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Incidence of *Trichinella spiralis* in Garbage-Fed Hogs in San Francisco.*

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Hall and Collins[1], summarizing published incidences of *Trichinella spiralis* in human autopsies in the United States, reported a total of 1,778 examinations with 12.5% positive. (More recent reports[2] place this figure at about 18%.) They noted that Queen[3] had found an incidence of 27.6% in Boston and McNaught and Anderson[4] 24% in San Francisco while Hinman's[5] survey of New Orleans had shown only 3.5% with other cities taking an intermediate position. They correlated the incidence of trichinella in man and that in the hogs from which they obtained their pork. Hall[6] and Schwartz[7] reported incidences of 1 to 1.5% of live trichinella in grain-fed hogs and 4.8 to 5% in garbage-fed hogs. Hogs in the vicinity of Boston fed offal from slaughtered hogs had previously shown as high as 18% infected. Hall and Collins suspected that the garbage feeding establishments supplying pork to Boston were largely responsible for the relatively high incidence of trichinosis in that area with a similar situation in San Francisco. In the South most hogs run at large in the fields and woods until ready for fattening on peanuts previous to slaughter and are not exposed to infection with trichinella. The incidence of infection in these hogs has been shown to be from .1 to .8% and probably accounts for the low figures for man in New Orleans and the more recent 2.8% for North Carolina.[8]

Having determined the incidence of trichinella infestation in human diaphragms in San Francisco[4] we were desirous of obtaining similar information regarding the hogs sold for consumption in this

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1 Hall, M. C., and Collins, B. J., *Pub. Health Rep.*, 1937, **52**, 468.

2 Pollock, R. C., *J. A. M. A.*, 1940, **114**, 35.

3 Queen, F. B., *J. Parasitol.*, 1931, **18**, 128.

4 McNaught, J. B., and Anderson, E. V., *J. A. M. A.*, 1936, **107**, 1446.

5 Hinman, E. H., *New Orleans M. and S. J.*, 1936, **88**, 445.

6 Hall, M. C., *Ann. Rep. Chief of B. of Animal Ind.*, 1935, p. 51.

7 Schwartz, B., *Idem*, 1936, p. 56.

8 Harrell, G. T., and Johnston, C., *So. Med. J.*, 1939, **32**, 1091.

area. In May 1938 we began examining garbage-fed hogs received by San Francisco abattoirs. Diaphragms from hogs from each hog ranch were submitted for examination.

Methods. The diaphragms were weighed, ground in a meat chopper, and subjected to 2 well recognized procedures for examining meat for trichinella. A quarter of a gram of each was pressed thin between glass slides and examined under the microscope using a magnification of 20. The remainder of each diaphragm was digested by artificial gastric juice and the concentrated sediment searched for the parasites.[4]

Results. Diaphragms from 495 hogs were received in 52 lots. There were usually 10 diaphragms per lot. All specimens in each lot were from the same hog ranch. The weight of the individual specimens varied between 5 and 100 g, averaging 21 g. Fully 85% weighed between 10 and 35 g. Twenty of the 495 diaphragms contained *Trichinella spiralis* showing an incidence of 4.04%.

The 20 positive specimens were from 13 lots. Eight contained one positive diaphragm each, three contained 2 each, and 2 contained 3 each. Although the examination of 10 diaphragms does not yield figures which are statistically valid it is noteworthy that the positive incidences of 8 ranches were 10%, 3 were 20%, and 2 were 30%. Table I details the findings for the positive diaphragms. Fifty-five per cent of the positive specimens contained less than one parasite

TABLE I.
Findings for Positive Cases of *Trichinella spiralis.*

Positive No.	Meat Wt, g	Findings by: Press	Findings by: Digestion	Total No. of Parasites	No. per g of meat
1	20	—	+	18	.9
2	12	—	+	402	33.5
3	22	+	+	657	29.8
4	25	—	+	8	.3
5	100	—	+	480	4.8
6	31	+	+	20,230	652.5
7	20	+	+	752	37.6
8	20	—	+	18	.9
9	13	—	+	6	.5
10	12	+	—	2	.2
11	26	+	+	530	20.4
12	28	—	+	14	.5
13	26	—	+	11	.4
14	16	+	+	54	3.3
15	20	—	+	13	.6
16	12	—	+	10	.8
17	16	+	+	102	6.4
18	14	—	+	11	.8
19	32	+	+	1,657	51.8
20	20	—	+	1	.05

per gram of muscle, 15% contained less than 10, 25% contained less than 100 and 5% contained less than 1000 per gram. No. 10 showed only 2 calcified cysts in the pressed specimen. Since no larvæ were found in the sediment it is assumed that whatever cysts were present in the remainder of the meat were completely digested and no live larvæ remained. All other specimens yielded living larvæ.

Only 8 of the 20 positive diaphragms showed trichinella by the press method while 19 were positive by digestion. The press procedure is adequate in detecting moderately heavy infections but not the light ones. It is valuable in detecting the calcified encysted parasites which are eventually digested and do not appear in the concentrated sediment. Naturally if larger quantities of muscle had been used in the press preparations a larger percentage of positives would have been found.

Discussion. The 4.04% incidence of trichinella which we found in 495 garbage-fed hogs raised in the San Francisco area closely approximates the percentages obtained by Hall and Schwartz for garbage-fed hogs in other parts of the United States. It is considerably lower than the 15% found by Hobmaier and Geiger[9] in 93 garbage-fed hogs in this area. The lower incidence in our survey completed in 1940 may have been in part due to the introduction of rodent control at the hog ranches through the efforts of the San Francisco Department of Public Health following the survey of Hobmaier and Geiger.

We find that the incidence of trichinosis in hogs is considerably less than that in humans (24%) in this area. In regions like Boston and San Francisco where the county hospital material comprises a high percent of immigrants it can not be assumed that all infections were acquired locally. Although only one out of 25 hogs contained the parasite, the meat from a single infected hog could infect many people. It is usual in large meat packing establishments to mix trimmings from many hogs in the preparation of sausage or other pork products, so that the meat from one badly infected hog could contaminate large quantities of the final product. If this product was consumed raw or improperly prepared many people could become infected. The dilution of the infected meat would however diminish the opportunities for severe or fatal infections of man.

It is apparent that an effective method of preventing trichinosis in man is to eliminate the infection in hogs. Alicata[10] in 1938 found only one trichinous animal out of 299 garbage-fed hogs in the

9 Hobmaier, M. D., and Geiger, J. C., *Am. J. of P. H.*, 1938, **28**, 1203.

10 Alicata, J. E., *Public Health Rep.*, 1938, **53**, 384.

Hawaiian Islands, an incidence of .3%. These hogs were kept in concrete or wooden pens and fed cooked garbage. In this same area 13.6% of 44 wild hogs were infected with trichinella. Cameron[11] found only .2% of 955 diaphragms from garbage-fed hogs in Canada contained this parasite. In Canada all garbage-feeding hog ranches are required to be licensed and inspected and all garbage is cooked prior to feeding. The low figures found in the Hawaiian Islands and Canada suggest strongly that the cooking of garbage and careful inspection of hog ranches are sound procedures for preventing much of the trichinosis in hogs.

Summary. The diaphragms of 495 garbage-fed hogs received in 2 abattoirs of San Francisco showed 20 or 4.04% infected with *Trichinella spiralis.* This figure is comparable with similar surveys of garbage-fed hogs in other areas of the United States. It is 20 times higher than found in garbage-fed hogs in Canada where garbage is cooked before feeding.

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Recovery of Virus Morphologically Identical with Psittacosis from Thiamin-Deficient Pigeons.

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The virus to be described here was recovered from young pigeons purchased in South Carolina. These pigeons, which were between 6 and 8 weeks old when received, were kept on a diet of mixed grain for one or 2 weeks, and then put on the following diet: Vitamin-free casein—180 g; cod liver oil—40 g; peanut oil—50 g; salt mixture—40 g and corn starch—580 g. Eighteen to 20 g of the above mixture was introduced daily by tube into the crops of the birds. The original purpose of these experiments was to study the changes produced in the central nervous system of the birds on this diet. These results have already been reported.[1]

In the majority of birds kept on the above diet, vomiting occurred on and after about the eighth day, opisthotonus began usually on the fourteenth day, and death rarely occurred before the twenty-first day. Occasional birds, however, developed leg weakness or opistho-

11 Cameron, T. W. M., *Canad. J. Res.*, Sect. D, 1940, **18**, 83.

1 Swank, R. L., *J. Exp. Med.*, 1940, **71**, 683.