

**A SURVEY OF ENTEROBIUS VERMICULARIS
INFESTATION AMONG PRE-SCHOOL AGE TRANSIENT
CHILDREN; WITH THE DESCRIPTION OF A
MODIFIED GRAHAM SWAB¹**

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During the months from June, 1954, to May, 1955, a survey for *Enterobius vermicularis* (Linn., 1758) infestation was conducted among pre-school age, white children, then in-patients in the Pediatric Ward at Valley Forge Army Hospital, Phoenixville, Penna. In total, 334 children, both males and females, ranging from 6 months to 6 years of age, were included in this study. These subjects were all dependents of military personnel of various ranks. Their places of residence, although available, are omitted herein since many were transient and just passing through the area, hence this information would contribute little in regard to correlation with any specific locale. It is felt, however, that the results of this survey do contribute some knowledge to our understanding of the frequency of pinworm infestation among pre-school age children in the United States.

This study was made possible through the permission and assistance of Dr. Harris Levine, then Chief of Pediatrics, Valley Forge Army Hospital, and to him the author is most grateful.

MATERIALS AND METHODS

Upon the admission of each child to the Pediatric Ward, a series of three perianal swabs were taken on the first three consecutive mornings. These smears were made at 6 a.m. prior to the engagement in the morning toilet habits. A modified Graham swab or Scotch tape swab (Jacobs, 1942) was used to make the swabbings. Although this modified swab is essentially identical to the commonly used tongue depressor-tape type, in this case the glass slide is combined as a unit with the Scotch tape and depressor and thus facilitating later examination without further handling by the examiner since all the essential units are present. Figure I illustrates this unit which was the standard "swab" at the parasitological laboratory of Valley Forge Army Hospital.

Immediately after swabbing, the tapes were preserved, sticky face attached to the microscope slide and were examined soon after. If one or more of the three examinations revealed eggs of *E. vermicularis*, the individual was recorded as a positive.

¹The Medical Corps, U. S. Army, is not responsible for all or part of the information contained herein. A contribution from the Jenks Biological Laboratory Lafayette College, and the Dept. of Biology, Univ. of Va.

DATA

Of the 334 children examined, 57 boys and 53 girls were found to be infested with *Enterobius vermicularis*. The breakdown of the accumulated data is given in the accompanying table.

TABLE I
Results of Survey Categorized by Age and Sex

Age Group	Boys exam.	Girls exam.	Total exam.	Boys inf.	Girls inf.	% inf. Boys	% inf. Girls	Total % inf.
6 mos.—1 yr.	15	21	36	0	1	0	4.07	2.77
1 yr.—2 yrs.	7	15	22	0	0	0	0	0
2 yrs.—3 yrs.	20	22	42	4	7	20	31.36	26.09
3 yrs.—4 yrs.	53	34	87	21	12	39.62	35.29	37.93
4 yrs.—5 yrs.	20	25	45	8	12	40	48	44.44
5 yrs.—6 yrs.	60	42	102	24	21	40	50	44.11
Total	175	159	334	57	53	32.57	33.33	32.93

DISCUSSION

An analysis of the data presented revealed that among the children surveyed, those from the ages of 3 years to 6 years were most frequently infested with the human pinworm. There appears to be no significant difference in the percentage of infestation between children of 4 to 5 years and of 5 to 6 years. There is no significant difference between the sexes in regard to the percentage of infestation, except in the 2 to 3 year category, but this numerical difference of 10.36% can be safely attributed to the small sampling of each sex. The total percentage of infestation among these 334 children is 32.93%, a figure which is comparable to some of the numerous surveys of this nature. Jacobs (1942) reported 33%; Cates (1953) reported 26.85% among students of five elementary schools in and around Tallahassee, Florida. The 32.93% of this survey is slightly lower than that of Zaiman, Leedy and Howard (1952) in a pre-school nursery in San Francisco, California, where the percentage was 58%. It is also lower than the 51% reported by Cram and Reardon (1939) among school children in the District of Columbia.

The concept that white children are more susceptible to infestation by *E. vermicularis* than are negro children (Cram, 1940), although based on survey results, is feasible, since Kelley and Scott (1953) determined only 2% infestation among 1 to

12 year old negro children in Washington, D. C., a figure which is appreciably lower than parallel surveys in this country among white children.

The distribution of this human parasite is generally termed "universal" although the degree of infestation varies. Among the more recent studies, Kessel *et al* (1954) reported no infestation among 0 to 5 year olds and 5% among 5 to 9 year olds in Tahiti, French Oceania; Ricci (1952) reported 77.14% among children in Sicily although only 6.09% among adults in the

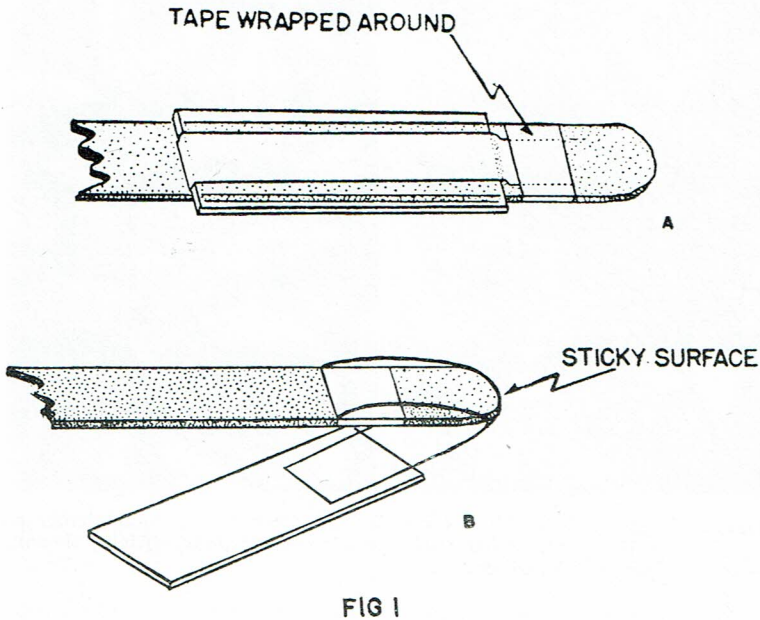


FIG 1

Figure 1. A. Modified Graham Scotch tape Unit Swab.

B. Swab with sticky surface of Scotch tape exposed ready for use.

same area; Ricci (1953) reported 30.56% among 777 children at the beginning of school in three Italian communities; Iwanczuk (1953) reported 8.6% among 1119 children from 0 to 4 years old in Warsaw, Poland; Bauge (1934) reported only one out of 730 adults infested with this parasite in the Hongay region of North Vietnam; Vosta (1955) reported 68.2% infestation among 3000 children in the Tabor district of Czechoslovakia; and Cintra and Rugai (1955) reported only 1.7% among 2879 schoolboys from 4 to 14 years old in Bauru, Sao Paulo, Brazil.

Dowell *et al* (1952) in an analysis of the "Pinworm" problem, brought out the fact that surveys conducted in the past have not been random ones and were usually limited to local schools, orphanages, etc. This present survey, although confined to one hospital, represents the study of children from various areas in eastern Pennsylvania, and furthermore, many of these had just moved to this area from as far west as California. Hence it is felt that the results of this survey, although limited, may be interpreted as somewhat representative of the children of these given ages in the United States.

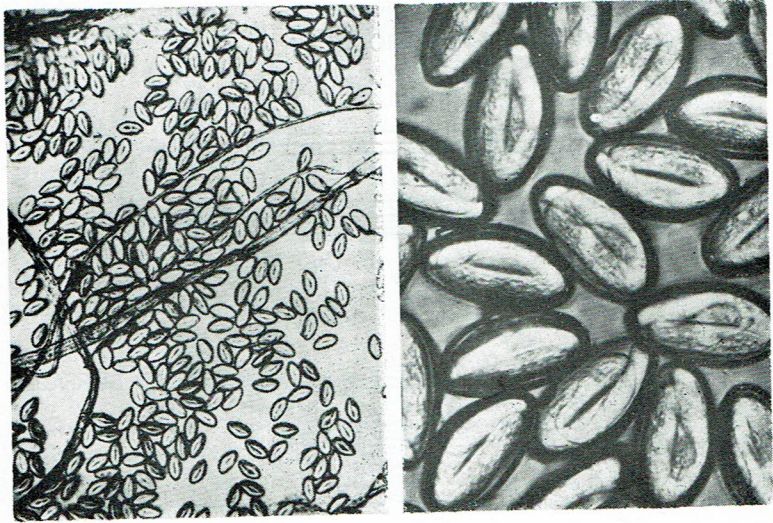


Figure 2. Eggs of *Enterobius vermicularis* in Scotch tape. Photomicrograph at 10w power (10x) (Left); at high power (43x) (Right) showing fully developed embryo.

The main advantage of the modified Scotch tape swab as described above is the fact that the slides can be set aside without danger of contaminating the area until the examiner can screen them. Furthermore, once the smear is taken there is no necessity to remount, rearrange, or expose the fingers to the sticky surface at any time.

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the State University of Milan, Italy, in 1952, and comes to the Division from the National Cancer Institute and the Institute of Pharmacological Research in Milan.

Donald F. Parsons has joined the Pathology and Physiology Section. Dr. Parsons received the Ph.D. in Physical Chemistry from Imperial College, London, England, and the M.D. from St. Bartholomew's Medical College, London. He comes to the Division from Duke University.

Otto Vos, a Public Health Service Fellow, who has been associated with the Mammalian Recovery Section for the past year has left the Biology Division. Dr. Vos has returned to the Medical Biological Laboratory, Rijswijk, The Netherlands.

Johan Harrie Stuy has completed a year of research in the Radiation Protection-Living Cells Section and left the Division to go to Yale University, New Haven, Connecticut. Dr. Stuy will be affiliated with the Biophysics Department at Yale.

Udo H. Ehling, a Public Health Service Fellow, has joined the Pathology and Physiology Section. Dr. Ehling received the Ph.D. in Zoology from the

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