We are IntechOpen, the world's leading publisher of Open Access books Built by scientists, for scientists

4,800
Open access books available

122,000
International authors and editors

135M
Downloads

Our authors are among the

154
Countries delivered to

TOP 1%
most cited scientists

12.2%
Contributors from top 500 universities

CLARIVATE ANALYTICS BOOK CITATION INDEX INDEXED

WEB OF SCIENCE™

Selection of our books indexed in the Book Citation Index in Web of Science™ Core Collection (BKCI)

Interested in publishing with us?
Contact book.department@intechopen.com

Numbers displayed above are based on latest data collected.
For more information visit www.intechopen.com

9

Epidemiology of Schistosomiasis Mansoni in Brazil

Maria José Conceição and José Rodrigues Coura
[1]*Faculdade de Medicina da Universidade Federal do Rio de Janeiro-UFRJ,. Doctor- Serviço de Doenças Infecciosas e Parasitárias-Hospital Universitário Clementino Fraga Filho, Departamento de Medicina Preventiva da Faculdade de Medicina- UFRJ, Professor from Curso de Pós-Graduação em Doenças Infecciosas e Parasitárias-UFRJ*
[2]*Fundação Oswaldo Cruz- Fiocruz- Ministério da Saúde-Brasil. Laboratório de Doenças Parasitárias*
Brasil

1. Introduction

The present chapter emphasized the historical aspects of *Schistosoma mansoni* infection in Brazil. It was introduced in the state of Bahia, possibly during the traffic of slaves infected by the parasite, and the disordered migratory movements from Northeast region towards the Southeast and South regions contributed significantly for infection expansion; another contributing factor was the sugar cane culture. The sectional and longitudinal surveys pointed out high levels of prevalence and morbidity due to aspects related to race, age, sex, occupation, parasite load, specific treatment and reinfection. Treatment with oxamniquine has been shown non-responsive in groups of patients, and the use of praziquantel for more than three decades has begun to reveal therapeutic failure. Support for the researches about new drugs is critical. The decrease in the prevalence rates as well as in the severe forms, though without reaching the transmission control goals, should be considered an alert sign for schistosomiasis not being neglected in the country.
The Brazilien authors have concluded in different endemic areas of Brazil that the indices of prevalence and morbidity are reducing, however the transmission control keeps the same high levels. On recommend the implementation of multiple measures as people should continue to receive treatment, improve sanitation conditions, potable water supply, and education in health, besides to avoid the frequent reinfections.

2. Key results

This chapter aims to provide some advances in reducing the rates of prevalence and morbidity of Schistosomiasis mansoni in many areas in Brazil, including Minas Gerais, Bahia, Pernambuco, Alagoas, Paraíba, Rio Grande do Norte and Sergipe, since these areas present high prevalence and severe hepatosplenic clinical forms.
The introduction of a Special Program for Schistosomiasis Control based on mass chemoprophylaxis, in 1976, changed the disease course. Sectional and longitudinal studies

developed by Brazilian researchers have contributed considerably for that purpose, due to specific treatment, education for health, and use of molluscicides in some areas.
Reinfection has been identified as one of the main factors related to the failure of infection transmission control.

3. Objectives

This chapter aims to analyze:

1. The source of infection by *S. mansoni* in Brazil, and the factors that led to its expansion toward vast areas of the territory,
2. The contribution of studies developed by Brazilian authors in different endemic areas and their impact on disease current situation,
3. Specific treatment with Oxamniquine or Praziquantel, and patients that present treatment failure.

4. Research methods

The research methods used for preparing this Chapter were based on articles written by our group and by other authors in literature on the topic Epidemiology of Schistosomiasis in Brazil, which were published in journals, national and international books, Master and Ph.D thesis, available at Internet, at Oswaldo Cruz Foundation-Fiocruz Libraries, and at the Faculty of Medicine of Federal University of Rio de Janeiro-UFRJ. Protocols and records used in clinic and in endemic areas, with the inhabitants clinical specifications and socio-economic conditions, with the sanitary situation of residences, maps with residences numbers, water streams localization and the specification of the productive seasons of mollusks of genus *Biomphalaria spp*. It also employed the statistical analysis methods for evaluating whether the results obtained presented significant differences.

4.1 The source of infection by *S. mansoni* in Brazil, and the factors that led to its expansion toward vast areas of the territory

Data on infection by *Schistosoma mansoni* in Brazil, a disease that affects around six million people, have obtained, since its initial phase, high emphasis in international scientific literature, due to the great number of affected municipalities. The increasing infection rates are directly related to the disorderly migratory movements that brought many inhabitants, especially those from the northeastern states towards the southeastern and south regions, creating new foci of infection in areas yet unaffected (Neiva 1947). The presence of the intermediate hosts *Biomphalaria glabrata, B. tenagophyla* and *B. straminea* in these regions facilitated the maintenance of the infection. It was emphasized the high prevalence, besides the severity and diversity of clinical forms, affecting mainly the age groups that were in productive phase. A follow-up study of fifteen-years was carried out in a locality of Paracambi.
It is estimated that, in Brazil, the disease has been introduced in Bahia, soon after the country discovery (1500), through the commerce of slaves infected by the parasite. Pirajá da Silva (1908) is considered the discoverer of *Schistosoma mansoni* in South America, after assisting an infected patient, at Bahia. Since 1904, he observed a lateral spicule in the worm eggs found in the feces of his patients, differently from the terminal spicule seen in eggs of *Schistosoma haematobium,* registered at that time, in Egypt, in patients with hematuria,

characterizing schistosomiasis haematobium. Lutz confirmed its initial discovery as he found out, during the autopsies of patients who passed away due to severe infection by *S. mansoni,* female mated worms, in the portal vein, with egg-endowed lateral spicule. In 1919, Lutz described the evolving forms of the parasite.

Uncontrolled migration may be related to outbreaks of *S. mansoni* focus in the northeast of the State of Santa Catarina (Schlemper Junior et al. 1996), and in the Southern most Brazilian State, Rio Grande do Sul (Graeff-Teixeira et al. 1999).

The transmission of *S. mansoni* infection in some touristic rural places in endemic areas of Minas Gerais was detected in 17 people with toxemic form of the disease, after a bath in a swimming pool, where there was infected *B. glabrata* (Enk et al. 2004). Also in Minas Gerais, Massara et al. (2008) confirmed the diagnosis of schistosomiasis infection in visitors who frequented ecotourism area. In a touristic beach of Pernambuco, Brazil, Barbosa et al. (2001) described an outbreak of acute schistosomiasis.

A follow-up study of fifteen-years was carried out in a locality of State of Rio de Janeiro, aiming to evaluate *S. mansoni* prevalence between 1360 inhabitants. The results showed 1.0%, of positivity. The authors concluded that over the years, it remained as a low prevalence area (Igreja et al. 2010). Other areas in the Rio de Janeiro State, also presented low infection levels reached and maintained by *Nectomys squamipes* rodents (Soares et al. 1995).

4.2 The contribution of studies developed by Brazilian authors in different endemic areas and their impact on the current situation of disease

Since 1908 there was two main stages regarding the disease study in Brazil. One aimed to detect the prevalence of infection and its clinical manifestations, and the other intended to understand the evolution of infection in the different areas over the years, as well as the main determining factors for the severity of clinical forms. Penna, cited by Lutz (1916), reported the infection in the School for Sailors, in Rio de Janeiro, which received students coming from Bahia, Sergipe, Alagoas and Rio Grande do Norte, but mostly from Sergipe and Pernambuco (Lutz and Penna, 1918).

After that Maciel (1925), studying a group of sailors, found higher rates in those originated from Alagoas (34.6%), in comparison to those from Sergipe (32.7%), Bahia (23%), and finally Minas Gerais (2.9%). Cançado (1929) defined the main foci of infection in Minas Gerais. In 1937, Gilberto Freyre analyzed the main foci of infection in Pernambuco and Bahia, and the interference of sugar cane culture zones on the infection expansion, highlighting the intense migratory movements and the impact of disease spreading. He emphasized ¨the dissemination route¨ toward Southeast and South regions, through infected individuals coming from the Northeast, Bahia and Minas Gerais.

Different epidemiological investigations unfolded, as Martins & Versiani (1938) in Minas Gerais; Meira (1947) in migrants settled in São Paulo; Pellon & Teixeira (1950) in students of 11 states (they were the first to delimit the endemic areas in the country); and Pessoa & Barros (1953) who conducted a survey with 1500 inhabitants of Sergipe.

Longitudinal studies were initiated by Jansen (1946), who assessed the prevalence of *S. mansoni* in a population of Pernambuco, between 1937 and 1941, and started to treat children and adults with antimonial drugs. Sette (1953), in a review of the same group, from 1942 to 1951, revealed that 1.7% of treated individuals developed hepatosplenic form, while this rate reached 9.9% in the untreated group. Brener and Mourão (1953) worked in five different

areas of Minas Gerais, which were reviewed ten years later, by Katz & Brener (1966). These authors found that less than 10% of hepatointestinal forms evolved to hepatosplenic forms, and among these, 25% had decompensation. Klöetzel & Klöetzel (1958), and Klöetzel (1966), in a municipality of Pernambuco, followed inhabitants evolutionarily, correlating severe clinical forms to higher parasite load. He concluded, in an original way, that chemoprophylaxis, in children and adolescents under severe risk of infection, constituted an effective measure for preventing progression to severe clinical forms. In 1958, Barbosa (1966) began to study four localities in Pernambuco, and only in one of them he introduced sanitation measures and use of molluscicides. In comparison with the others, it was observed a significant reduction of infection. Prata & Bina (1968) in Bahia, found no decrease in prevalence after five successive reviews.

Since 1974, Coura et al. (1984) conducted evolutionary surveys, involving 3782 inhabitants from four counties of Rio Doce and Jequitinhonha Valleys, Minas Gerais, of which 47.3% were infected and 78.4% were treated, with infection recurrence and reduction of parasite load in all municipalities. Also in Minas Gerais, Conceição & Borges-Pereira (2002), Conceição et al. (2007), following up, in evolutionary terms, individuals for a period up to 30 years, in the longer term study conducted in Brazil, found out that there were decrease in prevalence and hepatosplenic forms, although without success in the transmission control, attributed to reinfections. These results corroborate the conclusions presented by Andrade (1998) pointing out a remarkable improvement in the scenario of disease prevalence and severe forms in Brazil.

Klöetzel (1992) in a district of Alagoas concluded that the transmission was primarily peridomestic through the pollution of open ditches and some collections of water that required modest investments for the control. The measures have brought about the decline in the prevalence of schistosomiasis in the Northeast Brazil.

In Minas Gerais, from 2008 to 2010, in two areas located in Rio Doce and Jequitinhonha Valleys, Carlôto (2011) showed in a total of 288 and 257 inhabitants, 22,9% and 20,2 %, respectively, of infection. It was emphasized the high prevalence rates, mainly in males and young people, besides a low intensity of infection, and the lack of sanitary conditions that indicated towards immediate control actions in both areas, including education in health.

In a recent study carried out in one area of Maranhão, Brazil, Santos & Melo (2011) observed a schistosomiasis prevalence of 3.2% and 8.3 % of positivity in *B. glabrata*, raising control measures in the area. Drumond et al. (2010) have emphasized the program of surveillance for schistosomiasis control in Minas Gerais, Brazil, and the improvement related to the morbidity. Clinical and histopathological contributions came from the studies of Lenzi et al. (1998), Cheever et al. (2002), and Lambertucci et al. (2005), respectively. An important advance in the understanding of the intermediate hosts of the infection has been achieved by Carvalho et al. (2008), and Paraense (2008).

In the Fig. 1 are represented the nineteen States of Brazil with transmission of *S. mansoni* infection. The states of Northeast present the highest levels of prevalence alongside the states of Bahia and Minas Gerais. Some states have foci of infection, and are not endemic areas, like Rio Grande do Sul, Santa Catarina, Paraná, São Paulo, Distrito Federal, Rio de Janeiro, Piauí, Maranhão and Pará.

Figure 2 shows the prevalence of *S. mansoni* in a municipality of Minas Gerais, Brazil, studied by our working group up for more than thirty years, is observed on an ongoing basis the highest prevalence rates in males compared to females.

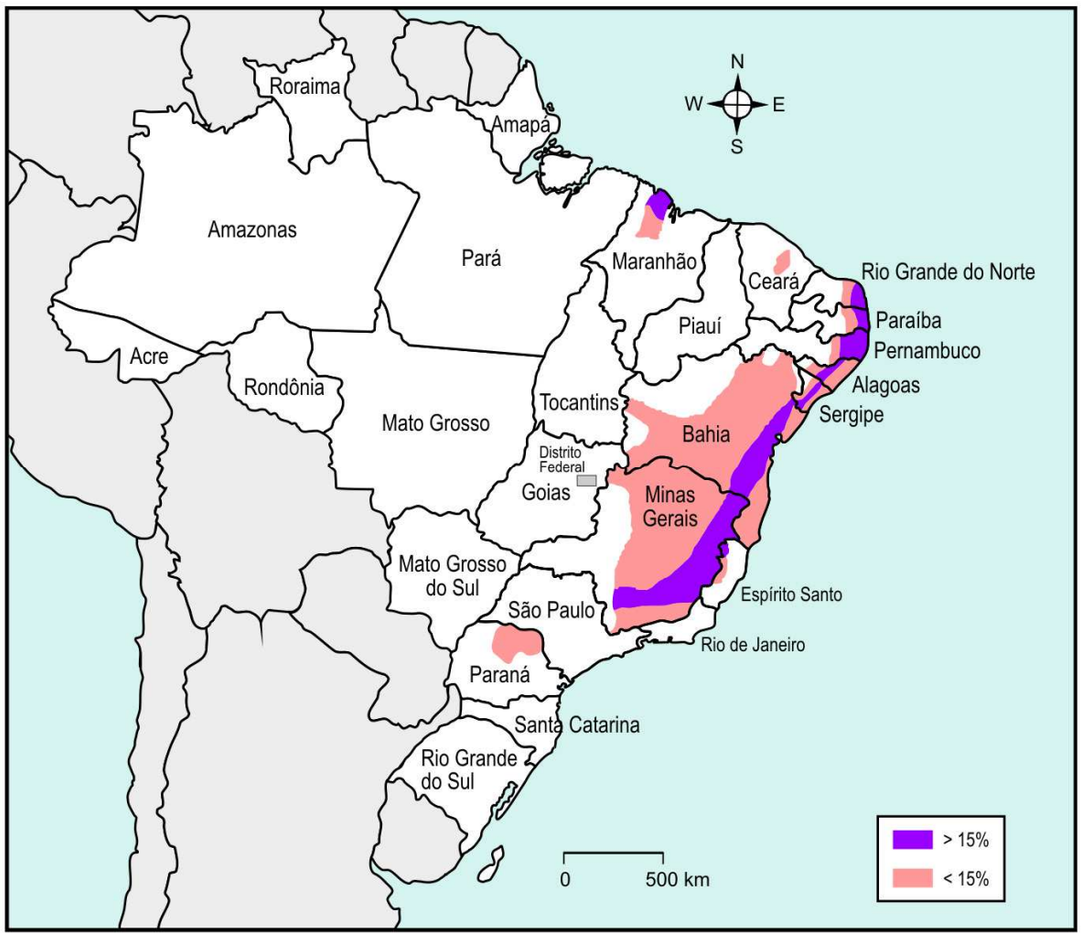


Fig. 1. States of Brazil with transmission of *S. mansoni* infection

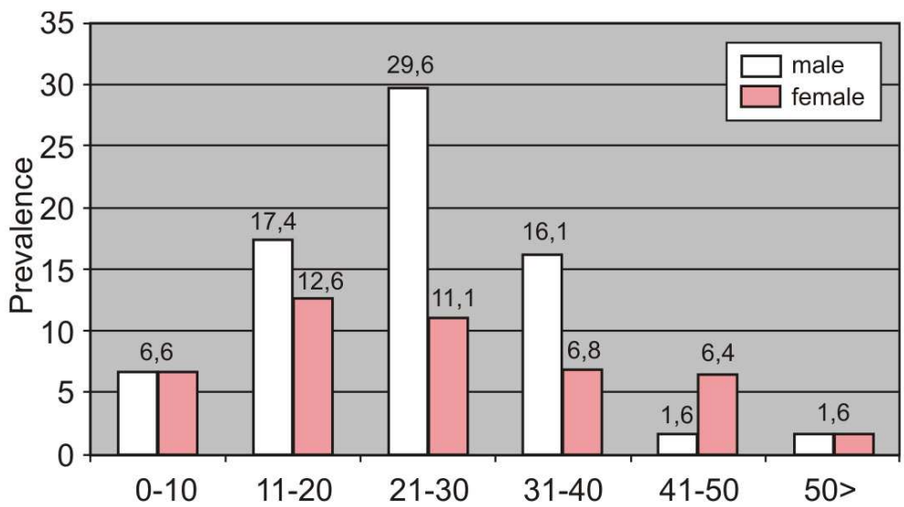


Fig. 2. Prevalence of *Schistosoma mansoni* in a Municipality of Minas Gerais, Brazil, according to age and gender.

4.3 Specific treatment with oxamniquine or praziquantel, and the cases of patients that present treatment failure

Since 1978 until today, patients with the disease have been treated and followed up at University Hospital-UFRJ. They were diagnosed in the period from 1985 to 2001 and constitute a group of 102 patients with hepatosplenomegaly, of which 63% were male, from the municipality of Capitão Andrade, Minas Gerais (n=26), where we worked since 1973, and from different Brazilian regions (n=76). It must be emphasized that young patients between 11 and 14 years old, with splenomegaly, showed regression of the spleen, only with specific treatment. In the other cases, surgical indications were due to gastrointestinal hemorrhage resultant from esophageal varices rupture, hypersplenism, abdominal pain and discomfort, and hypogonadism (Conceição et al. 2002).

Treatment with oxamniquine showed no response in 10.3% of patients, and treatment failure was experimentally confirmed (Katz et al. 1973, Conceição et al. 2000). Regarding praziquantel, it was presented a patient that underwent to three successive treatments and was still eliminating eggs of *S. mansoni* (Conceição et al. 2010). The publications on patients with lack of response to oxamniquine and, more recently, to praziquantel must encourage further support for researches on the synthesis of new drugs.

In a municipality of Minas Gerais, Sarvel et al. (2011) evaluated the variation of prevalence after successive treatments with oxamniquine and praziquantel, and verified a reduction of 70.4% (1981) to 1.7% (2005). The variation of hepatosplenic form in the same period was 7% to 1.3%. The authors concluded that to reach best results it was necessary to improve the sanitary conditions as well as give specific treatment. Similar discussions on schistosomiasis mansoni control were emphasized by WHO (2002), Coura & Amaral (2005), Rey (2007), Katz & Coelho (2008), and by Coura & Conceição (2010), showing the Brazilian contribution on the clinical therapy.

Co-morbidities like infections by hepatitis B and C virus, *Salmonella spp*. and other enterobacteria may add worse prognostic in the clinical evolution of schistosomiasis. The follow-up study of ten patients, including one who was eleven years old, infected by *S. mansoni* and *Salmonela infantum,* revealed prolonged fever, abdominal pain, diarrhoea, hepato and splenomegaly. There was regression of symptoms after treatment of both infections (Conceição et al. 2009).

5. Conclusion

The Brazilien authors have concluded in different endemic areas of Brazil that the indices of prevalence and morbidity are reducing, however the transmission control keeps the same high levels. On recommend the implementation of multiple measures as people should continue to receive treatment, improve sanitation conditions, potable water supply, and education in health, besides to avoid the frequent reinfections.

The transmission control of Schistosomiasis mansoni infection in Brazil did not improve and that has been showed in nineteen different endemic areas of the country and in areas with focal transmission. Although the levels of prevalence and morbidity have presented reduction, on emphasize the necessity of the widest prevention measures acting on all elements of the natural history of disease: the agent, host and environment. Preventing schistosomiasis has been overlooked and created health problems, mainly with the population of the rural areas.

6. References

Andrade Z 1998. The situation of hepatosplenic Schistosomiasis in Brazil. Mem Inst Oswaldo Cruz 93 (Suppl. I): 58-75.

Barbosa 1966. Morbidade da Esquistossomose. Estudo em quatro localidades no Estado de Pernambuco. Rev Bras Malar D Trop 3: 3-159.

Barbosa CS, Domingues ALC, Abath F, Montenegro SML, Guida U, Carneiro J. 2001. Epidemia de esquistossomose aguda na praia de Porto de Galinhas, Pernambuco, Brasil. Cad. Saúde Pública. 17: 725- 8.

Brener Z, Mourão OG. 1953. Inquéritos clínico-epidemiológicos em focos endêmicos de esquistossomose mansoni. Rev Bras Malar D Trop 8: 519-526.

Cançado JR. 1947. Contribuição ao estudo da Esquistossomose mansônica no Brasil. Dados relativos à má distribuição de renda no Brasil. Rev Bras. Med. 31 (1): 31 -35.

Carlôto AE. 2011. Avaliação Diagnóstica da Infecção por *Schistosoma mansoni* em duas áreas rurais de Minas Gerais: Comunidade São João, no Vale do Jequitinhonha, e Capitão Andrade, no Vale do Rio Doce. MSc Thesis. Curso de Pós-Graduação em Doenças Infecciosas e Parasitárias da Faculdade de Medicina da UFRJ. 57 pp.

Carvalho OS, Amaral RS, Dutra LV, Scholte RGC, Guerra MAM. 2008. Distribuição Espacial de *Biomphalaria glabrata, B. straminea e B. tenagophila*-Hospedeiros Intermediários de *Schistosoma mansoni* no Brasil. In: Carvalho OS, Coelho PMZ, Lenzi HL (org.), *Schistosoma mansoni e esquistossomose: uma visão multidisciplinar*, Editora Fiocruz, 1ª ed. Rio de Janeiro, p. 493-518.

Cheever AW, Lenzi JA, Lenzi HL, Andrade ZA. 2002. Experimental models of Schistosoma mansoni infection. Mem Inst Oswaldo Cruz. 2002. 97(7): 917-40.

Conceição MJ, Argento CA, Corrêa A.. 2000. Study of *Schistosoma mansoni* Isolates from Patients with Failure of Treatment with Oxamniquine. Mem Inst Oswaldo Cruz, Rio de Janeiro, Vol. 95(3): 375-380.

Conceição MJ, Borges-Pereira J 2002. Influence of specific treatment on the morbidity of schistosomiasis mansoni in an endemic area of Minas Gerais, Brazil. Mem Inst Oswaldo Cruz 97: 755-757.

Conceição MJ, Borges-Pereira J, Coura JR 2007. A thirty years follow-up study on schistosomiasis mansoni in a community of Minas Gerais, Brazil. Mem Inst Oswaldo Cruz 102: 1007-1009.

Conceição MJ, Pereira NG, Pereira JB, Carlôto AE, Melo EV. 2010. Não-Resposta de Paciente Infectado com *Schistosoma mansoni* a três Tratamentos Sucessivos com Praziquantel e Estudo Experimental em Camundongos com Repetição de Falha ao Tratamento. Rev Soc Bras Med Trop. 43 (Supl. I): 186-187.

Conceição MJ, Pereira NG, Vasques CHS, Rodrigues DP, Frota AC, Carlôto AE,Coura JR. 2009. Estudo de 10 Casos de Enterobacteriose Septicêmica Prolongada observados no Serviço de Doenças Infecciosas e Parasitárias-UFRJ e no Instituto de Pediatria Martagão Gesterira-IPPMG. Rev. Soc Bras Med Trop 42 (Supl.1): 206-207

Coura JR, Amaral RS 2004. Epidemiological and control aspects of schistosomiasis in Brazilian endemic areas. Mem Inst Oswaldo Cruz 99 (Suppl. I): 13-19.

Coura JR, Conceição MJ 2010. Specific Schistosomiasis treatment as a strategy for disease control. Mem Inst Oswaldo Cruz, Rio de Janeiro, Vol. 105(4): 598-603.

Coura JR, Conceição MJ, Pereira JB 1984. Morbidade da esquistossomose mansoni no Brasil. III. Estudo evolutivo em uma área endêmica no período de dez anos. Mem Inst. Oswaldo Cruz 79: 447-453.

Drumond SC, Pereira SRS, Silva LCS, Antunes CMF, Lambertucci JR. 2010. Schistosomiasis control program in the state of Minas Gerais in Brazil. Mem Inst Oswaldo Cruz, Rio de Janeiro, 105(4): 519-523.

Enk MJ, Caldeira RL, Carvalho OS, Schall VT. Rural tourism as risk factor for the transmission of schistosomiasis in Minas Gerais, Brazil. Mem Inst. Oswaldo Cruz 2004, 99 (Suppl 1):105-8.

Graeff-Teixeira C., Anjos CB, Oliveira VC, Velloso CFP, Fonseca MBS, Valar C, Moraes C, Garrido CT, Amaral RS, 1999. Identification of a transmission Focus of *Schistosoma mansoni* in the Southern most Brazilian State, Rio Grande do Sul Mem Inst Oswaldo Cruz, Rio de Janeiro, Vol. 94(1): 9 -10.

Igreja R.P, Gusmão MF, Barreto MGM, Paulino MT, Silva JF, Seck OK, Gonçalves M.M.L, Soares MS. 2010. A 15 - year follow-up study on schistosomiasis in a low-endemic area in Rio de Janeiro State, Brazil. J. Helminth. 84: 229-233.

Jansen G 1946. Profilaxia experimental da esquistossomose de Manson. Mem Inst Oswaldo Cruz 44: 549-578.

Katz N 2008. Terapêutica clínica na esquistossomose mansoni. In OS Carvalho, PMZ Coelho, HL Lenzi (org.), *Schistosoma mansoni e esquistossomose: uma visão multidisciplinar*, Editora Fiocruz, 1ª ed. Rio de Janeiro, p. 850-870.

Katz N, Brener Z. 1966. Evolução clínica de 112 casos de Esquistossomose mansoni observados após 10 anos de permanência em focos endêmicos de Minas Gerais. Rev Inst Med Trop S Paulo 8: 139-142.

Katz N, Chaves A, Pellegrino J 1972. A simple device for quantitative stool thick-smear technique in schistosomiasis mansoni. Rev Inst Med Trop S Paulo 14: 397-400.

Katz N., Coelho PMZ 2008 Clinical therapy of schistosomiasis mansoni: The Brazilian contribution. Acta Tropica 108 (2-3): 72-78

Klöetzel K. 1966. Morbidity in chronic splenomegaly due to Schistosomiasis mansoni: follow- up study in a Brazilian population .Trans.Roy.Soc.Trop.Med. Hyg , 1967 61 (6) : 803- 805

Klöetzel K. 1992. Some personal views on the control of schistosomiasis mansoni. Mem Inst Oswaldo Cruz. 87 (Suppl 4): 221- 226.

Klöetzel K, Klöetzel J. 1958. The hepatosplenic syndrome in Manson's schistosomiasis; notes on a series of 119 cases. Rev Bras Med. 15 (3):172-8.

Lambertucci JR, Silva LCS, Voieta I. 2005. Esquistossomose e Doenças Associadas. In: Coura JR. Dinâmica das Doenças Infecciosas e Parasitárias. Ed. Guanabara Koogan, 1ª ed, p. 789 -806.

Lenzi HL, Kimmel E, Schechtman H, Pelajo-Machado M, Romanha WS, Pacheco RG, Mariano M, Lenzi JA. Histoarchitecture of schistosomal granuloma development and involution: morphogenetic and biomechanical approaches. Mem Inst Oswaldo Cruz 93 (Suppl. 1): 143-151.

Lutz, A., 1919. O Schistosomum mansoni e a schistosomatose segundo observações feitas no Brasil. Mem. Inst. Oswaldo Cruz 11, 121–155.

Maciel H. 1925 Contribuição ao estudo da distribuição geográfica da schistosomose. . Imprensa Naval, Rio de Janeiro, 147 pp.

Martins AV, Versiani W. 1938. Schistosomose mansoni em Belo Horizonte. Brasil Médico, 52: 471-472.

Massara CL, Amaral GL, Caldeira RL, Drumond SC, Enk MJ, Carvalho OS. 2008. Schistosomiasis in an ecotourism area in Minas Gerais State, Brazil.Cad. Saúde Pública, Rio de Janeiro, 24 (7) :1709-1712.

Meira JA. 1947. Esquistosomíase mansoni: subsídio ao estudo de sua incidência e distribuição geográfica no Brasil - lista bibliográfica brasileira sobre a esquistosomose mansoni (doença de Manson-Pirajá da Silva). Arq. Fac. Hig. Saúde Públ.. Univ. São Paulo, 1 (1): 5 -146.

Neiva AH. 1947. Aspectos geográficos da imigração e colonização do Brasil. Rev. Bras. Geog. 9: 249- 270.

Paraense WL. 2008. Histórico do gênero *Biomphalaria*-Morfologia e Sistemática morfológica. In: Carvalho OS, Coelho PMZ, Lenzi HL. Schistosoma mansoni-Esquistossomose, uma visão multidisciplinar.Ed. Fiocruz. 1ª ed, Cap.8, p. 288 -307.

Pellon AB, Teixeira I. 1950. Distribuição geográfica da esquistossomose mansônica no Brasil. Ministério da Educação e Saúde, Rio de Janeiro, 24 pp.

Pessoa SB, Barros PR.1953. Notas sobre a epidemiologia da esquistossomose mansônica no Estado de Sergipe. Rev Med Cir São Paulo *13*: 147-154.

Pirajá da Silva MP. 1908. A esquistossomose na Bahia. Arquivo sobre Parasitologia 13: 281-300.

Prata A, Bina JC. 1968. Development of hepatosplenic form of schistosomiasis. Gazeta Médica da Bahia 68: 49-60.

Rey L. 2007. Parasitologia.Schistosoma e Esquistossomíase-Epidemiologia e Controle. ed. Guanabara Koogan, 1ª ed. p 475- 566.

Santos AM, Melo ACFL. 2011. Schistosomiasis prevalence in Tutóia village, Maranhão, Brazil. Rev Soc Bras Med Trop 44(1): 97-99.

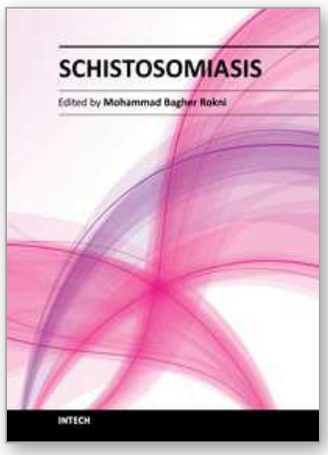
Sarvel AK, Oliveira AA, Silva AR, Lima ACL, Katz N. 2011. Evaluation of a 25-Year-Program for the Control of Schistosomiasis . PLoS Neglected Diseases. 5 (3): e 990

Schlemper Junior BR, Ferreira Neto JA, São Thiago PT, Bressan C, Amarante AR. 1996 The southern known limit of occurrence of *Schistosoma mansoni* Sambon 1907 in Brazil was the northeast of the State of Santa Catarina, Brazil. Rev Soc Bras Med Trop 29: 411-418).

Sette H.1953. *O tratamento da esquistossomose à luz da patologia hepática (Estudo clínico)*. Thesis, Universidade Federal de Pernambuco, Recife, 220 pp.

Soares MS, Barreto MG, da Silva CL, Pereira, JB, Moza PG, Rey L, Calçado MS, Lustoza A, Maspero R. 1995. Schistosomiasis in a low prevalence area: incomplete urbanization increasing risk of infection in Paracambi, R.J., Brazil. Mem. Inst. Oswaldo Cruz 90: 451-458.

WHO-World Health Organization 2002. Prevention and control of schistosomiasis and soil-transmitted helminthiasis.World Health Organization Tech Rep Ser 912(I–VI): 1–57.



Schistosomiasis

Edited by Prof. Mohammad Bagher Rokni

ISBN 978-953-307-852-6
Hard cover, 310 pages
Publisher InTech
Published online 13, January, 2012
Published in print edition January, 2012

In the wake of the invitation by InTech, this book was written by a number of prominent researchers in the field. It is set to present a compendium of all necessary and up-to-date data to all who are interested. Schistosomiasis or blood fluke disease, also known as Bilharziasis, is a parasitic disease caused by helminths from a genus of trematodes entitled Schistosoma. It is a snail-borne trematode infection. The disease is among the Neglected Tropical Diseases, catalogued by the Global Plan to combat Neglected Tropical Diseases, 2008-2015 and is considered by the World Health Organization (WHO) to be the second most socioeconomically devastating parasitic disease, next to malaria. WHO demonstrates that schistosomiasis affects at least 200 million people worldwide, more than 700 million people live in endemic areas, and more than 200.000 deaths are reported annually. It leads to the loss of about 4.5 million disability-adjusted life years (DALYs).

INTECH
open science | open minds

InTech Europe
University Campus STeP Ri
Slavka Krautzeka 83/A
51000 Rijeka, Croatia
Phone: +385 (51) 770 447
Fax: +385 (51) 686 166
www.intechopen.com

InTech China
Unit 405, Office Block, Hotel Equatorial Shanghai
No.65, Yan An Road (West), Shanghai, 200040, China
中国上海市延安西路65号上海国际贵都大饭店办公楼405单元
Phone: +86-21-62489820
Fax: +86-21-62489821

IntechOpen