

STOOL EXAMINATION AND RECTAL BIOPSY IN THE DIAGNOSIS AND EVALUATION OF THERAPY OF SCHISTOSOMIASIS MANSONI

Ana Lúcia Teles RABELLO (1), Roberto Sena ROCHA (1), João Paulo MENDES DE OLIVEIRA (2), Naftale KATZ (1) & José Roberto LAMBERTUCCI (2)

SUMMARY

From each of a group of 217 adult males selected through enzyme-immunoassay or skin-test (Group A), six stool samples were examined by both the Lutz/Hoffman, Pons & Janer (Lutz/HPJ) and Kato/Katz methods. In addition, one oogram of the rectal mucosa was performed. By these methods, schistosomiasis was detected in 44.7%, 47.5% and 40.1% of the individuals respectively.

To evaluate the methods in the assessment of cure, the last 40 patients from group A, treated with a single oral dose of oxamniquine at 15 mg/kg were followed up for six months (Group B). The criteria for parasitological cure included three stool examinations by Kato/Katz and Lutz/HPJ methods, one, three and six months post-treatment and a rectal biopsy between the fourth and sixth months post-treatment. The examinations were negative in 87.5%, 90% and 95% of the patients, respectively. The efficacy of oxamniquine was 82.5% when the three methods were considered together and there was no statistically significant difference between the sensitivity of the individual methods.

KEY WORDS: *Schistosoma mansoni*; Stool examination; Egg counts; Rectal biopsy; Oxamniquine.

INTRODUCTION

Parasitological methods, such as stool examination and oogram of the rectal mucosa, are recommended by scientific and governmental organizations for epidemiological studies, control programs and drug trials related to schistosomiasis mansoni³³.

Among the coproscopic techniques, spontaneous sedimentation in water, described by LUTZ²² and standardized by HOFFMAN et al.¹², and the method of KATO & MIURA¹³, modified by KATZ et al.¹⁸ offer the best sensitivity and performance characteristics^{5,6,7,30}.

The efficacy of stool examination was questioned at the beginning of the 1940s, when OTTOLINA & ATENCIO²⁶ first used the rectal mucosa fragments for the diagnosis of schistosomiasis. In the subsequent decades, several authors compared the efficacy of a number of coproscopic methods with the rectal mucosa biopsy (RB). It

was generally agreed that considering the presence of living eggs in rectal tissue as a sine qua non condition of factive infection and, if adequate approaches are carried out for preparation of feces, both rectal biopsy and stool examination are equally sensitive^{23,28}.

Therapeutic trials with oxamniquine primarily employed the three above mentioned techniques for the parasitological assessment of cure. In the 1980s, contradictions with respect to the efficacy of two schistosomicidal agents: oxamniquine and praziquantel, were found by one group of researchers that raised questions concerning to the reliability of the coproscopic methods^{8,9,10}.

The present work reports a comparative assessment of the coproscopic methods of Lutz/HPJ and Kato/Katz and RB, before and after oral treatment with oxamniquine.

(1) Centro de Pesquisas "René Rachou", Fundação Oswaldo Cruz, Brasil.

(2) Faculdade de Medicina, Universidade Federal de Minas Gerais, Brasil.

Address for correspondence: Dra. Ana Lúcia Teles Rabello. Centro de Pesquisas "René Rachou", Av. Augusto de Lima, 1.715, CEP 30190, Belo Horizonte, MG, Brasil.

PATIENTS AND METHODS

After informed consent, two hundred and seventeen adult males, aged between 18 and 25 (group A) were selected by immunological evaluation, performed in 410 recruit students of the military academy of Minas Gerais state. Skin test with 0.05 ml of 40 µg of adult worm antigen was used in 164 and 246 were tested by enzyme-immunoassay (ELISA) with soluble adult worm protein. Positivity was considered as the optical density higher than the medium plus two standard deviation of negative control in ELISA and as skin reaction with an area larger than 1.0 cm². Each recruit received six containers, labeled with name and number, and was asked to deliver feces in the early morning in a period of 10 days. RB and quantitative oogram were undertaken during the same period, in a blind manner.

All patients of group A with positive RB and/or stool examinations had the chronic intestinal form and were treated with a single oral dose of oxamniquine, 15 mg/kg of body weight, after a light snack, in the presence of examiners. Forty of them, from the last group of students, who were positive by all three methods were followed up (group B). Stool examinations were performed 30, 90 and 180 days after the drug administration by the Lutz/HPJ and Kato/Katz techniques on three consecutive days. RB was repeated between the fourth and sixth months of follow-up.

Lutz/HPJ method¹²: The samples were examined by the Lutz/HPJ method, on the same day as they were collected. With the aim of keeping the volume of the feces examined uniform throughout the study, flasks of Stoll were used. So, the amount of fecal material used for initial homogenizing was always taken as that which displaced 5 ml of the initial water volume. After the final sedimentation, 0.05 ml of sediment were examined on each slide, two slides for fecal sample. Samples showing live *S. mansoni* eggs were considered positive.

Kato/Katz method¹⁸: Two slides of 42 mg of feces per sample were examined using the Helmtest kit¹. The number of eggs per gram of feces was calculated from the arithmetic mean of the number of eggs counted in the two slides.

Oogram of the rectal biopsy: The RB was

performed according to OTTOLINA & ATENCIO²⁶. At least two fragments were taken from each rectal Houston's valve. The weight of the mucosa snips examined was calculated by measuring the difference of the slides' weight with and without the material taken. Each schistosomal element observed was recorded. Eggs were classified according to CANÇADO et al.³, except for the shells which were always considered dead elements.

Statistical analysis: For the comparison of positivity of repeated fecal samples, χ^2 with Yates' correction was utilized³¹. The McNemar's test was employed to evaluate the discordant frequencies between parasitological methods²¹. Pearson's coefficient of correlation analyzed the correspondence between the number of eggs in the rectal tissue and in the feces. Student's *t* test was used to compare means of weight and fragment number in the rectal biopsy²¹. The minimum level considered statistically significant was 95%^{21,31}.

RESULTS

Table 1 gives a general description of the parasitological results of the 217 persons of the group A.

Sixty-eight per cent of the individuals with positive immunological test showed schistosomal elements in at least one of the parasitological methods and, 51.2% showed active infection. On

Table 1.
Positivity for *S. mansoni* in the 217 persons of group A, evaluated by different parasitological methods.

Methods	positivity (n = 217)	
	Nº	(%)
Lutz/HPJ*	97	44.7
Kato/Katz*	103	47.5
RB (living eggs)	87	40.1
Lutz/HPJ-Kato/Katz-RB (living eggs)	111	51.2
RB (living or dead eggs)	143	65.9
Lutz/HPJ-Kato/Katz-RB (living or dead eggs)	147	67.7

* 6 samples

¹HELM - test. AK indústria e comércio Ltda, Belo Horizonte, Brasil

the Lutz/HPJ method, only one patient had dead eggs without the concomitant presence of living eggs.

There was no statistical difference in the weight of fragments used for rectal biopsy of the 87 positive patients before treatment (44.5 ± 2.4 mg) and 130 negative patients (43.5 ± 2.9 mg). The same holds true for the mean of the number of fragments in these patients: 13.1 ± 3.0 and 12.8 ± 2.6 ($p = 0.49$ for weight and $p =$ for number). This was also observed in the 40 treated patients: mean weight of fragments in the positive group = 43.8 ± 2.3 mg and in the negative group = 44.7 ± 2.8 mg; mean of fragments in the positive group = 14 ± 2.9 and in the negative group = 13.4 ± 3.1 ($p = 0.58$ for weight and $p = 0.71$ for number of fragments).

The comparative analysis of the sensitivity of the methods was undertaken by means of their discordance as shown in table 2 for the Kato/Katz

method and RB, in table 3 for the Lutz/HPJ and RB and in the table 4 for Kato/Katz and Lutz/HPJ methods.

One RB diagnosed more patients than one fecal examination by either Kato/Katz or Lutz/HPJ methods, but was as sensitive for the diagnosis of schistosomiasis as 2 to 5 coproscopies by the Kato/Katz and 2 to 6 examinations by the Lutz/HPJ method. Six stool examinations by Kato/Katz method diagnosed statistically higher number of infected patients than RB (tables 1 and 2).

The coproscopic methods were equally efficient in diagnosis of schistosomiasis when one to six samples were examined (table 4).

Increasing the number of the samples studied to three, both methods (Kato/Katz and Lutz/HPJ), diagnosed more positive patients than one exami-

Table 2.

Analysis of discordance between rectal biopsy and one to six stool examinations by the Kato/Katz method in the schistosomiasis diagnosis, in 217 individuals of group A.

Method	Rectal biopsy		χ^2*	p
	positive (%)	negative (%)		
Kato/Katz				
1 exam.				
Positive (%)	60 (27.6)	9 (4.1)	8.03	0.005
Negative (%)	27 (12.4)	121 (55.8)		
2 exams.				
Positive (%)	67 (30.9)	16 (7.4)	0.25	0.617
Negative (%)	20 (9.2)	114 (52.5)		
3 exams.				
Positive (%)	73 (33.6)	19 (8.8)	0.49	0.486
Negative (%)	14 (6.5)	111 (51.2)		
4 exams.				
Positive (%)	75 (34.6)	22 (10.1)	2.38	0.123
Negative (%)	12 (5.5)	108 (49.8)		
5 exams.				
Positive (%)	77 (35.5)	22 (10.1)	3.78	0.052
Negative (%)	10 (4.6)	108 (49.8)		
6 exams.				
Positive (%)	79 (36.4)	24 (11.1)	7.03	0.008
Negative (%)	8 (3.7)	106 (48.8)		

* Mc Nemar's test

Table 3.

Analysis of discordance between rectal biopsy and one to six stool examinations by the Lutz/HPJ method in the schistosomiasis diagnosis, in 217 individuals of group A.

Method	Rectal biopsy		χ^2*	p
	positive (%)	negative (%)		
Lutz/HPJ				
1 exam.				
Positive (%)	54 (24.9)	9 (4.1)	12.60	0.004
Negative (%)	33 (15.2)	121 (55.8)		
2 exams.				
Positive (%)	65 (30.0)	13 (6.0)	1.83	0.176
Negative (%)	22 (10.1)	117 (53.9)		
3 exams.				
Positive (%)	70 (32.3)	20 (9.2)	0.11	0.742
Negative (%)	17 (7.8)	110 (50.7)		
4 exams.				
Positive (%)	71 (32.7)	20 (9.2)	0.25	0.617
Negative (%)	16 (7.4)	110 (50.7)		
5 exams.				
Positive (%)	71 (32.7)	23 (10.6)	0.92	0.337
Negative (%)	16 (7.4)	107 (49.3)		
6 exams.				
Positive (%)	72 (33.2)	25 (11.5)	2.03	0.155
Negative (%)	15 (6.9)	130 (59.9)		

* Mc Nemar's test

Table 4.

Analysis of discordance between the Kato/Katz the Lutz/HPJ methods in the schistosomiasis diagnosis, in 217 individuals of group A.

Method	Kato/Katz		χ^2*	p
	positive (%)	negative (%)		
Lutz/HPJ				
1 exam.				
Positive (%)	51 (23.5)	12 (5.5)	0.83	0.361
Negative (%)	18 (8.3)	136 (62.7)		
2 exams.				
Positive (%)	68 (31.3)	10 (4.6)	0.64	0.424
Negative (%)	15 (6.9)	124 (57.1)		
3 exams.				
Positive (%)	79 (36.4)	11 (5.1)	0.42	0.838
Negative (%)	13 (6.0)	114 (52.5)		
4 exams.				
Positive (%)	83 (38.5)	8 (3.7)	1.14	0.286
Negative (%)	14 (6.5)	112 (51.6)		
5 exams.				
Positive (%)	86 (39.5)	8 (3.7)	0.76	0.383
Negative (%)	13 (6.0)	110 (50.7)		
6 exams.				
Positive (%)	91 (41.9)	6 (2.8)	1.39	0.238
Negative (%)	12 (5.5)	108 (49.8)		

* Mc Nemar's test

nation. Analysis of 4, 5 or 6 samples showed no statistically significant difference, when compared with 3 examinations (table 5).

Figure 1 shows the distribution of the patients infected with *S. mansoni*, per number of eggs per gram of tissue and per gram of feces.

Geometric mean of number of eggs per gram of feces was 53.7 ± 131.8 and of number of viable eggs in the rectal tissue was $630.9 \pm 3,801.9$.

A positive correlation ($r = 0.80$; $p < 0.0001$) was found between the logarithm of the number of living eggs in the rectal mucosa and the logarithm of the number of eggs in the feces (figure 2). The same was observed when a similar analysis was applied for living and dead eggs in the rectal tissue ($r = 0.72$; $p < 0.0001$).

In terms of therapeutic evaluation, the Kato/

Table 5.

Cumulative frequency of one to six stool examinations by the Kato/Katz and the Lutz/HPJ methods in 217 individuals of group A.

Nº of samples	Method (n = 217)			
	Kato/Katz		Lutz/HPJ	
	Nº	(%)	Nº	(%)
1	69	(31.8)*	63	(29.0)**
2	83	(38.2)	78	(35.9)
3	92	(42.4)*	90	(41.5)**
4	97	(44.7)	91	(41.9)
5	99	(45.6)	94	(43.3)
6	103	(47.5)	97	(44.7)

* $\chi^2 = 5.22$; $p = 0.02$

** $\chi^2 = 7.36$; $p = 0.0067$

Katz, Lutz/HPJ and RB demonstrated respectively 87.5%, 90.0% and 95.0% of the patients were cured. Whith the three methods combined the rate of cure of schistosomiasis by oxamniquine was 82.5%.

By discordance analysis, RB, Lutz/HPJ or Kato/Katz methods did not differ in the assessment of schistosomiasis cure. The RB and the Kato/Katz methods agreed in 37 (92.5%) patients, and diverged in three (7.5%) which were positive in the stool examinations and negative in the RB ($p = 0.25$). The Lutz/HPJ method disagreed with the RB in four (10.0%) patients, being three considered cured by RB and not-cured by stool examination and one (2.5%) exhibiting the opposite situation ($p = 0.65$).

The coproscopic methods differed in a single patient, who was considered cured by the Lutz/HPJ method and not-cured by the Kato/Katz method.

DISCUSSION

Similar results were obtained when Kato/Katz and Lutz/HPJ methods were used for the diagnosis of the schistosomiasis mansoni, when the same number of fecal samples were examined. Highest sensitivity was achieved in each case, when three samples were performed, which is an agreement with the observations of several authors^{5,6,7,23}.

In previous studies, three factors may have been responsible for the discrepancies between the comparative reported efficiencies of coproscopic

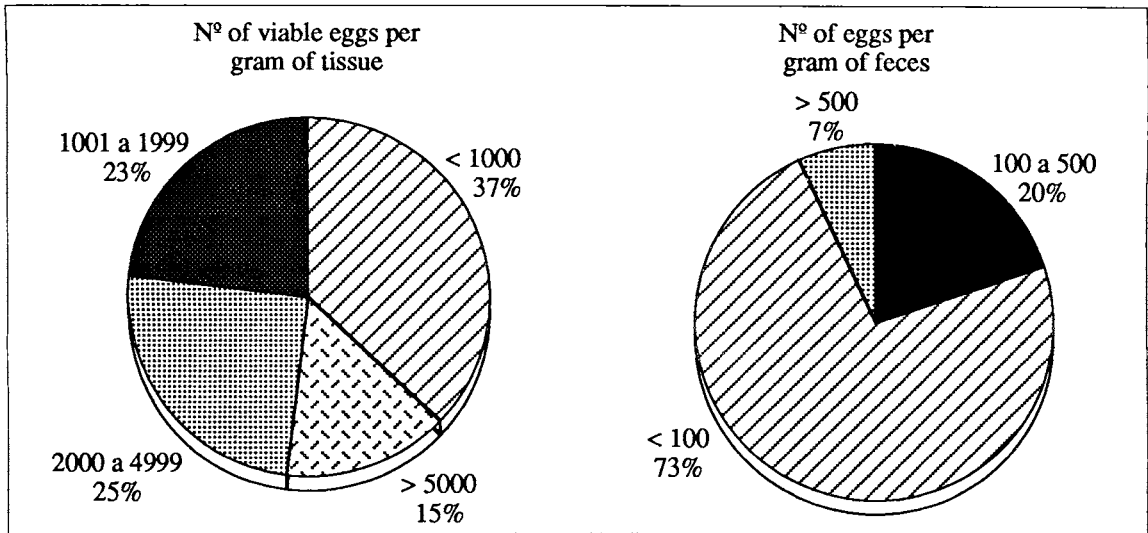


Fig 1 - Intensity of infection of positive patients of group A.

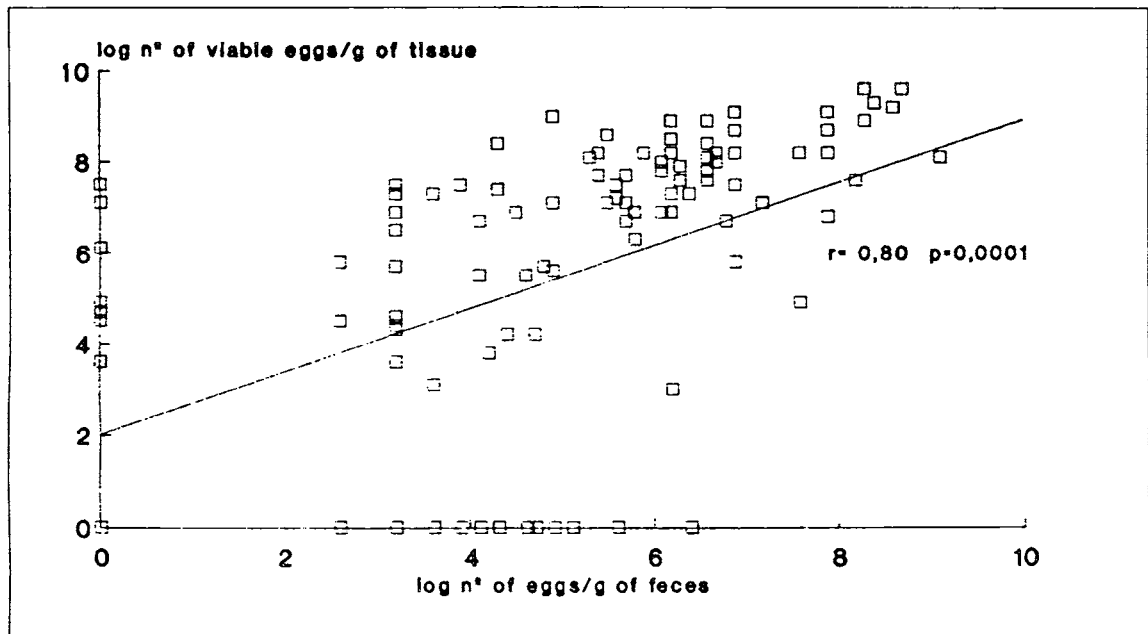


Fig 2 - Correlation between nº of eggs/g of faces and nº of viable eggs/g of tissue in 217 patientis of group A

method and the oogram of the rectal biopsy: i) the absence of uniformity of the criteria of positivity in RB, some authors considered the existence of schistosomal elements of any nature in the rectal tissue to indicate current infection^{26,32} while others defined activity by the existence of only living eggs in the mucosa²⁸; ii) the number of fecal samples and the parasitological method used and iii) the technical expertise of those performing the examinations.

Since the introduction of Kato/Katz quantitative methods the present report is the first work that compared rectal biopsy and stool examination for the diagnosis of schistosomiasis mansoni with several fecal samples and which evaluates not-selected individuals by one of the methods in the study.

With doses of 20 mg/Kg of body weight for children and of 10 - 15 mg/Kg for adults, various levels of therapeutic efficacy have been reported

using different methods of evaluation: - Lutz/HPJ: 50 - 95%^{2,4}; - Kato/Katz: 65 - 94%^{14,16,17,19,20,25,34} - Lutz/HPJ and Kato: 67 - 95%^{11,24,27,29}; - RB: 38%⁸; - Kato/Katz and RB: 85%²⁹; - Kato/Katz, Lutz/HPJ and RB: 23 - 100%^{9,29}.

In the present study, high correlation between number of eggs in the rectal tissue and in the feces was observed. Of 32 discordant results in group A, 24 (11.1%) were considered positive only by the coproscopic methods, all but one presenting less than 200 eggs per gram of feces. On the other hand, eight (3.7%) patients had only positive RB. They had less than 2000, and in six cases less than 1000, eggs per gram of rectal tissue.

For practical purposes the choice of diagnostic method has to be made in two distinct sets of circumstances: diagnosis of individual patients and population studies. For the care of the individuals, in hospital or as outpatients, the relatively low sensitivity of one stool examination may be remedied by an increase in the number of fecal samples examined. The quantitative technique of Kato/Katz is recommended by the WHO for determination of the prevalence and intensity of infection and evaluation of control of transmission and morbidity¹. The convenience and the short time required for slide preparation and the possibility transporting of the samples to places with appropriate facilities, makes the Kato/Katz technique the chosen method for epidemiological surveys in underdeveloped countries.

This present study shows the reliability of the coproscopic examination of three fecal samples by the Kato/Katz technique in conditions of low prevalence and intensity of infection and its usefulness in assessing the cure of human schistosomiasis mansoni. The therapeutic efficacy of oxamniquine in a single oral dose of 20 mg/Kg of body weight for the treatment of intestinal schistosomiasis in adults, when evaluated by the Lutz/HPJ, Kato/Katz or RB methods, was also confirmed.

RESUMO

Exame de fezes e biópsia retal no diagnóstico e controle de cura da esquistossomose mansoni

Em um grupo de 217 adultos do sexo masculino selecionados através de ELISA ou intradermo-reação, realizaram-se seis exames de fezes pelos métodos de Lutz/Hoffman, Pons e Janer (Lutz/

HPJ) e Kato/Katz e um oograma da mucosa retal, observando-se positividade em 44,7%, 47,5% e 40,1%, respectivamente.

A análise comparativa dos resultados mostrou: 1) aumento da sensibilidade de ambos os métodos de exames de fezes até a terceira amostra examinada; 2) maior sensibilidade da biópsia retal quando comparada ao exame de uma única amostra fecal pelos métodos de Lutz/HPJ ou Kato/Katz; 3) igual sensibilidade pelo exame de duas a cinco amostras fecais pelo método de Kato/Katz ou duas a seis amostras pelo método de Lutz/HPJ e a biópsia retal; 4) sensibilidade superior de seis amostras fecais pelo método de Kato/Katz, quando comparado à biópsia retal; 5) igual sensibilidade entre o mesmo número de amostras examinadas pelos métodos de Lutz/HPJ e Kato/Katz.

Para avaliar a cura parasitológica, os últimos 40 pacientes do grupo A, tratados com oxamniquine oral, dose única, 15 mg/kg foram acompanhados durante seis meses (Grupo B). O controle de cura incluiu três exames de fezes mensais, pelos métodos de Lutz/HPJ e Kato/Katz no 1º, 3º e 6º meses e uma biópsia retal, entre o 4º e 6º meses após o tratamento. Os exames foram negativos em 87,5%, 90,0% e 95,0% dos pacientes tratados e avaliados pelos métodos de Kato/Katz, Lutz/HPJ e biópsia retal, respectivamente. O percentual de cura com a oxamniquine foi de 82,5%, quando considerados os três métodos de controle parasitológico associados e, não houve diferença estatística entre o número de casos considerados curados por um deles.

ACKNOWLEDGEMENTS

We thanks Gercy de Souza Morais and Aureo Almeida Oliveira for their technical assistance.

REFERENCES

1. BEAVER, P.C. - Evaluation of Kato thick-smear technique for quantitative diagnosis of helminth infections. *Amer. J. trop. Med. Hyg.*, 17: 382-391, 1968.
2. BINA, J.C. & PRATA, A. - Tratamento da esquistossomose com oxamniquine (xarope) em crianças. *Rev. Soc. bras. Med. trop.*, 9: 175-178, 1975.
3. CANÇADO, J.R.; CUNHA, A.S.; CARVALHO, D.G. & CAMBRAIA, J.N.S. - Evaluation of the treatment of human *Schistosoma mansoni* infection by the quantitative oogram technique. *Bull. Wld. Hlth. Org.*, 33: 557-566, 1965.

4. CARVALHO, S.A.; AMATO NETO, V.; ZEITUNE, J.M.R.; SHIKANAI-YASUDA, M.A. & TAKIGUTI, C.K. - Avaliação terapêutica do oltipraz na infecção humana pelo *S. mansoni*. *Rev. Inst. Med. trop. S. Paulo*, 28: 271-277, 1986.
5. CHAIA, G.; CHAIA, A.B.; McSULLIFE, J.; KATZ, N. & GASPER, D. - Coprological diagnosis of schistosomiasis. II - Comparative study of quantitative methods. *Rev. Inst. Med. trop. S. Paulo*, 10: 349-353, 1968.
6. CHAVES, A.; ALCANTARA, O.S.; CARVALHO, O.S. & SANTOS, J.S. - Estudo comparativo dos métodos coprológicos de Lutz, Kato-Katz e Faust modificado. *Rev. Saúde públ. (S. Paulo)*, 13: 348-352, 1979.
7. COURA, J.R. & CONCEIÇÃO, M.R. - Estudo comparativo dos métodos de Lutz, Kato e Simões Barbosa no diagnóstico coprológico da esquistossomose mansoni. *Rev. Soc. bras. Med. trop.*, 8: 153-158, 1974.
8. CUNHA, A.S. - A avaliação terapêutica da oxamniquine na esquistossomose mansoni humana pelo método do oograma por biópsia de mucosa rectal. *Rev. Inst. Med. trop. S. Paulo*, 24: 88-94, 1982.
9. CUNHA, A.S. & PEDROSA, R.S. - Double-blind therapeutical evaluation based on the quantitative oogram technique, comparing praziquantel and oxamniquine in human schistosomiasis mansoni. *Rev. Inst. Med. trop. S. Paulo*, 28: 337-351, 1986.
10. CUNHA, A.S.; CANÇADO, J.R. & REZENDE, G.L. - Therapeutical evaluation of different dose regimens of praziquantel in schistosomiasis mansoni, based on the quantitative oogram technique. *Rev. Inst. Med. trop. S. Paulo*, 29: 295-304, 1987.
11. DOMINGUES, A.L.C. & COUTINHO, A. - Tratamento da esquistossomose mansônica com oxamniquine oral. *Rev. Inst. Med. trop. S. Paulo*, 17: 164-180, 1975.
12. HOFFMAN, W.A.; PONS, J.A. & JANER, J.L. - Sedimentation concentration method in schistosomiasis mansoni. *Puerto Rico J. publ. Hlth.*, 9: 283-298, 1934.
13. KATO, K. & MIURA, M. - Comparative examinations. *Jap. J. Parasit.*, 3: 35, 1954.
14. KATZ, N.; GRIMBAUM, E.; CHAVES, A.; ZICKER, F. & PELLEGRINO, J. - Clinical trials with oxamniquine, by oral route, in schistosomiasis mansoni. *Rev. Inst. Med. trop. S. Paulo*, 18: 371-377, 1976.
15. KATZ, N. - Chemotherapy of schistosomiasis mansoni. *Advanc. Pharmacol. Chemother.*, 14: 1-70, 1977.
16. KATZ, N.; ZICKER, F. & PEREIRA, J.P. - Field trials with oxamniquine in schistosomiasis endemic area. *Amer. J. trop. Med. Hyg.*, 26: 234-237, 1977.
17. KATZ, N.; PELLEGRINO, J.; GRIMBAUM, E.; CHAVES, A. & ZICKER, F. - Novos ensaios clínicos com a oxamniquine, um novo agente esquistossomicida. *Rev. Inst. Med. trop. S. Paulo*, 15 (supl. 1): 120-125, 1973.
18. KATZ, N.; CHAVES, A. & PELLEGRINO, J. - A simple device for quantitative stool thick smear technique in schistosomiasis mansoni. *Rev. Inst. Med. trop. S. Paulo*, 14: 397-400, 1972.
19. KATZ, N. & ROCHA, R.S. - Double-blind clinical trial comparing praziquantel with oxamniquine in schistosomiasis mansoni. *Rev. Inst. Med. trop. S. Paulo*, 24: 310-314, 1982.
20. LAMBERTUCCI, J.R.; GRECO, D.B.; PEDROSO, E.R.P.; ROCHA, M.O.C.; SALAZAR, H.M. & LIMA, D.P. - A double blind trial with oxamniquine in chronic schistosomiasis mansoni. *Trans. roy. Soc. trop. Med. Hyg.*, 76: 751-755, 1982.
21. LILLENFELD, A.M. & LILLENFELD, D.E. - *Foundations of Epidemiology*. 2 ed. New York, Oxford University Press Inc., 1981.
22. LUTZ, A. - *Schistosomum mansoni* and schistosomiasis observed in Brazil. *Mem. Inst. Oswaldo Cruz*, 11: 109-140, 1919.
23. MARTINS, A.V. - Sobre a pesquisa de ovos de *Schistosoma mansoni* pelo método da sedimentação-concentração. *Brasil méd.*, 51: 319-321, 1937.
24. MOURA, H.; NISQUER, H.; BICHARRA, S.; DOMINGUES, L.C. & COUTINHO, A. - Tratamento da esquistossomose mansônica nas crianças com oxamniquine na forma de xarope. *Rev. Soc. bras. Med. trop.*, 10: 250-259, 1979.
25. NOZAIS, J.P. - Estudo de quinze meses de duração sobre a eficácia de dose única de 15 mg/kg de Vansil na esquistossomose mansoni em área endêmica. *Rev. Inst. Med. trop. S. Paulo*, 22 (supl. 4): 168-174, 1980.
26. OTTOLINA, C. & ATENCIO, H.M. - Nuevos caminos para o diagnóstico clínico preciso de la schistosomiasis mansoni. *Rev. Policlín. Caracas*, 12: 1-35, 1943.
27. PEDRO, R.S.; AMATO-NETO, V.; RODRIGUES, M.S.M.; MAGALHÃES, L.A. & LUCA, R.S. - Tratamento da esquistossomose mansônica por meio da oxamniquine: estado atual de nossas observações. *Rev. Inst. Med. trop. S. Paulo*, 19: 130-137, 1977.
28. PRATA, A. - *Biópsia retal na esquistossomose mansoni: bases e aplicações no diagnóstico e tratamento*. Bahia, 1957. (Tese de cátedra - Faculdade de Medicina da Bahia).
29. SILVA, L.C.; ZEITUNE, J.M.R.; ROSA-EID, L.M.F.; ANTONELLI, R.H.; CHRISTO, C.H.; SAEZ-ALQUEZAR, A. & CARBONI, A.C. - Treatment of patients with schistosomiasis mansoni: a double blind clinical trial comparing praziquantel with oxamniquine. *Rev. Inst. Med. trop. S. Paulo*, 28: 174-180, 1986.
30. SLEIGH, A.; HOFF, R.; MOTT, K.E.; BARRETO, M.; PAIVA, T.M.; PEDROSA, J.S. & SHERLOCK, I. - Comparison of filtration staining (Bell) and thick-smear (Kato) for the detection and quantification of *Schistosoma mansoni* eggs in faeces. *Trans. roy. Soc. trop. Med. Hyg.*, 76: 403-406, 1982.

31. SNEDECOR, G.W. & COCHRAN, W.G. - *Statistical Methods*. 6 ed. Iowa, The Iowa State University Press, 1977.
32. URDANETA, A.R. - La biópsia rectal como prueba diagnóstica de la bilharziasis mansoni. *Rev. Policlin. Caracas*, 14: 325-344, 1945.
33. WORLD HEALTH ORGANIZATION - Epidemiology and control of schistosomiasis. Geneva, 1985. (Technical Report Series, 728).
34. ZWENGENBERGER, K.; NOGUEIRA-QUEIROZ, J.A.; POGGENSEE, U.; ALENCAR, J.R.; VALDEGUNAS, J.; ESMERALDA, F. & FELDMEIER, H. - Efficacy of oxamniquine, praziquantel and a combination of both drugs in schistosomiasis mansoni in Brazil. *Rev. Inst. Med. trop. S. Paulo*, 29: 305-311, 1987.

Recebido para publicação em 13/03/1992.
Aceito para publicação em 29/09/1992.