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Isospora hominis, a Common Parasite of Inhabitants in Ethiopia

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There is a general consensus that human infection with *Isospora hominis* is very seldom, although Elsdon-Dew (1953), Routh (1955), Jeffery (1956), Henderson *et al.* (1963), French *et al.* (1964) and Brandborg *et al.* (1970) have made case reports. To our knowledge, as human *Isospora* infection has not yet been recorded in Ethiopia, it seems worthwhile and of practical importance to note that the cases are commonly found and routinely diagnosed in patients.

Materials and Methods

Numerous fresh stool specimens (see Table 1.) from apparently healthy and clinically unhealthy people are collected for daily routine examination in our laboratory* where monthly in the average about 320 stools are examined for protozoan and helminthic parasites.

First, the fecal samples are examined directly under microscope for the presence of human parasites, and mature sporocysts of *Isospora hominis* were diagnosed.

Second, besides the direct examination of the stools, all the fecal samples brought to the laboratory are examined according to the AMS-III and formalin-ether concentration techniques. After the diagnosis of *Isospora hominis* became a common practice in our laboratory, the zinc sulfate floatation was used for the collection of the mature coccidial sporocysts. Morphologically similar forms to those passed by the patients were also found in dogs, therefore, the methods mentioned above were also utilized to examine the stools of the latter.

Further, immature and mature oocysts of *Toxoplasma gondii*, obtained from a cat experimentally infected with the mouse brain "cyst" of the Beverly strain, were compared to *I. hominis* sporocysts (Fig. 1), because some investigators have pointed out similarity of the oocyst among *I. hominis*, *I. bigemina* and *T. gondii* [Elsdon-Dew and Freedman (1953), Routh, McCroan and Hames (1955), Sheffield and Melton (1970)].

Appearance of the human stools: They were in most of the cases soft, foamy, light in colour and appeared fatty. Mucus in the stools was not a rare finding and the stools were some times of diarrhoeal nature. Occasionally, they were dark in colour and well formed. Some of the people complained of colicky abdominal pain, continued loss of appetite, and diarrhoea changing with constipation. Most of the people examined were apparently healthy without any cinical manifestations. Repeated fecal examinations from the same persons were made 4, 7, 14 days after the first finding in order to ascertain a continuous appearance of the sporocysts in the stool.

Results

According to the results of our routine fecal examination, more than 8.4% of the people examined in our laboratory are in-

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Table 1. Routine stool examination for protozoan and helminthic parasites in the ICL & RI, Addis Abeba, Ethiopia*

Series of examination**	A		B		C		D	
Total No. of persons examined	309		353		253		347	
Total No. of positive persons	148	(47.9%)	177	(50.2%)	109	(43.1%)	163	(47%)
Parasites routinely diagnosed		%		%		%		%
Isospora hominis	8	3.84	38	19	18	7.74	24	11.28
Giardia lamblia	15	7.2	15	7.2	17	7.31	21	9.87
E. histolytica	22	10.56	30	15	15	6.45	34	15.98
S. mansoni	6	2.88	9	4.5	3	1.39	2	0.94
Fasciola hepatica	2	0.96	30	15	—	—	2	0.94
A. lumblicoides	28	13.44	30	15	22	9.46	33	15.51
T. trichiura	70	33.6	81	40.5	56	24.08	80	37.6
Hook worm sp.	4	1.92	2	1.0	2	0.86	13	6.1
Trichostrongylus sp.	—	—	1	0.5	2	0.86	1	0.47
Strongyloides sp.	40	19.2	28	14	17	7.31	47	24.19
E. vermicularis	2	0.96	2	1.0	2	0.86	—	—
Taenia saginata	3	1.44	7	3.5	6	2.58	3	1.42
Hymenolepis nana	—	—	5	2.5	3	1.39	8	3.76

* The results presented in this table are from subjects living in and around the Capital, Addis Abeba where the hygenic conditions are relativly better than those of the rural areas.

** Each examination was performed in different time.

fected with *I. hominis* (Table 1). The mature *Isospora* sporocysts found commonly in the human stools are identified as those of *I. hominis*. The criteria used for the differentiation and identification of the present *I. hominis* from the other *Isospora* species are those described by Reichenow (1925), Elsdon-Dew and Freedman (1953). In the present study, up to date, the oocyst was never observed in the stools, and fully developed sporocysts were only encountered. In most of the cases, they were single and/or occasionally coupled in pairs. The paired sporocysts occasionally encountered do not reveal any membrane surrounding them and the adherence of one to the other seems to be quite solid (Fig. 3). The sporocysts measured about 13.5 by 12.2 microns each (Table 2). As indicated in Figs. 1 and 2, the granular mass or residual body is of coarse nature and has a polar position, the residual material is only concentrated in one area. Every sporocyst contains 4 sporozoites without any granular structure (Figs. 1, 2). The general appearance and measurements of the sporocysts seem to be within the range of those of *Isospora hominis*. They are illustrated in Figs. 1, 2 and in Table 2.

The present *Isospora* species appears morphologically indistinguishable from the socalled *I. bigemina* found commonly in dogs whose stools harboured usually mature sporocysts lacking the oocyst wall, because size and appearance of the sporocyst of these two species of *Isospora* are almost the same, as it is shown in Table 2. The size of the fully developed sporocysts of *I. hominis* is almost that of the oocyst of *Toxoplasma gondii* found in the stools of experimentally infected cat (Figs. 1 to 4 and Table 2). The mature oocyst of *T. gondii* contains always two sporocysts and each with 4 sporozoites while that of *I. hominis* lacks the oocyst wall (Figs. 2 and 4). From these findings it was recognized that *T. gondii* in cat is morphologically different from *I. bigemina* in dog examined by the present authors and from *I. hominis* in human.

Table 2. Measurements of the *Isospora* material in comparison with those of *T. gondii*.

Species	Oocyst	Sporocyst
Isospora hominis	——	13.5±1.4×10.2±1.2* 15×10** 16×10***
I. bigemina (dog) ?	——	13.5×10.2*
Toxoplasma gondii : mature	12.5±1.1×10.6±1.1*	——
immature	12.3±1.2×10.4±1.1*	——

*: measurement after the present authors
**: measurement after Elsdon-Dew and Freedman
***: measurement after Wenyon
Remarks : [Elsdon-Dew and Freedman postulated that "the large form of *I. bigemina*" and the sporocyst of *I. hominis* could be the same organisms. This hypothesis might be confirmed or disproved by detailed future investigation.]

All the persons found infected with *I. hominis*,—were repeatedly checked for the presence of this coccidial parasite, 4, 7, and 15 days after the first positive finding. Without exception, mature sporocysts were continuously detected by the re-examination of the stools from the same subjects. Two months after the first finding, the mature sporocysts could be also found in different specimens from the same cases. Our table demonstrates clearly that *I. hominis* belongs to the very common parasites found in Ethiopia.

Discussion

Despite several case reports [Barksdale and Routh, 1948., Matsubayashi and Nozawa, 1948., Elsdon-Dew and Freedman, 1953., Routh *et al.*, 1955., Henderson *et al.*, 1963., French *et al.*, 1964., and Smitskamp and Oey-Muller, 1966.] on human isosporosis in some parts of the world, there is a considerable confusion in the literature on the *Isospora* species infecting humans. According to Reichenow (1925), Wenyon (1926) and Elsdon-Dew and Freedman (1953), there are at least two species of *Isospora* infecting man, the one being *I. belli* and the other *I. hominis*. To the present knowledge of the parasitologists, *Toxoplasma gondii* belonging to the genus *Isospora* causing infection in humans, deserves also a particular attention.

The identification and differenciation of the present coccidial parasite, *Isospora hominis*, are based on the taxonomical data proposed by Elsdon-Dew and Freedman (1953). Then we encountered in fresh stools as shown in Fig. 1, only fully developed single sporocysts and/or occasionally double sporocysts without any oocyst wall (Fig. 2). Furthermore, there are, in each sporocysts, four sporozoites and coarse residual body concentrated only in one of the polar areas. The general appearance and measurements of the mature sporocysts are within the range of those described by Elsdon-Dew and Freedman (1953). Further, the *I. belli* case observed recently by Asami and Akao *et al.* (1973) is quite distinct and different from that of ours.

On the other hand, Henderson *et al.* (1963) and others are of the opinion that all *Isospora* found in man can be treated as one species. It is, therefore, very difficult to say if the various case reports are caused by *Isospora belli* and/or *I. hominis*. It remains also unknown which one of the two morpholgically distinct *Isospora* species affects or induces the severer clinical manifestations in humans. There seems no doubt any more that there are more than one *Isospora* species involving man.

On this occasion, it is worthwhile to note that the fully developed sporocysts detected in dog stools are morphologically indistinguishable from those of *Isospora hominis* found commonly by the present authors in human

feces (Table 2). This finding reaffirms the description made by Reichenow (1925), Wenyon (1926), Elsdon-Dew and Freedman (1953) and others for *I. hominis*. Comparative studies on the pathogenecity, immunology and fine structure of those of *I. hominis* encountered in human and dog should be performed before a conclusion can be reached whether the two coccidial parasites belong to the same *Isospora* species or not.

As indicated in Table 1, in contrast to the general consensus, the authors conclude that *I. hominis* infection can not be considered to be rare any more. Then our monthly routine fecal examination demonstrates sufficiently that the detection of *I. hominis* is a common practice in our laboratory. It should be pointed out that the present study has been done in patients living in and around Addis where the sanitory conditions are relatively good. There seems no doubt that infection with *I. hominis* is considerably higher in the rural areas than that demonstrated in Table 1, because the hygenic conditions in the provinces are poorer than those in the Capital. An examination of mucosal biopsies of the small intestine might also show a higher infection rate with *I. hominis*. Animals such as dogs and others might possibly play a significant part in the epidemiology of human isosporosis.

To our knowledge, it is the first report dealing with the regular and routine detection of *I. hominis*. The most important factor for the common occurence of *I. hominis* in Addis seems to be the awarness that the stools being examined may contain the parasite. It appears that this coccidial organism was simply overlooked in the past. The routine clinical parasitology laboratory lacks often awarness and is not acquainted with *Isospora*. Furthermore, particularly in *I. hominis*, the oocyst wall is absent, and only the small fully developed single sporocysts measuring 13.5 by 10.2 microns are encountered in the stools, occasionally double mature sporocysts adhering to each other without oocyst wall were found.

The present authors point out that they regard *I. hominis* infection as genuine, because the mature sporocysts could be found over a period of days and weeks in different specimens from the same subjects. It might be unlikely that a repeated contamination could be responsible for the sporocysts appearing in the stool. It is hoped that further investigations on the immunology and fine structure would throw some light on the relationship between *I. hominis*, *I. bigemina* and *I. belli*.

Summary

Over 8.4% of the patients visited the ICL & RI, Addis, Abeba, Ethiopia, for fecal examination are encountered with *I. hominis*. Only fully developed sporocysts are found in fresh stools, and single sporocysts are commonly detected while two sporocysts adhering tightly are occasionally found but any visible oocyst wall. Oocysts were in none of the cases observed.

The mature sporocysts of the present coccidial organism measured about 10.2 by 13.5 microns. The general appearance and morphology of the sporocysts corespond to those described by Elsdon-Dew and Freedman (1953) and others. Morphologically similar forms, *I. bigemina*, to those passed by human patients are also found in dogs. Sporocysts of *I. hominis* and *I. bigemina* are compared to the immature and mature oocysts of *T. gondii* found in the stool of experimentally infected cat, because some investigators have pointed out similarity of the oocyst or sporocyst among these three species of *Isospora*. Definite difference was recognized morphologically between *T. gondii* and the other two species of *Isospora*.

I. hominis infection is quite common in Ethiopia and is not and any more justifiable to regard it as a rare occurrence. The authors conclude that because of lack of awarness, the parasites were overlooked in the past. Some of the patients infected with *I. hominis* have colicky abdominal pain, loss of appetite, discomfort and diarrhoea changing occasionally with constipation.

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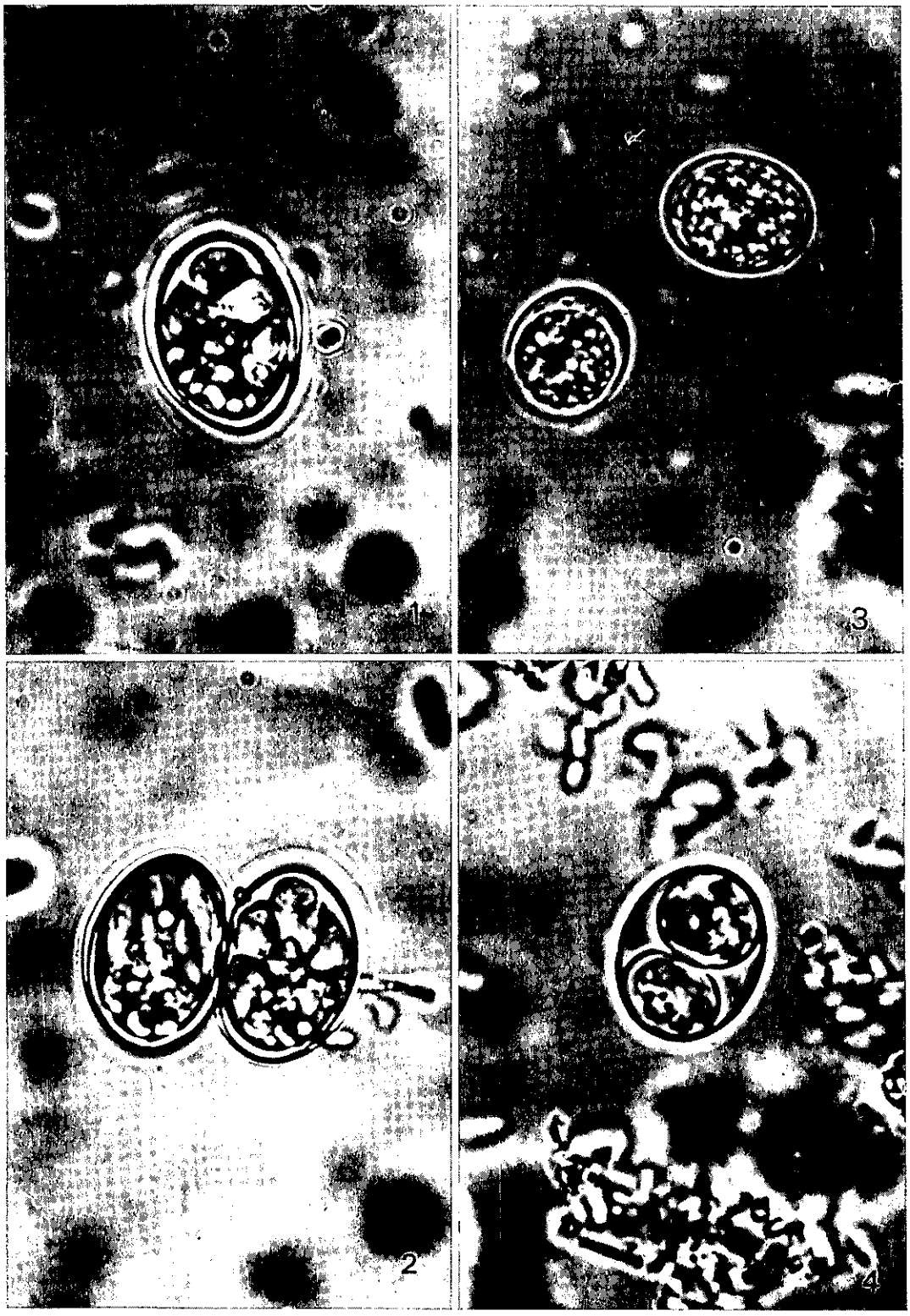
Explanation of Figures

Fig. 1 : Mature sporocyst of *I. hominis* (× 4500).
Fig. 2 : Occasionally found double sporocyst (mature) of *I. hominis* (× 4500).
Fig. 3 : Immature Oocyst of *T. gondii* from cat (× 4000).
Fig. 4 : Mature Oocyst of *T. gondii* from cat (× 4500).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エチオピアにおけるイソスポーラ・ホミニス感染の流行

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著者等はエチオピアにおいて，イソスポーラ・ホミニスの感染がごく普通にみられ，ICL & RI に来る患者の検便で平均8.4％にスポロシストが検出されることを報告する．このイソスポーラのスポロシストは新鮮便から検出時に十分発育しており4個のスポロツォイトが残体とともにみられる．その際オオシスト壁を有するものは全く検出されず単独のスポロシストあるいは稀に2個のスポロシストが密着した形で検出される．スポロシストの大きさは約10.2×13.5ミクロンである．イソスポーラ・ホミニスの形態については Elscon-Dew & Freedman (1953) 等2～3の研究者により報告されているが，著者等の観察したイソスポーラは過去の報告のそれとほぼ一致した．ヒトのイソスポーラ・ホミニス，イヌ，ネコのイソスポーラ・ビゲミーナ，ネコのトキソプラスマ・ゴンジーのオオシストあるいはスポロシストの類似性について過去に報告されているので，このイソスポーラのスポロシストを，ネコに感染せしめたトキソプラスマのオオシストおよびイヌに普通に見られるイソスポーラ (*I. bigemina*) のスポロシストと比較観察した．トキソプラスマ・オオシストの大きさは約10.6×12.5 μ で，イソスポーラ・ホミニスおよびイソスポーラ・ビゲミーナとは明らかに相違がある．イヌからのものの計測値，形態はヒトからのものに酷似した．イソスポーラ・ホミニスが検出され難い理由は感染者が少ないということではなく，それが極めて小さい為に検便に際して見落しがあるからであろう．一般にイソスポーラホミニス感染者の症状は腹痛，食欲不振，脂肪性下痢，不快感等である．