caldwell and Caldwell,[2] Robbins,[3] and lately by Faust and Thomen,[4] that the latexes of some species of fig trees are very effective anthelmintics *in vitro* as well as *in vivo*. The anthelmintic activity of these latexes is due to the proteolytic enzyme, ficin.

In 1939 Berger and Asenjo[5] and later, Asenjo,[6] reported that fresh pineapple juice has the power to digest live intestinal parasites *in vitro* in the same fashion as the latexes do. The digestive action, exhibited by the juice, was shown to be due to bromelin, a proteolytic enzyme similar in many respects to the ficin present in the latexes.

In 1940 Kuitunen-Ekbaum[7] reported for the first time trials *in vivo* with fresh pineapple juice. He experimented on a puppy and a kitten, both infected with *Toxacara*. After giving them fresh pineapple juice for several days, he found at autopsy a large number of *Toxacara* distributed throughout the intestinal tract. He also fed fresh juice to a child infected with pinworms but, after three weeks of treatment, the infection still persisted.

As these were the only experiments *in vivo* so far reported, it seemed to us that further work had to be done before reaching a definite conclusion as to the anthelmintic value *in vivo* of fresh pineapple juice. In the present communication we report several experiments performed on cats, dogs, and human beings. Also, observations were made on the inactivation *in vitro* of pineapple juice by human gastric juice.

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1. Received for publication December 16, 1941.
2. F. C. and E. L. Caldwell, *Am.J.Trop.Med.*, IX (1929), 471–82.
3. B. H. Robbins, *J.Biol.Chem.*, LXXXVII (1930), 251–56.
4. E. C. Faust and L. F. Thomen, *Proc.Soc.Exper.Biol. & Med.*, XLVII (1941), 485–87.
5. J. Berger and C. F. Asenjo, *Science*, XC (1939), 299–300.
6. C. F. Asenjo, *J.Am.Pharm.A.,Sc.Ed.*, XXIX (1940), 8–10.
7. E. Kuitunen-Ekbaum, *Science*, XCI (1940), 240–41.

EXPERIMENTAL

Inhibition of pineapple juice by gastric juice. Fresh pineapple juice was mixed with different volumes of gastric juice (see Table) and *Ascaris* of hogs were incubated in each of the different mixtures. The period of incubation was twenty-four hours and the temperature 37° C.

Inhibition of the Digestive Activity of Pineapple Juice by Gastric Juice

Percent Pineapple Juice	*pH of Mixture*	*Digestive Action Observed after Twenty-four Hours Incubation*
100	3.40	Totally digested
80	3.29	Totally digested
70	3.17	Digested
40	2.47	No digestion
30	2.18	No digestion

Action of the juice on cats infected with Toxacara.[8] Two cats, one weighing 2.3 kilograms and the other 3.0 kilograms and both showing *Toxacara* eggs in their feces, received through the stomach tube 50 cc. of fresh pineapple juice per kilogram of body weight on an empty stomach. Both animals vomited about an hour after receiving the juice. In the vomit of the first, three normal live *Toxacara* were ejected; the second cat ejected two.

A third cat, weighing 2.9 kilograms and also infected with *Toxacara*, was given 50 cc. of boiled pineapple juice per kilogram of body weight. This cat, as had the other two, vomited within an hour, ejecting three normal live *Toxacara*. No *Toxacara* were passed in the feces. At autopsy, twenty-four hours later, no *Toxacara* were found in the intestinal tract of these cats.

Action of the juice on a dog infected with Toxacara. One dog weighing 3.4 kilograms and infected with *Toxacara canis* received by means of stomach tube 72 cc. of fresh pineapple juice per kilogram of body weight. The animal was sacrificed four hours later and, at autopsy, six normal live *Toxacara* were found in the intestinal tract.

Positive controls. Action of 0.1 percent and 10 percent Merck ficin in dogs infected with Toxacara. By the procedure already described, one dog weighing 3.1 kilograms received 67 cc. of 0.1 percent ficin solution per kilogram of body weight. A second dog, weighing 4.5 kilograms, received 39 cc. of 10 percent ficin solution per kilogram of body weight. Both animals were sacrificed four hours after receiving the ficin. At autopsy four normal live *Toxacara* were found in the dog receiving the 0.1 percent ficin solution. On the other hand, in the dog that received the 10 percent solution, three dead and well-digested *Toxacara* were found near the rectum. No other *Toxacara* were present throughout the rest of the intestinal tract of this dog. In both of these animals a large number of live hookworms were present in the upper part of the small intestine.

Action of the juice on patients infected with Taenia saginata. Three patients harboring *Taenia saginata* were selected. In order to avoid the inhibiting action of the gastric juice, a duodenal tube was passed into the stomach and allowed to enter the duodenum. Fifteen hundred cc. of fresh pineapple juice were injected through the tube, 500 cc. every thirty minutes. In none of the patients was the head of the taenia passed. No proteolytic activity was observed on the segments expelled. The three patients were then treated with male fern, and in the three of them the taenia head was passed.

8. This part of the work was done by the junior author while at the Department of Pharmacology of the University of Chicago

SUMMARY

1. Gastric juice was found to exert an inhibitory action on the activity of pineapple juice at a pH of 3.17 or below.

2. Fresh pineapple juice was found to be of no value in the treatment of *Toxacara* in cats and dogs, and of *Taenia saginata* in man.