

## Short Communication

# Effectiveness of Dried *Carica papaya* Seeds Against Human Intestinal Parasitosis: A Pilot Study

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**ABSTRACT** The tropical fruit *Carica papaya* and its seeds have proven antihelminthic and anti-amoebic activities. To determine the effectiveness of air-dried *C. papaya* seeds on human intestinal parasitosis, 60 asymptomatic Nigerian children with stool microscopic evidence of intestinal parasites received immediate doses (20 mL) of either an elixir composed with air-dried *C. papaya* seeds and honey (CPH) or honey alone (placebo) in two randomized treatment groups. Repeat stool microscopic examinations were conducted 7 days postintervention for intestinal parasites. Significantly more subjects given CPH elixir than those given honey had their stools cleared of parasites [23 of 30 (76.7%) vs. five of 30 (16.7%);  $z = 4.40$ ,  $P = .0000109$ ]. There were no harmful effects. The stool clearance rate for the various types of parasites encountered was between 71.4% and 100% following CPH elixir treatment compared with 0–15.4% with honey. Thus, air-dried *C. papaya* seeds are efficacious in treating human intestinal parasites and without significant side effects. Their consumption offers a cheap, natural, harmless, readily available monotherapy and preventive strategy against intestinal parasitosis, especially in tropical communities. Further and large-scale intervention studies to compare *C. papaya* with standard antiparasitic preparation are desirable.

**KEY WORDS:** • amoebiasis • ascariasis • giardiasis • helminths • honey • ova • parasites • pawpaw • stool

## INTRODUCTION

**H**UMAN INTESTINAL PARASITOSIS constitutes a significant global health problem with enormous financial implications.<sup>1</sup> Unfortunately, for reasons mainly attributable to poor hygiene,<sup>2</sup> the burden is more in the tropics and subtropics where, particularly among children,<sup>3,4</sup> parasites cause noteworthy morbidity such as anemia, diarrhea and dysentery, malnutrition, apathy, and underdevelopment as well as severe acute abdominal and surgical conditions.<sup>2</sup>

As most patients particularly from the tropics and particularly from Africa are from low socioeconomic groups who can ill-afford imported and expensive medicines,<sup>5</sup> the need for affordable and readily available local alternatives cannot be overemphasized. *Carica papaya*, a fruit plant also called papaya, pawpaw, pawpaw, mamao, or tree melon, is

found in virtually every tropical and subtropical country.<sup>6</sup> *C. papaya* contains proven antihelminthic<sup>7</sup> chemical agents such as benzyl isothiocyanate and papain<sup>8,9</sup> and has other antiparasitic properties.<sup>10,11</sup> In folk medicine, *C. papaya* seeds have been used to treat helminthiasis.<sup>12</sup> Thus, we evaluated the antiparasitic effects of dried *C. papaya* seeds. It is hoped that the information obtained will provide guidance for further research that may ultimately assist in the formulation of necessary preventive and treatment strategies against intestinal parasitosis, particularly in tropical communities.

## MATERIALS AND METHODS

Between November 1, 2003 and January 30, 2004, in the Children's Welfare Clinic of the Wesley Guild Hospital, Ilesa, Nigeria, consecutive children 2–6 years old with normal weight and height for age and no health complaints were screened with light microscopic examination of wet preparations of freshly passed stools to confirm the presence of intestinal parasites, their cysts, trophozoites, larvae, or ova.

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Following informed parental consents, a total of 60 children with seven different species of intestinal parasites were recruited into this study.

*C. papaya* seeds and natural honey were harvested from an apiary of one of the investigators (O.A.O). The seeds were air-dried and then machine-blended. An elixir of the air-dried *C. papaya* seeds and honey (CPH) was prepared by mixing 500 g of the blend with honey to make a total preparation volume of 1,000 mL, i.e., 0.2 g of dried *C. papaya* seeds/mL. Each subject received immediately received an oral dose of either 20 mL (equivalent to 4 g of dried, blended *C. papaya* seeds) of the CPH elixir or honey alone in two randomized treatment groups. Thus, honey served not only as the means of administration of the *C. papaya* seeds but also as the placebo/control. All the subjects were advised to abstain from honey and *C. papaya* during the study period. The children then had repeat stool microscopic examination 7 days later conducted by the same laboratory scientist (L.A.A), who was blinded to each subject's treatment. Histories of gastrointestinal symptoms and other possible side effects were further documented. Data were analyzed using with the computer program for epidemiologists (PEPI) version 3.01.<sup>13</sup> Means and standard deviations were compared using Student's *t* test and proportions by the *z*-scores at 95% confidence interval (CI). Values of *P* < .05 were considered statistically significant.

**RESULTS**

Sixty children (41 boys and 19 girls) between 3 and 6 years of age (mean, 4.6 ± 1.1 years) with stool microscopic evidence of intestinal parasites were recruited, with 30 (50.0%) each treated with CPH elixir or honey. Table 1 details the types of intestinal parasites and the comparison of stool clearance in both treatment groups. The most prevalent intestinal parasites were *Ascaris lumbricoides*, *Entamoeba histolytica*, *Necator americanus*, and *Strongyloides stercoralis*, found in 26 (43.3%), 14 (23.3%), nine (15.0%), and eight (13.3%) of the 60 children, respectively. Only two (3.3%) children (one in each treatment group) had *Taenia*

*saginata*. Fifty-one (85.0%) of the children had single parasites only, while nine (15.0%) had polyparasitism; in addition to *A. lumbricoides*, six (10.0%) had *E. histolytica*, and the remaining three (5.0%) had *N. americanus*. Among the children with multiple parasites, five received CPH elixir, and four had honey treatment.

CPH elixir demonstrated a high stool clearance efficacy against *A. lumbricoides* (84.6%) and *S. stercoralis* (100%) with statistically significant differences compared with honey. Although CPH demonstrated 100% efficacy against *Trichuris trichuria*, *Giardia lamblia*, and *T. saginata*, compared with honey, the efficacy in each instance did not reach the accepted level of statistical significance. Also, despite a high stool clearance rate for *E. histolytica* (71.4%) and *N. americanus* (80.0%), these were not statistically significant relative to honey. Overall, the stools of 23 of 30 (76.67%) subjects given the CPH elixir compared with five of 30 (16.67%) given honey alone were cleared of parasites (standard error = 0.1029; 95% CI = 0.3649; 0.8351, *z* = 4.40; *P* = .0000109).

There were no significant adverse effects, though two of 30 (6.7%) children given the CPH elixir had transient complaints on the day the treatments were given. One had nausea, while the other had an episode of loose stools. None of the children who received honey alone had complaints. The difference in the proportion of children with complaints in either treatment group was not statistically significant (standard error = 0.0456; 95% CI = -0.0559, 0.1893; *z* = 0.72; *P* = .472).

**DISCUSSION**

Our high stool parasite clearance rates of between 71.4% and 100% are an affirmation of the effectiveness of *C. papaya* seeds against intestinal parasites.<sup>7,12</sup> *A. lumbricoides*, the most prevalent intestinal helminth (a nematode), was effectively cleared. Probably because of the limited sample population, our findings lacked statistical significance despite demonstrable and absolute parasite clearance of certain other helminths, including a cestode, *T. saginata*. Our

TABLE 1. TYPES OF INTESTINAL PARASITES AND THE COMPARISON OF STOOL CLEARANCE WITH CPH AND HONEY TREATMENT

Parasite (number of children with parasite)	Clearance		Statistical values		
	CPH elixir group	Honey-alone group	<i>z</i> score	95% CI	P
<i>A. lumbricoides</i> (n = 26) <sup>b</sup>	11/13 (84.6%) <sup>a</sup>	2/13 (15.4%)	3.14	0.3376, 1.0464	.002
<i>E. histolytica</i> (n = 14)	5/7 (71.4%)	1/7 (14.3%)	1.62	0.0047, 1.1373	.106
<i>N. americanus</i> (n = 9) <sup>b</sup>	4/5 (80.0%)	1/4 (25.0%)	0.98	-0.2255, 1.3255	.330
<i>S. stercoralis</i> (n = 8)	4/4 (100%)	0/4 (0%)	2.12	0.0075, 1.2500	.034
<i>T. trichuria</i> (n = 6)	3/3 (100%)	0/3 (0%)	1.63	0.6667, 1.3333	.102
<i>G. lamblia</i> (n = 4)	2/2 (100%)	1/2 (50.0%)	0.00	0.6930, 1.6930	1.000
<i>T. saginata</i> (n = 2)	1/1 (100%)	0/1 (0%)	0.00	0.0000, 2.0000	1.000

<sup>a</sup>Number (%) of children with stools cleared on parasite/total number of children with the same parasite.

<sup>b</sup>Some children had multiple parasites.

observation of over 70% effectiveness against *E. histolytica* was also watered-down by the lack of statistical significance compared with the honey placebo. Papaya had previously been documented as having anti-amoebic properties.<sup>10</sup>

Ezeoke<sup>14</sup> had earlier reported a case of hypersensitivity reaction to papaya. However, it was gratifying to note the absence of untoward effects in both treatment groups. This was indeed our expectation *ab initio* considering the facts that *C. papaya* and its seeds are edible<sup>6</sup> and widely consumed by both humans and animals in the tropics, though the seeds are less favored because of less palatability. This was why we opted to use honey, a natural sweetener, as vehicle for our elixir. The transient nausea and loose stools observed among two of our subjects may be unrelated to our elixir in view of the fact that all our subjects had intestinal parasitosis, which may present with these features.<sup>1,2,4</sup>

The mechanisms of action of *C. papaya* are not fully elucidated,<sup>7</sup> though it clearly has antihelminthic activity<sup>8,9</sup> and other immunomodulatory activities.<sup>15</sup> Though intestinal parasite clearance by honey, our placebo in this study, was unexpected, it is still noteworthy. Could there be a possible antihelminthic property to honey? Our observations are at best inconclusive in view of the low clearance rate. This finding may be a spurious occurrence or possibly a demonstration of minimal antihelminthic properties to honey. Also, could the honey have had synergistic or inhibitory effects on the therapeutic properties of the *C. papaya* seeds? Further large-scale human studies are required to provide a conclusive clarification.

It is conceivable that *C. papaya*, which thrives effortlessly,<sup>6</sup> can be much more readily available and affordable still if commercial and subsistence farming of the papaya plant was encouraged in tropical communities. Also, future studies may revolutionize preventive or therapeutic care against intestinal parasites by determining the minimal amounts of *C. papaya* seeds or its active ingredients required to be consumed. There is that old English adage that "an apple a day keeps the doctor away." Could a papaya a day also do the same? Especially judging from its luxuriant growth in the tropics and its richness in  $\beta$ -carotene, the main precursor of vitamin A,<sup>6,12</sup> a vitamin reputed to be a magic bullet in childhood survival.<sup>16</sup> We conclude that *C. papaya* seeds could be beneficial in the treatment and plausibly prevention of intestinal parasites, more so being readily available, harmless, and cheap. We therefore recommend their consumption for not only for their nutritive but their medicinal value.

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