Comparison of the direct faecal smear and two thick smear techniques for the diagnosis of intestinal parasitic infections

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Abstract

Among 547 health centre patients in Burundi, the diagnostic performance of a glass coverslip modification of the Kato thick smear technique was compared with the combination of direct slide examination and the quick Kato–Katz method, currently recommended in basic health services, for the diagnosis of intestinal parasitic infections. The classical Kato-Katz method performed best for the diagnosis of common helminth infections, especially in combination with direct examination. For the diagnosis of protozoa, both trophozoites and cysts, the direct slide examination was superior to the glass coverslip technique. Despite its being a single and easy procedure, the glass coverslip technique could not be recommended as the method of choice for the diagnosis of intestinal parasites in basic health services.

Keywords: intestinal parasites, diagnosis, Kato–Katz method, faecal examination

Introduction

The Kato–Katz method (KATO & MIURA, 1954; KATZ *et al.*, 1972) is widely used for the field diagnosis of intestinal helminth infections. With this technique, a measured amount of stool (25–50 mg) is examined, approximately 10–20 times more than the quantity examined with the direct smear technique. It therefore considerably increases the diagnostic sensitivity and also permits a quantitative diagnosis. The Kato–Katz method is, however, not suitable for the detection of hookworm, protozoa and filariform larvae (e.g., *Strongyloides stercoralis*). It also has the disadvantage of requiring a certain clearing time. ENGELS *et al.* (1993) have shown that, in combination with direct slide examination, a quick variant of this method (PETERS *et al.*, 1980) can considerably improve the diagnosis of *Schistosoma mansoni* and common intestinal helminths in basic health services. This variant method takes only 45 min and is also suitable for hookworm detection. But even this quick Kato–Katz method remains relatively tedious in a health centre setting and some centres are reluctant to perform it. TEESDALE & AMIN (1976a, 1976b) and TEESDALE *et al.* (1985) have proposed a glass coverslip modification of the Kato thick smear method which can be examined immediately and is able to detect a wider range of intestinal parasites. We have tested, in 2 health centres in Burundi, the diagnostic performance of this method in comparison with the direct slide examination, the quick Kato–Katz method, and a combination of both techniques.

Table 1. Prevalences of common intestinal parasites detected by different techniques of faecal examination in 529 health centre patients in Burundi

Parasite	Prevalence (%) Coverslip technique	Direct examination	Kato–Katz technique	Direct examination +Kato–Katz technique
Helminths, eggs/larvae				
Schistosoma mansoni	35·3	17·2***	38·6	40·8**
Hookworm	23·3	16·1***	48·2***	49·1***
Ascaris lumbricoides	3·6	3·0	4·2	4·2
Strongyloides stercoralis	2·8	1·7	0·4	1·7
Trichuris trichiura	1·3	0·9	4·9***	4·9***
Taenia spp.	0·4	0·6	0·4	0·8
Enterobius vermicularis	0·2	–	–	–
Protozoa, trophozoites				
Enteromonas hominis	22·9	36·1***	–	36·1***
Giardia duodenalis	18·5	25·0***	–	25·0***
Entamoeba spp.	16·8	29·1***	–	29·1***
Trichomonas hominis	5·5	8·3*	–	8·3*
Chilomastix mesnili	2·5	3·8	–	3·8
Balantidium coli	0·2	0·2	–	0·2
Protozoa, cysts				
Entamoeba histolytica	25·1	31·0**	–	31·0**
Entamoeba coli	5·5	8·1*	–	8·1*
Giardia duodenalis	1·1	2·1	–	2·1

[a]Significance of differences between the results indicated and the coverslip technique is shown thus: *$P<0·05$, **$P<0·01$, ***$P<0·001$; all other values were not statistically significantly different.

Materials and Methods

We asked 547 patients visiting 2 rural health centres to supply a stool specimen, regardless of their complaints. Each specimen was examined by means of the 3 techniques by the same microscopist, who was unaware of the origin of each slide. Three experienced microscopists participated in the study.

The direct examination (one slide per person) was carried out without staining. The 25 mg Kato–Katz slide (KATZ *et al.*, 1972; PETERS *et al.*, 1980) was also prepared without staining and examined after 45 min. The glass coverslip technique involved sieving the stool and placing a measured aliquot (25 mg) on a microscope slide (2·5×7·5 cm), using the same template as in the Kato–Katz method. One drop of normal saline was

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Table 2. Comparison of the number of cases diagnosed by the combination of direct examination + Kato–Katz method, the coverslip technique, and both methods in 529 health centre patients in Burundi

Parasite	No. of cases diagnosed[a]			
	DE+KK only	CT only	CT and DE+KK	Total no. of cases
Helminths, eggs/larvae				
Schistosoma mansoni	64	35	152	251
Hookworm	147	10	113	270
Ascaris lumbricoides	4	1	18	23
Strongyloides stercoralis	4	10	5	19
Trichuris trichiura	22	3	4	29
Taenia spp.	3	1	1	5
Enterobius vermicularis	0	1	0	1
Protozoa, trophozoites				
Enteromonas hominis	96	26	95	217
Giardia intestinalis	56	22	78	156
Entamoeba spp.	88	22	69	179
Trichomonas hominis	25	11	19	55
Chilomastix mesnili	11	4	9	24
Balantidium coli	0	0	1	1
Protozoa, cysts				
Entamoeba histolytica	68	37	96	201
Entamoeba coli	26	12	17	55
Giardia intestinalis	5	0	6	11

[a]CT = coverslip technique, DE = direct examination, KK = Kato–Katz method.

added to this aliquot before covering it with a glass coverslip (2·0×2·5 cm). The slide was then turned upside down on a piece of blotting paper and gentle but firm pressure was applied to spread the stool in a thin layer. The sample was examined immediately under the microscope at a magnification of ×100, or ×400 when more precise identification of parasites was required. As the aim of the study was to test the value of the different diagnostic methods in a health centre setting, only qualitative diagnosis was considered.

Statistical testing of the difference between prevalences observed by the different techniques was done by means of the McNemar test for paired proportions. When fewer than 10 cases had different outcomes (positive or negative) with the 2 techniques, the binomial distribution was used to calculate the exact value of P.

Results

All 3 methods of faecal examination were conducted on 529 people; the results are summarized in Table 1.

Fewer helminth infections were detected with the direct examination than with the glass coverslip technique. This difference was most marked for *S. mansoni* and hookworm. The Kato–Katz technique, especially when combined with direct slide examination, gave better results than the glass coverslip technique for all helminth infections, apart from strongyloidiasis and enterobiasis. Direct stool examination was more sensitive for the diagnosis of protozoa than the glass coverslip technique. This was true for both vegetative forms and cysts, and the difference was most marked for enteromoniasis, giardiasis and amoebiasis.

The prevalences of *S. mansoni*, hookworm and *Taenia* species determined by the combination of direct examination and the Kato–Katz method were higher than those determined by a Kato–Katz slide only. Twelve cases of schistosomiasis, 5 of hookworm infection, and 2 of taeniasis were diagnosed by the direct slide method but not by the Kato–Katz technique. The numbers of cases diagnosed by the glass coverslip technique, the combination direct slide Kato–Katz slide, and both methods are compared in Table 2.

Discussion

Compared with direct examination, the Kato–Katz method is known to be more sensitive for the diagnosis of *S. mansoni*, *Ascaris*, *Trichuris* and *Taenia* infections. The quick variant of this method is also more sensitive for diagnosis of hookworm infection. Our results confirmed this, and also showed that a combination of both methods could further increase the sensitivity for infections with *S. mansoni*, hookworm and *Taenia* species.

The results also showed that the diagnostic performance of the combination of direct examination and a Kato–Katz slide was superior to the glass coverslip technique. This is particularly true for *S. mansoni* and hookworm, 2 important health problems in the area where the study was conducted. The glass coverslip technique performed better for strongyloidiasis only, a less common health problem in Burundi, and for enterobiasis, for which stool examination is not the diagnostic method of choice. Somewhat unexpected was the superior sensitivity of direct examination over the glass coverslip technique for the diagnosis of trophozoites and cysts of protozoa. This was possibly due to the fact that, without a clearing stage, the examination of a thick faecal smear is not easy. In fact, the microscopists complained about the difficulty of examining the glass coverslip preparations. The use of 2 microscope slides instead of a slide and a coverslip, as described by TEESDALE *et al.* (1985), may allow the stool to be spread out a little more, but it was impossible to examine such a 'glass sandwich' at magnification of ×400 with the microscopes routinely available in basic health services in Burundi.

The infections detected with different techniques were not necessarily the same (Table 2). This means that even the sensitivity of these 'improved' techniques is far from ideal, and health personnel should be aware that a person cannot with certainty be classified as uninfected on the basis of a single negative examination by one of these techniques.

The present study was intended to determine whether, in Burundi, the glass coverslip technique could replace, with advantage, the combination of direct and Kato–Katz examinations as the method of choice for the coprological diagnosis of intestinal parasites in basic health services. The glass coverslip technique has the advantage of being a single procedure, and would therefore considerably simplify the process and encourage its

adoption by health centres. Using the current procedure, the proportion of incomplete examinations is considerable in some centres, particularly in private health services and urban areas. This phenomenon seems to be related to both organizational aspects of health care and the system of payment in private health services, some of which charge extra for the additional Kato–Katz procedure. However, the results presented here do not provide enough evidence to advocate that health centres should start using the glass coverslip technique. It seems preferable to deal with the operational aspects leading to the failure of health centres to comply with the present guidelines rather than to introduce a new technique of examination.

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