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A SURVEY OF HUMAN INTESTINAL PROTOZOA
OF
LOGAN CITY AND VICINITY

by

Robert B. Harrison

A thesis submitted in partial fulfillment of the requirements
for the degree of
Master of Science

in the

School of Arts and Sciences

Utah State Agricultural College

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Major Professor

For English Department

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Robert B. Harrison

INTRODUCTION

Intestinal Protozoa

History. Parasitic protozoa of the intestinal tract of man were first observed by Anthony van Leeuwenhoek (1632-1723), a Dutch microscopist. In the year 1681, while observing his own excrement, Leeuwenhoek discovered and described certain forms of life which he called "animalcules" and which were verified later by workers in protozoology as Giardia lamblia, a protozoan parasite of the intestinal tract. During the period preceding the later part of the 19th century many observations of the parasitic intestinal protozoa of man and lower animals were made and many species were classified. It wasn't, however, until the year 1875 that a protozoan of the human intestine was observed to be pathogenic. Loesch, in this same year discovered the protozoan Endameba histolytica in the feces of a Russian peasant who was suffering from dysentery; and although he did not regard the organism as the cause of the symptoms, it was supposed by many authorities that the cause of dysentery was directly due to this organism. In the year 1912 all doubt as to the pathogenicity of this amoeba was erased when two American protozoologists, Walder and Sellards, demonstrated by experiments upon human volunteers that Endameba histolytica was the cause of amoebic dysentery. The work of these two men confirmed results of workers such as Osler, Kartulis, Councilman and LaFleur. It was also in 1913 that Walger and Sellards proved, through experiments on human patients, that a closely related form, Endameba coli,

was a harmless commensal of the intestinal tract. The cyst forms of these organisms were discovered in 1893 by Quinke and Roos, while Huber in 1903 made accurate descriptions of this stage in the life cycle of these organisms. It has only been within the last 20 years that intestinal protozoa have been cultured successfully outside of the human body. This has added greatly to the understanding of the life cycles, growth, and reproduction of these organisms; and it has consequently increased the knowledge of treatment of intestinal protozoa infestation.

Distribution. The distribution of the forms of protozoa inhabiting the human intestinal tract is world wide. The heaviest infection, according to surveys made, occurs in the tropic and sub-tropical regions of the world. This is accounted for by the^msanitary conditions which exist in these countries. The ease with which food and water can become contaminated with human and animal wastes is great. In some of these tropical regions human waste is used as fertilizers for fields, and much of the infection is transmitted by the abundant insect life. Even though the sub-tropical and tropical regions do show high incidence of infestation with intestinal protozoa, surveys of temperate regions of the world show a surprisingly high infection. Dobell, in 1931, analyzed data published by a number of investigators and estimated the percentage incidence of infection of 4 of the most common parasitic intestinal protozoa, Endameba histolytica, Endameba coli, Endolimax nana, and Iodameba butschlii, as 16.4 percent. This estimate was made from data compiled from 3,146 individuals

who had never left the British Isles. Endameba histolytica was found in 107 individuals, and the incidence of infection of this species was estimated at 7-10 percent. In investigations upon 8,029 United States soldiers by Boeck and Stiles (1923) (13), the estimate of percentage of infection by the same parasites was 21.6 percent. It is through these surveys of other regions throughout the civilized countries of the world that the world-wide geographical distribution of intestinal protozoan infection has been established.

Importance. The status of all forms of intestinal protozoa of man have not as yet been fully determined. Workers in this field are still in doubt as to the pathogenicity of some species. It is known, however, that one species, Endameba histolytica, is definitely pathogenic, causing lesions of the intestinal tract and liver abscesses. The lesions produced by this organism vary greatly in extent and appearance. In some infections there are merely superficial erosions of the mucous membrane of the intestinal wall, while in others there may be most extensive ulceration and destruction of large areas of the intestinal coats, with abscess formation in the liver or other organs. The majority of persons infected by this parasite show no marked symptoms; but where symptoms are shown, they vary markedly in different individuals, in some assuming fulminant character, followed by death in a very short time; while in others they may be very mild with rapid, spontaneous recovery. The onset of the disease may be sudden, but more frequently follows repeated attacks of diarrhea, and is often immediately preceded by

diarrhea. With a sudden onset of the disease there may be acute attacks of abdominal pain, accompanied by nausea, vomiting, chills and chilly sensations. There is an intense desire for defecation, and after the first stools are passed, each succeeding stool contains much mucous and blood. The patient may become rapidly exhausted, complaining of aching in the lumbar region, of great weakness of the legs, and is mentally depressed. In milder attacks fever is not present, but in more acute cases the fever may register 100 to 102 degrees F. Other species of intestinal protozoa, Giardia lamblia, and Trichomonas hominis, are believed to produce intestinal disturbances when found in large numbers in the intestinal tract. These species are believed by many workers in this field to cause diarrhea, and when found in sufficient numbers, weaken the intestinal walls allowing for harmful bacterial invasion. The other protozoan forms of the alimentary tract are believed to be harmless commensals, probably living on bacteria and debris of the digestive tract. Because of the uncertainty of the status of some of the protozoan parasites as to their pathogenicity, it is expected that much work will be done in the field of intestinal parasitism in future years.

Transmission. Intestinal protozoa usually escape from the body in the fecal material and must be able to live for some time outside the body. In most of the species, cysts are formed which remain viable for considerable periods outside the body, whereas, trophozoites (active stage), which may be carried from the body of the host, quickly die.

Sellards and Theiler (1924) (14), in experiments upon kittens, indicate that cysts of Endameba histolytica are still infective after 6 days when left in fecal material at 2 degrees C. Walker and Sellards (15) showed by experiments on humans that cysts of Endameba histolytica were able to infect man after they had been outside of the body, in fecal material, for 2 days at tropical temperatures, and with cysts of Endameba coli after 10 days under similar conditions. Whether these cysts can survive the low temperatures of temperate regions has never been determined, but it has been proved that cysts are not only able to live at room temperature (21 degrees C.) but at slightly lower temperatures. Boeck (16) found that all Endameba histolytica cysts were killed at 63 degrees C. when held at that temperature for 5 minutes. Yorke and Adams (17) found that the cysts would withstand a temperature of 45 degrees C. for 30 minutes. According to Craig and Faust (1), cysts of Endameba histolytica are viable under ordinary conditions for 2 to 3 weeks. It seems probable that the organisms in the cyst stage are able to withstand ordinary temperature conditions in temperate and tropical regions, and as long as they are kept moist, will survive all but the severest cold temperatures of northern countries.

In some rare cases, such as Trichomonas hominis, there is no cyst stage in the life cycle of the organism, and transmission is effected by trophozoites. If eaten by a suitable host, they undergo excystment in the intestine and the active or trophozoite stage is resumed.

The only conceivable avenue of infection for intestinal protozoa is by way of the mouth. It seems probable that infective stages gain entrance to the human alimentary tract through contaminated food and water. This contamination may be the result of improper sewage disposal or leakage of sewage into the sources or mains of city water supplies. The cysts of the protozoa, under these conditions, are able to enter suitable hosts through drinking water. Flies may be instrumental in contaminating the food or water. The work of Wenyon and O'Connor (13) and Root (19), indicates that human intestinal protozoa cysts survive a long time in the fly's intestine and that they can pass through it and be deposited in a living condition in the feces. Knowing the habits of the common house fly, one can imagine the possibility of food contamination by these insects. Infective stages of these parasites may also gain entrance into the digestive tract of man by other carriers, principally the common brown rat and the house mouse. These two animals, because of their filthy habits and close relationship with man, often contaminate food. Another possible means of food contamination, with infective stages of these parasites, is by food handlers who are carriers of these parasitic protozoans.

Classification, Description, Habitat, and Importance of the most Common Forms of Intestinal Protozoa. Classification is as follows:

Phylum--Protozoa

Subphylum--Plasmodroma

Class--Rhizopoda

Order Amoebina

Family--Amoebidae

Genus--Endameba

Species--histolytica

Description. The trophozoite of this amoeba (plate 1, figure 1) varies in size from 15 to 60 microns in diameter. The average size is between 18 and 25 microns. The ectoplasm is clear and glass-like in appearance. The endoplasm is less refractive and more granular in nature. In a living amoeba, the nucleus is usually invisible. The pseudopodia may be long and fingerlike, or short and more rounded in shape, and are rapidly extruded, after which the endoplasm flows into them and progressive movement occurs. In freshly passed stools the organisms are very motile. They are slug-like in shape, and move rapidly in a given direction.

A cyst of this organism (plate 1, figure 2) is a spherical, hyaline-appearing body surrounded by a cyst wall. The cysts vary greatly in size, measuring from 5 to 20 microns in diameter depending upon the strain. When stained with iron-haematoxylin, the cytoplasm takes a grayish-blue color, while the nuclear structures and chromatoidal bodies stain a deep black. The nuclei vary from 1 to 4, and cysts with 6 and 8 nuclei are very rarely observed. The characteristic chromatoidal bodies are well differentiated in stained cysts. They appear as black, ovoid, bar-like, or sausage-shaped masses with rounded ends, lying in the cytoplasm either as one, or multiples of two or more.

3

Habitat. The characteristic habitat of Endameba histolytica is in the tissues of the lower portion of the small intestine, and the whole of the large intestine of man. It is essentially a tissue parasite, and, so far as evidence indicates, cannot live indefinitely in the lumen of the bowel without penetrating the tissues.

Importance. It has been proved that this protozoan is the direct cause of the forms of dysentery known as amoebic dysentery, and forms intestinal lesions. When found in the liver, this parasite is the cause of the type of abscess known as amoebic abscess of the liver.

Classification. Genus--Endameba
Species--coli

Description. The trophozoite of this organism varies in size from 5 to 50 microns in diameter, the average usually being from 20 to 30 microns. The cytoplasm appears colorless, and less refractive than Endameba histolytica. Motility is sluggish. The endoplasm is granular in appearance, and the nucleus is visible as a ring of refractive granules. Vacuoles are present in the cytoplasm and may contain bacteria, crystals, vegetable cells, and other material.

In haematoxylin stained preparations, the cytoplasm of the cysts of this species is granular in nature and stains a bluish grey. The cyst wall remains unstained. In size they are from 10 to 33 microns in diameter. The chromotoidal bodies and the 1 to 3 nuclei stain black. Sometimes as many as 16 to 32 nuclei can be observed in an Endameba coli cyst.

Habitat. Endameba coli is found in the luman of the large intestine of man, and they do not penetrate the tissue or produce lesions.

Importance. This amoeba is a harmless commensal in the intestine of man, and there is no evidence that either lesions or symptoms are caused by its presence.

Classification. Genus--Endolimax
Species--nana

Description. In size, the average diameter of this protozoan is 8 to 10 microns. In stained preparations, the cytoplasm of this species is vacuolated and granular, staining a bluish gray. The nuclear membrane stains black, is thin, and without chromatin granules. The karyosome is typical of this species, usually consisting of a single black mass of chromatin, at times lying near or in contact with the nuclear membrane, although it is frequently central in location. Sometimes the karyosome is split, and connected to the nuclear membrane by delicate chromatin filaments.

The cysts of Endolimax nana are typically ovoid, and contain 1 to 4 nuclei. In size they are usually 5 to 14 microns in diameter. The karyosome is typical as described above.

Habitat. It is presumed that this species lives in the large intestine of man.

Importance. Endolimax nana is regarded as a harmless commensal, never producing lesions in the intestinal tract, and never causing intestinal disorders.

Classification. Genus--Iodameba
Species--butschlii

Description. The active stage of this parasite is not commonly observed. In stained preparations it averages 8 to 20 microns in size, and is bluish gray in color. The nuclear membrane, nuclear chromatin, and karyosome stain black. The karyosome is distinctive, and is located in the center of the nucleus, connected with the nuclear wall by delicate radiating fibrils.

The cysts of this organism are usually 5 to 18 microns in diameter. The shape is irregular, being ovoid, rectangular, rhomboid, or lobulated. The karyosome of the nucleus migrates to an eccentric position, while peripheral chromatin granules often appear as a crescent shaped mass over the karyosome. There is a noticeable cytoplasmic inclusion in the cyst in the form of a glycogen mass.

Habitat. Iodamaba butschlii is a parasite of the large intestine. The exact portion that it inhabits is unknown.

Importance. There is no evidence that this parasite is a pathogenic organism. No lesions or intestinal disturbances have been described as resulting from its presence in the intestinal tract.

Classification. Class--Mastigophora

Subclass--Zoomastigina

Order--Protozoanida

Family--Chilomastigidae

Genus--Chilomastix

Genus--mesnili

Description. The trophozoites of Chilomastix mesnili

are pear shaped, 6 to 20 microns in length, and from 3 to 10 microns in breadth. They have a broad, rounded anterior extremity, and an attenuated, sharp posterior extremity. The body is asymmetrical, and marked by a spiral groove extending around the body in a dorsal direction. Three flagella extend out from the anterior end, and a fourth flagellum lies within an oral pouch. The nucleus is situated at the anterior end near the cytostome, and is round or oval in shape. At the anterior pole of the nucleus are chromatin granules (blepharoplasts) from which arise the flagella. There are 2 fibrils which form the mouth of the cytostome.

The cysts of this parasite are light-globe shaped, with a finely granular cytoplasm, and a singular nucleus lying at the anterior end or at the middle of the cyst. The karyosome may be centrally located or appear as a black mass to one side of the nucleus, in contact with the nuclear membrane. Chromatin granules may appear within the nucleus. The cyst also contains 2 fibrils, and the flagellum.

Habitat. The exact locality of this parasite is still one of controversy; some authorities believe it to be a parasite of the small intestine, while others say it is a parasite of the large intestine.

Importance. There is no evidence that this protozoan causes symptoms of dysentery or produces lesions in the intestines of man.

Classification. Family--Trichomonadidae

Genus--Trichomonas

Species--hominis

Description. The trophozoite of this organism (plate 1, figure 3), when stained, shows a grayish-blue cytoplasm, which is finely granulated and vacuolated. It is a pear-shaped parasite, having 3 to 5 flagella on the anterior end, and possesses an undulating membrane. Arising from the deep stained blepharoplast, at the extreme anterior pole of the organism, is the axostyle, a broad, semi-rigid, spike-like, unstained structure, extending backward, and protruding at the posterior end as a sharp pointed tail. The nucleus is single and oval, lying in the anterior portion of the organism, just posterior to the blepharoplast.

True cysts of this organism have not been found in man or animals.

Habitat. Trichomonas hominis is found to be most numerous in the ileum of the small intestine, and in the large intestine of man.

Importance. From all evidence available, Trichomonas hominis has not been proved to cause lesions or inflammation of the intestinal tract. It may, however, when found in large enough numbers, aggravate an already existing inflammation of the intestinal tract and cause intestinal disturbances to the host. It is generally considered to be a harmless flagellate.

Classification. Family--Oxosomatidae

Genus--Giardia

Species--lamblia

Description. The trophozoite of this parasite, (plate 1, figure 4) when found in stained preparations, are pear-like

in shape. The anterior end is broad and rounded, and the posterior end tapers to a sharp point. The average size of this protozoan is 14 microns in length by 7 microns in breadth. Dorsally the flagellate is convex, and ventrally a large sucking disk is noted at the anterior end. All of the structures in the body are paired, there being 2 nuclei, 2 axonemes, and 4 pairs of flagella. The nuclei are oval in shape, and have a centrally located, large, karyosome. The 8 flagella are divided into anterior, middle, ventral, and caudal pairs.

The cysts of *Giardia lamblia* (plate 1, figure 5) are generally ovoid in shape, having finely granular cytoplasm, and from 2 to 4 nuclei which are usually situated at one end of the cyst and arranged in pairs. The nuclei are round in shape and have a centrally located karyosome. The cysts contain short, curved fibrils, usually arranged in groups of 4, and remains of flagella, and axonemes. These structures are usually in the mid-plane of the cyst, vertical to its long axis.

Habitat. The normal habitat of this parasite is the duodenum of the small intestine. It may be located in the crypts of the intestinal wall, clinging to the epithelial cells by means of its sucking disks.

Importance. The pathogenicity of this organism has never been satisfactorily established. It is generally agreed, however, that they do not produce lesions of the intestinal tract, but may, when found in sufficient numbers, cause a diarrhetic condition.

NEED FOR A LOCAL SURVEY

Surveys of human intestinal protozoa in the United States have been confined mostly to Eastern sections of the country and to the Pacific coast. There has been little work done concerning these parasites in western mountain states, and no previous surveys have been made of these organisms in the Intermountain West.

It is important that the kinds and numbers of these parasitic protozoa be determined for this locality; and it is only through surveys that the harmful, as well as the commensal, intestinal protozoa can be determined and treated.

In 1933, the city of Chicago experienced a general epidemic of amoebic dysentery, believed to be caused by a Endameba histolytica carrier. The seriousness of this epidemic led to the realization that the amoebic dysentery of the tropics could occur in temperate regions. It is one of the purposes of surveys to recognize the incidence of pathogenic protozoa, with the purpose of averting possible epidemics of dysentery, diarrhea, and other minor intestinal disturbances.

RESEARCH

Area Covered

The area covered in gathering the material for this thesis has Logan City, Utah, as its focal point, and includes surrounding small communities.

Logan city is the county seat of a mountainous farming area and has a population of approximately 11,000 people.

Plate 1.

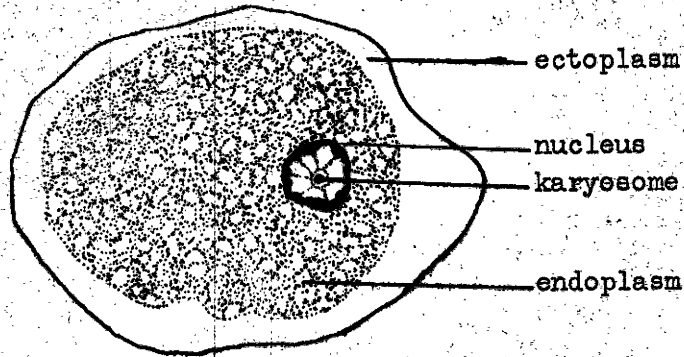


Fig. 1. *Endameba histolytica*, trophozoite X2000

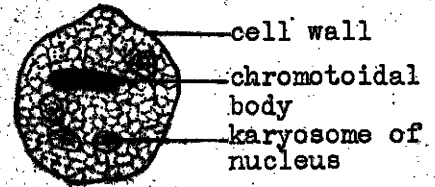


Fig. 2. *Endameba histolytica*, cyst X2000

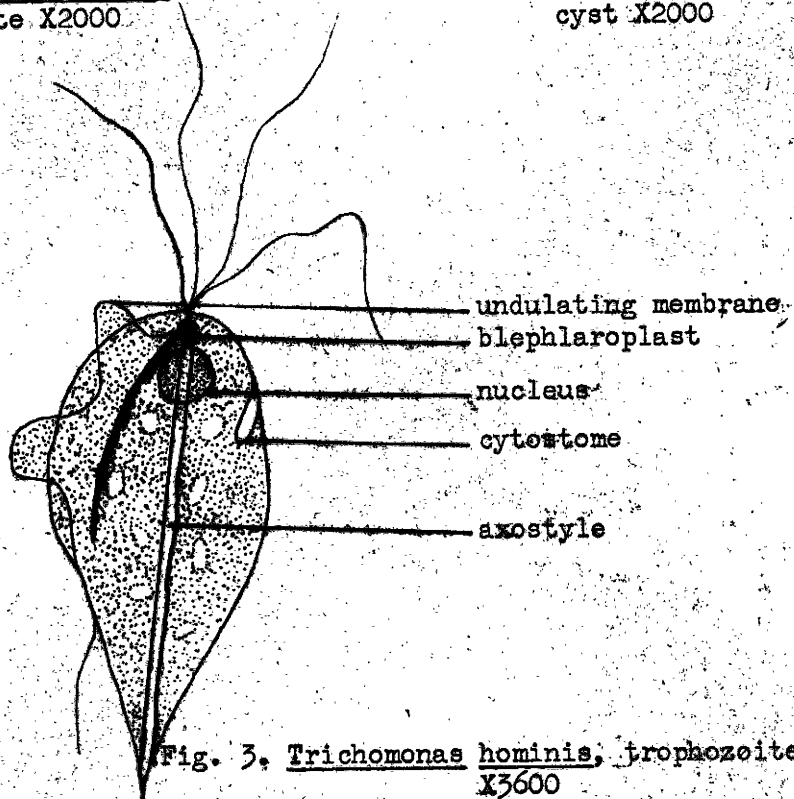


Fig. 3. *Trichomonas hominis*, trophozoite X3600

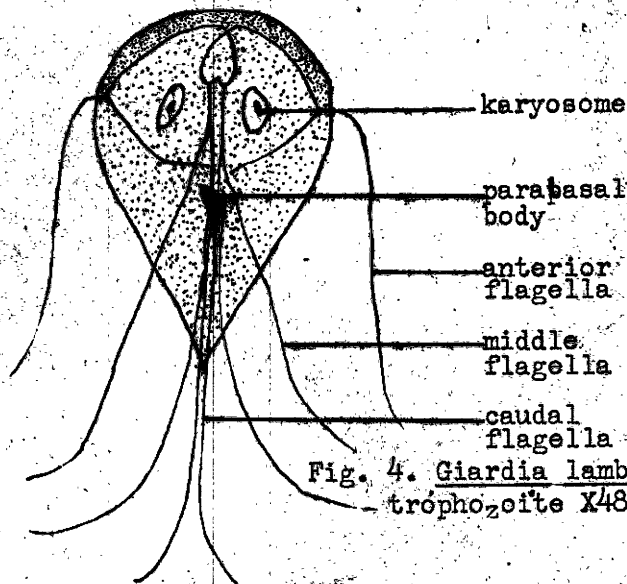


Fig. 4. *Giardia lamblia*, trophozoite X4800

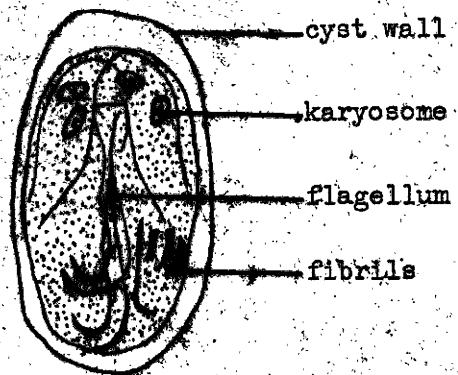


Fig. 5. *Giardia lamblia*, cyst X4300

It is a typical farm-trading center, and during the winter months its population is increased by some 3,000 college students. Elevation of this city is 4400 ft. The source of the water supply is located 7 miles east of the city and is supplied by several natural springs. The water is piped underground to the city and distributed through underground mains. The sewage-disposal system is of the drainage type, underground pipe-lines carry wastes to a common dam located 2 miles west of the city limits. Possible infection by protozoan parasites of this locality could come, indirectly, through rats and other smaller rodents living in the vicinity of this sewage dam, which serves also as a city dump grounds.

The living conditions and homes in Logan City and vicinity are very desirable. Most homes have modern plumbing facilities, a sanitary water supply, and proper sewage disposal. There are few sanitation problems encountered.

Methods

The fecal stools gathered for study in this survey were contributed by residents of Logan City and vicinity who were attending the Utah State Agricultural College. Some few samples were supplied through the cooperation of the William Hudge Memorial Hospital, and were collected from patients free from intestinal disorders. Stools were collected in small pill boxes, furnished to the donors, and, in most cases, the material was prepared for examination within 2 hours after collection.

Preparation of Material. In preparing the stools for

microscopic identification, each stool was fixed and stained in the following manner:

1. A small bit of feces was smeared on a glass slide by means of a small brush. (One slide was made of each stool; and in cases where no protozoa were observed, or where classification of the organism was doubtful, another stool was collected, and 2 slides were prepared for observation.)

2. The material was fixed by immersing the slide in cold Schaudinn's solution, which has the following composition:

Hg₂Cl₂ -----65 pts.

95 percent alcohol----33 pts.

Glacial acetic acid---2-5 pts.

3. The slide was transferred, after 5 minutes, to 70 percent alcohol, to which had been added a few drops of alcoholic iodine solution. This removed the corrosive sublimate. The slides remained in this solution from 5 to 10 minutes.

4. Hydration was carried out by successive immersions of 5 minutes each, in 70 percent and 55 percent alcohol and distilled water.

5. After the slide was washed in distilled water, a mordant was applied by placing the slide in a 2 percent aqueous solution of iron-alum (ammonium-ferric sulphate). This step required 5 to 15 minutes, depending upon the age of the solution.

6. After being removed from the mordant, the slide was washed in distilled water a few seconds, then placed in a

0.2 percent aqueous iron-haematoxylin staining solution for 5 to 10 minutes.

7. Upon being removed from the staining solution, the slide was washed in distilled water and differentiation was carried out by destaining in a 11.5 percent aqueous solution of iron-alum. At intervals the slide was removed, washed, and examined under the microscope until destained sufficiently. It was then washed in distilled and running tap water.

8. Dehydration was carried through the series 35 percent, 70 percent, 95 percent, and iso-propyl alcohols. Five minutes was taken for each immersion.

9. The slide was finally cleared in xylol for 5 minutes, removed, and mounted in balsam.

Location of Protozoa. The intestinal protozoa were located on the slides by use of the oil immersion objective on a bifocal microscope. The magnification of this objective was X95. The magnification of the eyepiece used was X10, making a total magnification, used in identifying the protozoan forms, of X950.

The total area of the stained fecal material was covered in locating the parasites by beginning in the upper left-hand corner of the field, and, by use of a mechanical substage, crossing and recrossing the field until the total area had been observed.

RESULTS

Kinds, Numbers, and Percentage Infection of Intestinal Protozoa. The kinds, numbers and percentage infection of

intestinal protozoa of 130 individuals of Logan City and vicinity are as follows:

Protozoan	Number Infected	Percentage
<u>Endameba histolytica.</u>	2	1.11
<u>Endameba coli.</u>	47	26.11
<u>Endolimax nana.</u>	24	13.35
<u>Iodameba butschlii.</u>	13	7.66
<u>Chilomastix mesnili.</u>	14	7.77
<u>Trichomonas hominis.</u>	11	6.11
<u>Giardia lamblia.</u>	3	4.44
<u>Balantidium coli.</u>	1	0.55
Total number of individuals infected.	105	58.88

Of the total number of individuals infected with intestinal protozoa 17 (9.44 percent) harbored 2 or more parasites.

Discussion of Results. It has been found by E. E. Faust and co-workers (5), that hasmotoxylin stained fecal films detect only about 40 percent of the Endameba histolytica infections found, and only 45 to 50 percent of all species of protozoa. From this work one can conclude that the actual percentage of intestinal protozoa is much higher than the results show.

Individuals who were found to be carriers of Endameba histolytica were retested for the presence of this parasite after an interval of one month, and in both cases the results were positive. In neither case were symptoms of dysentery displayed, nor did the individual have any intestinal disturbances.

The results of this survey show that individuals of Logan city and vicinity harbor intestinal protozoa. In order to gain an idea of the proportion of individuals infected with intestinal protozoa, as compared with infection in similar localities, this survey is compared with other surveys of college populations, and with average percentage infections as given by Craig and Faust (1).

Survey A. Results of survey of Logan city and vicinity.

Survey B. Results of a survey, made by E. E. Byrd (5), from 257 college freshmen of the University of Georgia.

Survey C. Results of a survey, made by W. H. Hadlie and R. M. Cable of Perdue University (4), from 514 students of the Academy of Berea College, Kentucky.

Average. Average percentage infection given by Craig and Faust (1):

	Survey A*	Survey B*	Survey C*	Average *
<u>Endameba histolytica</u>	1.11	7.77	7.8	10.2
<u>Endameba coli</u>	26.11	22.13	-	10-60
<u>Endolimax nana</u>	13.33	23.73	47.3	13.2
<u>Iodameba butschlii</u>	7.33	2.72	9.5	5.0
<u>Chilomastix mesnili</u>	7.77	0.33	1.4	1.4-7.5
<u>Trichomonas hominis</u>	3.11	0.33	-	0.7-5.8
<u>Giardia lamblia</u>	4.44	12.33	6.6	5.7
<u>Balantidium coli</u>	0.55	-	-	0.01

*(Results given are in percent)

The results of the local survey indicate a low infection of Endameba histolytica, the pathogenic protozoan, as compared with surveys of other similar regions, and as compared

with the average results compiled by Craig and Faust (1), from the results of 26 surveys which included 57,561 individuals.

A high infection of Chilomastix mesnili and Trichomonas hominis is shown, as compared with results of other surveys, and with the average infection.

The other forms of intestinal protozoa show a percentage of infection which is similar to the average percentage of infection as found by other surveys.

CONCLUSIONS

Because of the relatively small number of individuals sampled in this survey, the results cannot be too conclusive, but they do indicate the following:

1. That from a local survey of Logan city and vicinity, infection by intestinal protozoa is present, and that this infection is high.

2. That the number of individuals infected with the pathogenic intestinal protozoan, Endameba histolytica, is low compared with the average infection as found in the United States.

3. That the number of individuals infected with the protozoan parasites, Chilomastix mesnili, and Trichomonas hominis are high compared with the results obtained from other similar surveys.

4. That average infection is found in the cases of the parasites Endameba coli, Endolimax nana, Iodameba butschlii, Giardia lamblia, and Balantidium coli.

SUMMARY

Previous surveys for human intestinal protozoa have been confined to Eastern sections, and Pacific Coast regions of the United States. The species of intestinal protozoa and their percentage infection had never been determined in an Intermountain region of the West, previous to this survey of the inhabitants of Logan City, Utah, and vicinity.

Fecal stools were taken from 100 individuals of this locality, and prepared by smears on glass slides, fixed by Schaudinn's solution, and stained with iron-haematoxylin.

Examinations of the iron-haematoxylin stained films were made, and the following percentage of infection was determined for the species identified:

Protozoan	Percent infection
<u>Endameba histolytica</u>	1.11
<u>Endameba coli</u>	25.11
<u>Endolimax nana</u>	13.33
<u>Iodameba butschlii</u>	7.66
<u>Chilomastix mesnili</u>	7.77
<u>Trichomonas hominis</u>	6.11
<u>Giardia lamblia</u>	4.44
<u>Balantidium coli</u>	0.55

Of the 100 individuals examined, 106 (52.99 percent) were infected with at least one species of intestinal protozoa, and 17 individuals (9.44 percent) harbored 2 or more parasites in their intestinal tracts.

The results of this survey indicate infection by intestinal protozoa, with a relatively low incidence of infection by the pathogen Endameba histolytica.

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