Hookworm Infestation in a Small Town of Puerto Rico[1]

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INTRODUCTION

DURING THE summer of 1941, an intestinal parasite survey was conducted in Trujillo Alto, Puerto Rico. The municipality of Trujillo Alto, comprising the town and six rural districts, is located in foothill country near the north shore of the Island. The town itself is situated on a narrow tongue of land, surrounded on three sides by the Loíza Rivera, 12.3 miles southeast of the City of San Juan. In 1940, it had a population of 1,014 inhabitants, who occupied 153 dwellings, all of them fitted either with septic tanks, cesspools, or pit privies.

In this same year, the six rural districts had a population of 10,712 persons living in an area of approximately 10,225 acres, 47 percent of which was listed as crop-land. Agricultural production consisted of sugar cane and minor crops. In 1935, cattle totaled 3,726 heads; 1,071 of them were milk cows.[2]

In 1935, a Public Health Unit was established in Trujillo Alto, one of its functions being a yearly collection of fecal specimens of school-children for examination and treatment of all those found harboring intestinal parasites with the standard treatment of 2 parts of carbon tetrachloride and 1 part of oil of chenopodium. Very few of the inhabitants of this municipality would have otherwise received anthelmintic treatment.

The main causes of death per 1,000 inhabitants, reported for the year 1940, were: diarrhea and enteritis, 2.59; malaria, .09; tuberculosis in all forms, 1.61; total mortality, 11.72. Notwithstanding, Trujillo Alto and its environs has one of the lowest death rates in Puerto Rico.[3]

The present paper deals only with the data collected on hookworm infestation.

1. Received for publication November 14, 1945.

2. Sanitary survey of Trujillo Alto, Department of Public Health, School of Tropical Medicine, 1941.

3. Report of the Commissioner of Health of Puerto Rico, 1940.

PROCEDURE

A regular sanitary survey was first made of the entire municipality for the purpose of obtaining information as to excreta disposal and water supply. At this time all houses were enumerated, and a small card with a number stamped on it was affixed to each. Every sixth home was admitted to the survey and detailed information as to its occupants, surroundings, and so forth, secured at the same time that a specimen of feces was requested for examination.

Egg counts were performed only on those individuals whose stools were found positive for hookworm ova by the Willis brine-flotation technique.[4] In such cases, a second stool specimen, consisting of a whole bowel movement, collected in a half pint waxed pasteboard box, was obtained. Counts were then made by the displacement method, according to Stoll and Hausheer's[5] modification of the original Stoll[6] dilution egg-counting technique. Two 0.075 cc. drops were counted from each preparation and the number of eggs per gram of feces calculated from the average of the two counts. In order to render the figures comparable for estimating the degree of infestation, these were reduced to the basis of formed stools by multiplying the counts made on mushy stools by two, and by four, those on diarrheic specimens.[7]

INCIDENCE OF INFESTATION

A total of 1,722 persons were examined, of whom 1,046, or 60.7 percent, harbored hookworm ova in the stools. Egg counts were made of 625 persons, the average egg count being 6,400 eggs per gram of feces. Table 1 shows the result of fecal examinations and egg counts by age, sex, and residence.

In the rural area, the infestation rate was 67.2 percent as compared to only 20.3 percent for the urban area. There was little difference between the rates of infestation for males and females of the rural zone, that for males being 71.7 percent while that for females was 62.7 percent. However, this difference was more pronounced in the urban area; males had a rate of 30.0 percent; females had one of 11.9 percent.

4. H. H. Willis, A simple levitation method for the detection of hookworm ova. Med.J. Australia, 8:375–376, 1921.

5. N. R. Stoll and W. C. Hausheer, Concerning two options in dilution egg counting: small drop and displacement. Am.J.Hyg., 6:134–145, 1926.

6. N. R. Stoll, Investigations on the control of hookworm disease. XV. An effective method of counting hookworm eggs in feces. Am.J.Hyg., 3:59–70, 1923.

7. W. W. Cort, J. B. Grant, and N. R. Stoll, Researches on hookworm in China. Monographic series, Am.J.Hyg., 7:6–7, 1926.

TABLE 2

Percentage of Hookworm Disease by Age and Sex

Age	Rural and Urban									
	Males			Females			Total			
	No. of Egg Counts	No. Cts. of 5,000 or more	Percentage of Cts. of 5,000 or more	No. of Egg Counts	No. Cts. of 5,000 or more	Percentage of Cts. of 5,000 or more	No. of Egg Counts	No. Cts. of 5,000 or more	Percentage of Cts. of 5,000 or more
Under 2	1	1	100.0	3	1	33.3	4	2	50.0
2– 4	13	1	7.7	19	7	36.8	32	8	25.0
5– 9	66	26	39.4	55	30	54.6	121	56	46.3
10–14	60	20	33.3	51	15	29.4	111	35	31.5
15–24	71	34	47.9	68	33	48.5	139	67	48.2
24–44	72	32	44.4	58	18	32.1	128	50	39.1
45–59	35	12	34.3	33	12	36.7	68	24	35.3
60 and over	10	4	40.0	12	3	25.0	22	7	31.8

or 39.8 percent, were of 5,000 or more. The percentage of egg counts above 5,000 was more or less the same in males and females. Forty-six percent of children under ten years of age with hookworm infestation had counts of 5,000 or more; of the fifteen to twenty-four year age group, 48.2 percent had counts of 5,000 or more. After the twenty-fifth year, the percentage with such counts decreased slowly to 31.8 percent after the sixtieth year.

HOOKWORM INFESTATION AND SANITATION

An area where a housing program had been established by the Puerto Rico Reconstruction Administration several years previous, as well as its surrounding area, was also studied.

Table 3 shows the incidence of infestation among inhabitants of a sanitated and an unsanitated area. It was found that the infestation rate was 70.07 percent for the second group with no privies or with privies in poor condition. Among persons in this same area, but with good privies, the rate dropped to 54.0 percent, while it dropped still further (30.9 percent) among persons in the completely sanitated area.

TABLE 3

Percentage of Hookworm Infestation in Areas under Varying Sanitary Conditions

	Persons Examined	*Persons Infested with Hookworm*	*Percentage Infested*
Sanitated area	81	25	30.9
Unsanitated area (total)	399	259	64.9
Sanitated houses	113	61	54.0
Unsanitated houses	286	198	70.0

DISCUSSION AND CONCLUSION

The town of Trujillo Alto is typical of towns along the coastal and foothill sections of Puerto Rico. It had a hookworm infestation rate of 60 percent. Considering an average of 22 eggs per worm, the average hookworm burden was around 290 among those infested. Of these, only 39.8 percent had egg counts of 5,000 or more, that is, 24.2 percent of the total population had egg counts of 5,000 or more and, in accordance with Andrews' criteria, hookworm disease. These findings may be compared with Hill's at Camuy,[9] another town in Puerto

9. R. B. Hill, Hookworm reinfestation for 3 years after treatment in sanitated area in Puerto Rico and its bearing on permanent hookworm control on group studied. Am.J.Hyg. (supp.), 6:103–117, 1926.

Rico similar to Trujillo Alto, where an infestation rate of 89.2 percent was found in 1922.

A significant difference was noted in the infestation rates among urban dwellers (30.4 percent) and the rural population (60.7 percent). This difference may be accountable to the fact that the town was completely sanitated, as evidenced by the sanitary survey carried out, and the soil was free from pollution. In the town, the incidence rate began to rise in males of the ten to fourteen year age group, while it did not go up in females until they reached the fifteen to twenty-four year span. This is probably due to the fact that boys began to make trips into the country at an earlier age than girls and that the women did not visit the rural areas as often as men. The average egg count for men in the urban area was 8,600 and for women, 1,200, which again reveals the difference both in the rate and the intensity of infestation between the sexes living in the urban section.

The percentage of persons with egg counts of 5,000 or more was also higher in the rural area—40.2 percent as compared to 30.4 percent in the urban zone; it was also higher among males of the latter area—46.2 percent as compared to 10 percent among urban females. In the rural area, the egg-count average was higher for males—7,600 as compared to 5,300 for females—but the percentage of egg counts over 5,000 was about the same for both males and females.

The difference in infestation and in intensity of infestation rates between the urban and rural areas may be attributed mostly to the sanitary facilities available. In the completely sanitated urban zone, the infestation rate and the intensity of infestation was much lower than in the rural area. However, the difference in intensity and rate of infestation between males and females was much less in the rural area.

The age distribution of hookworm infestation and hookworm disease also showed considerable variation in both the urban and rural areas. In the former, the infestation rate increased at a later age than in the rural area, and at a later age in females than in males. In the rural zone, the infestation rate rose to a peak at a much earlier date there being no difference between the sexes.

Several factors may be accountable for these differences, the most important again being lack of sanitary facilities. The added fact that men from the urban zone work in the fields of the rural area, while the women stay at home, is also important and explains the differences encountered in the urban area. Although the activities of the women in this rural area are restricted more to the home and

they seldom go out to work in the fields, they nevertheless become infested because of the lack of sanitary facilities and the contamination of the soil in the immediate neighborhood of their houses.

The differences in infestation rates among persons living under various sanitary conditions have been demonstrated. In the unsanitated area, the infestation rates varied between persons living in houses provided with sanitary privies and houses not similarly fitted. The infestation rate for a well sanitated neighboring zone was much lower.

HOOKWORM INFESTATION
ACCORDING TO SANITARY CONDITIONS AND LOCATION OF HOUSES, TRUJILLO ALTO.-1941.