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Schistosoma Prevalence World-Wide

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INTRODUCTION

Schistomiasis is the third-leading endemic parasitic disease in the world after Malaria and Amoebiasis[1], it's endemic in 76 countries worldwide[2]. Schistosoma is a parasitic disease caused by blood flukes (trematodes) of the genus schistosome[3].

It's a water-based disease that affects an estimated 250 million people, mainly in sub-Saharan Africa[4].And its transmission is spatially and temporally restricted to fresh water bodies that contain schistosoma cercaria released from specific snails that acts as intermediate host Urinary schistosoma and hookworms' infections cause considerable morbidity in school age children in West Africa, males are significantly more infected than females[5].

It is estimated that 250 million people are infected and approximately 700 million people are at risk of infection of whom [6]. Schistosomiasis is the third most devastating tropical disease globally and is a major cause of morbidity and mortality for developing countries in Africa, South America, the Caribbean, the Middle East, and Asia [7].

GENERAL PREVALENCE

The data available on the prevalence of schistosomiasis, i.e., the proportion of people infected, are unreliable because of unrepresentative sampling procedures and the uneven distribution of the infection itself caused by ecological or social peculiarities of the countries concerned. Therefore, it is only possible to estimate the numbers of people exposed to infection and the degree of endemicity of schistosomiasis[3].

The disease is endemic In 74 countries [5]where 779 million people were at risk of schistosomiasis and 207 million individuals were infected with schistosoma worms. Regarding the at-risk population, an estimated 660 million were concentrated in Africa, accounting for 85% of the global at-risk estimate. An alarming 201.5 million schistosome infections (mainly Schistosoma haematobium) were estimated to occur in Africa, accounting for more than 97% of the estimated number of infections worldwide [1].

Most of the countries endemic for schistosomiasis are among the least developed, whose health systems face severe strains to provide basic care at the primary level. They can only undertake schistosomiasis control through grants [4].Based on the estimated prevalence and the size of the endemic areas, the most severely affected countries are: in Africa: Angola, CentralAfrican Republic, Chad, Egypt, Ghana, Madagascar, Malawi, Mozambique, Nigeria, Senegal, Sudan, the United Republic of Tanzania, Zambia;bIn South America: Brazil;In South-East Asia: Philippines;In South-West Asia: Yemen Arab Republic [3].

Almost 300,000 people die annually from schistosomiasis in Africa alone. About 10 million women in Africa are infected during pregnancy.Zoonotic transmission is possible with these species, because the parasite infects not only humans but also wildrodents[5].

Least prevalence countries were reported or estimated number of infections is below 1000 in Antigua and Barbuda, India, Indonesia, Jordan, Oman and Saint Lucia. While most suffering countries at present, 29 African countries, Brazil and Yemen which harbour more than one million cases each[8].

SUBTYPE-SPECIFIC PREVALENCE

Schistosoma mansoni(the causative of intestinal morbidity) is the most prevalent being endemic in 55 countries e.g. Arab peninsula, Egypt, Sudan, and Libya, Sub-Saharan African countries,Brazil, Some Caribbean islands and Venezuela[9].

*S. haematobium*is endemic in 53 countries in Africa and the Middle East, where more than 110 million people are infected [5,9].

*S. japonicum*is endemic in China, Indonesia and Philippines approximately 60 million individuals are at risk of infection and close to two million are currently infected[5]. Schistosoma Japonicum has been eradicated from Japan as the last case of infection in man was in 1977 and infected snails were last detected in 1982[4].In China it can be stratified into three distinct geographical and ecological zones, namely (i) plain regions, (ii) swamp and lake regions, and (iii) hilly and mountainous regions-patchy distribution-.An estimated 11.6 million Chinese were infected with schistosomes [8].

*Schistosoma mekongi*is endemic along the Mekong River and certain tributaries in the lower Mekong basin. Approximately, 140,000 people are at risk for infection with 80,000 found in Cambodia and a further 60,000 in Laos[5].

*S.intercalatum*prevails in rain forest areas of Central Africa[9]Two main distinct species are recognized: one in Zaire and one in Lower Guinea (mainly Cameroon)[5].

*The distribution of schistosomiasis is greatly modified by the creation of irrigation systems, manmade lakes, and other types of water development projects required for food production and generation of hydroelectric power.Wide varieties of domestic and feral animals are infected which sustainschistosomal life cycle [5]. Schistosomiasis is a widely spread tropical disease that Africa suffers most, yet some species does not exist in Africa like *S.japonicum*. It is predominant in countries rich in lakes and rivers, yet *S.japonicum*was found in hilly mountainous regions in china. Annual deaths from schistosomiasis increased in the last 20 years to become the third most devastating neglected tropical disease [10] (Figure1).

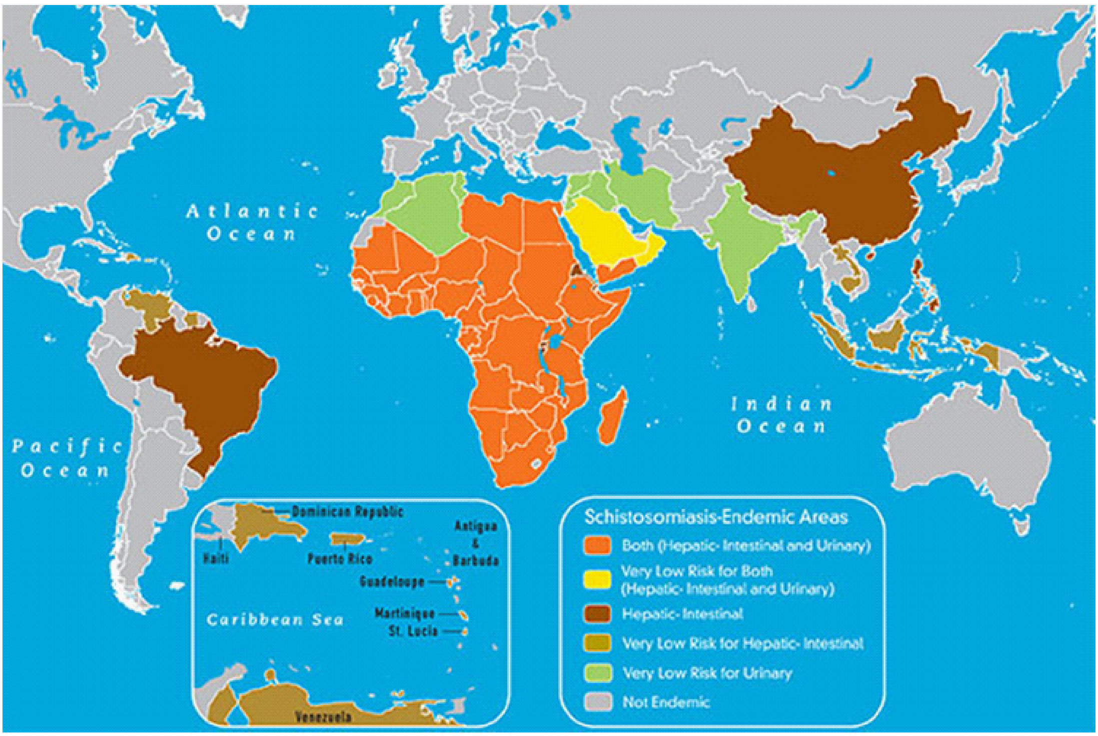

Figure 1: Map of the current global distribution of schistosomiasis. Source: US Centers for Disease Control and Prevention [11].

Climate change may alter the geographical distribution of Schistosoma by affecting the suitability of fresh water bodies for hosting parasite and snail population[12].

Maps were produced showing predicted changes in risk as a result of increasing temperature over the next 20-50 years.Infection risk may increase by up to 20% over most of eastern Africa over the next 20-50 years.The disease is hyper endemic in the great lake regions of east Africa, owing to the favorable habitat for snails of the biomphalaria genus, which are the intermediate host.There're some ways to predict and detect the prevalence of Bilhaziasis, The first application of remote sensing to predict the probability of occurrence of human Schistosoma using landsat 5 thermatic mapper (TM) data was published in 1984 for the Philippines.Diurnal temperature difference derived from data of the National Oceanic and Atmospheric Administration-Advanced Very High Resolution Radiometer (NOAA-AVHRR) has been related to survey measurements of Schistosoma prevalence in Egypt.

As thermal difference between day and night reflect regional hydrologic conditions, the significant inverse relationship showed well the predictive ability of remote sensing data for Schistosoma transmission risk.Immuno epidemiologic studies have shown a relationship between IgE and IgG4 antibodies with age and with resistance and susceptibility to infection. It's believed that IgE and IgG4 responses to soluble egg antigen (SEA) can be used for serological analysis of infection[13].

IgG4 anti-SEA reactivity in infected individuals was signfically higher than that of uninfected at all time points, so IgG4 anti-SEA reactivity can be used as a biomarker for immune monitoring of the presence of infection with S.Mansoni in endemic areas.Molecular markers have been used to describe the transmission dynamics of Schistosoma [14].

Regarding Schistosoma studies there were only 4 studies in pregnant women despite WHO statement "Schistosoma is second only to Malaria in public health importance, and pregnant women are one of the important risk groups "[15].

Finally, an increase number of countries in Africa and elsewhere are developing national plans for the control of neglected tropical diseases. A key component of such plans is school-based deworming (SBD) for the control of soil-transmitted helminthes (STH) and Schistosoma.

African Countries

Of the 662 million people infected worldwide, 85% are from Africa. In Tanzania, Schistosoma is highly endemic and its prevalence varies from one region to another up to 80% in highly endemic areas. Very few systematic reviews were done aiming to present the prevalence of parasitic infections in the developing world over the last 30 years , and high level of *Schistosoma mansoni*were found in Zimbabwe (50%) and Tanzania (63.5%) , but the prevalence in other countries was typically around 30%.Another Study in Tanzania, a total of 5952 school children from 36 schools were recruited for the study and had their stool and Urine specimens examined, out of 5952 children:898 (15.1%) were positive for *S.Mansoni*while 519 (8.9 %) were positive for*S.Hematobium*..The study area is located on the northwest of Tanzania around Lake Victoria. Intestinal schistosoma decrease with the distance from the Lake Victoria, conversely the prevalence of urogenital Schistosoma Increase with distance from the lake.Regarding Nigeria, It has the greatest number of cases of Schistosoma worldwide [16].The overall prevalence of Schistosoma was 17.8%, with 8.9% and 8.3% infected with *S.Mansoni and S.hematobium*respectively, and 0.5% had co-infection of both species. A study was carried out among 960 pupils within the age range of 5 – 16 years,the findings of this research revealed that the study area was found to be endemic for schistosomiasis as the overall prevalence rate (43.55%) was considered to be high[17].

It's well documented that *Schistomiasis hematobium*was endemic in Ancient Egypt.The prevalence and species distribution of Schistomiasis differ in different governorates and regions in Egypt.*S.hematobium*was highly prevalent (60%) both in Nile Delta and Nile Valley south of Cairo in districts of perennial irrigation , while it's was low (6%) in districts of basin irrigation. *S.mansoni*infected 60% of the population in the Northern and Eastern parts of Nile Delta and only 6% in the Southern part. Neither *S.mansoni*cases nor its snail intermediate host were found in the Nile Valley South of Cairo. The highest prevalence was recorded in the Northern and Eastern parts of the Delta where 85% of the population was infected with either one or both species of the parasite[14]In Egypt, the implementation of Schistomiasis control programs has accelerated the decline of the disease [15].

In 1996, 168 villages has *S.mansoni*prevalence >30%, 324 villages 20-30% and 654 villages 10-20%. By the end of 2010, in the whole country only 29 villages had prevalence >3% and none had more than 10%.So, *S.hematobium*rates decreased from approximately 60-70% in 1925 to 5% in 1996, and *S.mansoni*rates fell from 32% in 1932 to 12% in 1996[18].

A study was done in Sudan where Shistomiasis is the most prevalent parasitic disease,and had shown that prevalence of schistosomiasis, especially *S.Hematobium*, is high in the White Nile River basin, and is closely associated with frequencies of water contact. (18) 157 of 338 (46.5%) students were found to be infected by *S. haematobium* or *S. mansoni*, and 4.4% of them had mixed infections. The egg-positive rate in boys and girls were 48.9% (86 cases) and 43.8% (71 cases), respectively.And regarding age, the egg-positive rates were 47.8% in 7–9-years old, 44.7% in 10–12-year-old, and 46.2% in 13–15-year-old.

In Zambia, a symptom questionnaire, demographic survey and physical examination was conducted among patients presenting to Kaoma district outpatient clinics to assess the prevalence of*S.Mansoni*infections. Blood was collected and screened for the presence of Schistosoma antibody using ELISA, of the 110 patients 88% were ELISA positive. (19). In 2008 in Ghana, 42% of the *S.Hematobium*infections are of heavy intensity (> 50 eggs/10 ml urine).The risk of S.hematobium mono-infections is highest (> 30 %) in areas adjacent to the lake Volta as well as in areas not associated with the lake Volta in the south of the country.

Schistosoma is a public health problem in Malawi but estimates of its prevalence vary widely[20].A cross sectional study between May and July 2006 among pupils in Blantyre district from a random sample of 23 primary schools. Urine samples were examined for *S.hematobium*ova using Filtration method, 1150 pupils were enrolled with a mean age of 10.5 years.In this population, children who attend schools close to open water sources are at in increasing risk of infection. The study provides an important update on the status of infection in this part of sub-Saharan Africa and exemplifies the success of deliberate national efforts to advance active participation in Schistosoma prevention and control activities at the sun-National or sub-district levels. Repeated cross-sectional survey in a representative sample of 200 schools (over 20,000 children) across Kenya. Samples were obtained for microscopic examination, the overall prevalence of *S.Mansoni*was 2.1% while the prevalence of *S.hematobium*was 14.8% and the mean infection intensity was 16 eggs/10 ml urine [21].

Non-African Countries

Regarding impact of water level changes on the density of Schistosoma transmission of snail inChina, the relationship between number of flooding per year and the density of living snails was more pronounced in the medium and high elevation areas[22].

In China, water buffaloes have been identified as major reservoir hosts for Schistosoma japonicum contributing up to 75% of human transmission[23].

The density of living snails kept decreasing from 2003 to 2014.

Three Gorges Dam influenced water levels and reduced the risk of flooding and the density of living snails.

Regarding Philippines, the cause of zoonotic Schistosoma *is S.Japonicum*, which infects up to 46 mammalian hosts, including human and bovines. and actually *S.Japonicum*is endemic in China, the Philippinesand Indonesia.

Between 2001 and 2009, a longitudinal study in Brazil was performed in which parasitological and blood specimens and water-contact infection were collected from 127 individuals. Schistosoma prevalence and the geometric mean of the egg count in 2001 were 59%, decreasing to 26.8% in 2009[13] (Figure 2).

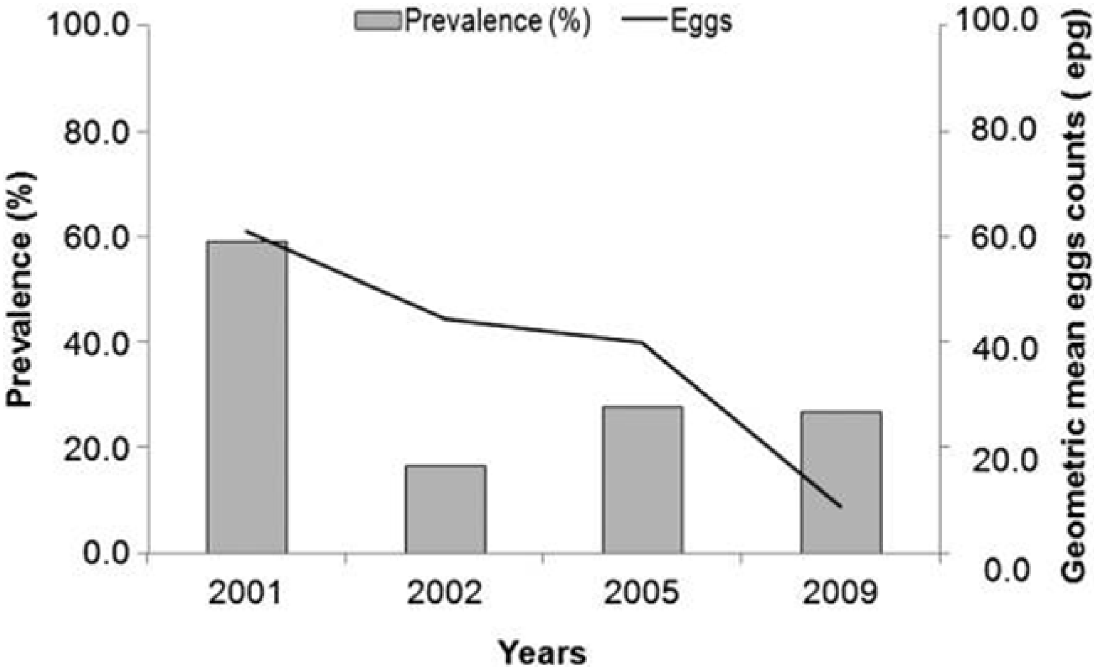

Figure 2: Prevalence and intensity of *Schistosoma mansoni* infection between 2001 and 2009 in Virgem das Graças, Brazil.

A study was done in Yemenincluding 400 children with mean age 10 years old, as Urine and Feacal samples were collected from them, and the results showed that the prevalence of *S. haematobium* infection was higher than *S. mansoni* (23.8% and 9.3% respectively), and the prevalence of schistosomiasis was significantly higher among children aged >10 years compared to those aged ≤10 years[24].

As usual male children had higher prevalence of schistosomiasis than females (33.6% and 29.0% respectively).

CONCLUSION

Schistosomiasis is a widely spread tropical disease that Africa suffers most, yet some species does not exist in Africa like S.japonicum. It is predominant in countries rich in lakes and rivers, yet S.japonicum was found in hilly mountainous regions in china. Annual deaths from schistosomiasis increased in the last 20 years to become the third most devastating neglected tropical disease. About 12.5% of earth population is at risk for Schistosoma infection where 3.34% are already infected. The percentage increases with agricultural expansion espicially in developing countries that lack basic health care.Travellers to these countries espiciallyTo Tropical countries elevate the risk of infection.A school age male in an endemic territory is the most likely to get infected.

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