

## SYSTEMATIC REVIEW ON EPIDEMIOLOGICAL STUDIES OF SCHISTOSOMIASIS IN SOKOTO STATE, NIGERIA

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### Abstract

**Background of the study:** Schistosomiasis has been as one of the dangerous neglected tropical diseases that cause huge socioeconomic health problems in many parts of Nigeria including Sokoto State. However, there is a dearth of information on the disease distribution, intensity and risk factors associated with the illness in the state.

**Aim of the Study:** The present study was conducted to systematically review the prevalence, intensity and risk factors causing schistosomiasis infection in Sokoto state, Nigeria.

**Methodology:** Information from more than five hundred (500) research articles at ResearchGate, ScienceDirect, PubMed, Google Scholar and World Health Organization (WHO) were gathered. However, only manuscripts that were found with relevant information needed for the sake of the present research were highly considered, articles that contained information on the prevalence, intensity, or risk factors associated with the schistosomiasis were given much emphasis, only articles in which at least their abstract was written in English language were considered.

**Results:** Results from the available article showed that; the overall schistosomiasis infection rate across the state ranged from 2.9% to 61.8, and the overall intensity of the disease in the state was between 499.0 to 1.75. Identified risk factors in the State were: occupation, education, age group, personal habits socioeconomic status, personal hygiene and residence location.

**Conclusion:** It was concluded that there is a high prevalence and intensity of schistosomiasis in Sokoto state, Nigeria as a result of many risk factors such as environmental, socioeconomic and demographic.

**Recommendation:** It was recommended that further research should focus on investigating the antigenic factors responsible for the persistence of the parasite in the state to allow for best preventive and control measures.

**Keyword:** *distribution, intensity, factors, schistosomiasis, Sokoto state*

## Introduction

Schistosomiasis is a Neglected Tropical Disease (NTD) caused by trematode worms which belong to the genus “Schistosoma”<sup>1</sup>. The six species of schistosomes which have been discovered to be medically important to humans include *Schistosoma haematobium* which is responsible for Urinary schistosomiasis, *S. mansoni*, *S. mekongi*, *S. japonicum*, *S. guineensis* and *S. interclatum* are responsible for intestinal schistosomiasis<sup>2</sup>.

Schistosomiasis is one of the 20 illnesses classified as one of the NTDs which have been documented in 78 nations<sup>3</sup>. World Health Organisation (WHO) estimates, around 290.8 million persons need care in 2018<sup>4</sup>. *S. haematobium*, which causes urinary schistosomiasis, is widespread in sub-Saharan Africa, the condition requires annual treatment for an estimated 30 million Nigerians<sup>5</sup>. Infection with the parasite occurs when an infected individual passes urine contaminated with eggs of the parasites in a freshwater body, the egg hatch into miracidia which penetrate the snail body which belongs to the genus *Biomphalaria* or *Bulinus*. When the miracidia undergo a certain developmental stage, infective stage (cercaria) are discharged from freshwater snails, the infectious larvae pierce the skin of any human or mammalian body that comes into touch with the water<sup>6</sup>. The adult worms live inside the blood vessels of the human host<sup>7</sup>.

Urinary schistosomiasis is the most pathological form of schistosomiasis that causes blood in the urine, pain when urinating, and, in more severe cases, also causes fibrosis of the bladder and ureter, kidney damage, and bladder cancer<sup>8</sup>. Men who have genital forms may experience

testicular pain and blood in their sperm<sup>9</sup>. Women who have had eggs placed in their cervix and lower female genital tract develop intravaginal lesions, which cause genital itchiness, pain, bleeding, and dyspareunia. Additionally, eggs that lodge in the fallopian tubes and uterus might cause infertility<sup>10</sup>.

Since schistosomiasis is primarily thought of as a disease in rural areas where people depend on natural freshwater bodies for daily activities, research and control efforts have been concentrated in such areas<sup>11</sup>. However, schistosomiasis centres have been appearing and even growing in urban and peri-urban areas during the past few decades due to rapid migration from rural to urban settlements<sup>12</sup>. Nigeria has a significant number of cases of urinary schistosomiasis and young people, who will be tomorrow's leaders, suffer the brunt of the cost because they are the most vulnerable group in endemic countries<sup>13</sup>. Subsequently, various activities that children engage in such as swimming, fishing, irrigation farming, passing through contaminated water and passing urine and faeces into the freshwater body are factors associated with the transmission of the disease<sup>14</sup>.

Although there is no up-to-date estimate for the disease in Nigeria, earlier estimates which indicated that, there were approximately 25 million infected and 101 million at risk of infection have been documented in Nigeria. The majority of infection is either caused by *S. haematobium* (Urinary Schistosomes) or by *S. mansoni* (intestinal Schistosomes)<sup>15</sup>. It was reported that the urine form of the disease (*S. haematobium*) had more prevalence and intensity in the country than the intestinal form (*S. mansoni*)<sup>12</sup>. The main risk factor for infection is contact with river water that is

thought to be infected with cercariae<sup>16</sup>. The distribution of schistosomiasis prevalence, the severity of infection, morbidity, and death are all influenced by a variety of environmental factors<sup>17</sup>. The degree of transmission and severity of infection, which might differ amongst groups, are determined by patterns of contact with the infected water. Sometimes, in particular, irrigation farming and water development plans are linked to schistosomiasis<sup>18</sup>.

Schistosomiasis typically affects the poor, who lack access to basic care and preventative measures while living in conditions that facilitate transmission<sup>12</sup>. The disease is widespread in many parts of Nigeria, including Sokoto State. Despite the widespread occurrence and its intensity in the state, there is no documented review search indicating the distribution and intensity of *S. haematobium* infection among the people of the state. Hence a systematic review was conducted across the state to find out the distribution and infection rate as well as the intensity of the disease among the people of the state. It is hoped that the present review will serve as the baseline data for determining the other factors associated with schistosomiasis and for providing the best way to prevent and control the disease in the state and other parts of the country.

## Methodology

### Standard for Eligibility

All research articles examining the prevalence, and intensity of human schistosomiasis in Sokoto were considered and reviewed, overall prevalence and intensity of schistosomiasis were recorded from each location. There was no discrimination regarding, age, gender, occupations, of the participants while

conducting the review. Studies examining non-human *Schistosoma* infection in animals other than snails were not included in the search. This study looked at Sokoto State inhabitants contracting an infection while visiting rural areas as tourists.

### Search Engines and Information Sources

ScienceDirect, PubMed, Google Scholar, Research Gate, Academia and WHO database were used in organizing the systematic literature review with the aid of computer-assisted literature search. The first review was started in July 2021 and then updated in October 2022, Schistosomes, Sokoto, prevalence, intensity, distribution, and risk factors were keywords used as search terms, no additional selection was undertaken. The individual study's methodologic quality was not evaluated. There was no distinction established between the various schistosomiasis types. All available records were evaluated for eligibility for the review, to get the clearest picture possible of the research done on schistosomiasis distribution among the Sokoto people in general. The deadline fell on January 2023.

### Studying Choice

The present review search only took into account research articles for which either a complete paper or the abstract was available, articles written in a language other than English were considered as long as the abstract was written in the English language, therefore, only data with the abstract written in the English language were included; no data were taken from any non-English content. Any paper underlying data quality was not included. Studies that had no information regarding a peer review procedure in progress were also included.

### Items of Data

For the present review, information on the frequency and severity of *Schistosoma* infection in humans was considered, the location and the year of the data collection were also noted when available, the majority of studies were cross-sectional, and information given in the articles on infection over time was retrieved and reported on in the review to establish a knowledge of how Sokoto schistosomiasis has altered in that specific context over time. In each setting in Sokoto, data on factors recognised or deemed relevant for promoting the spread of *Schistosoma* infections were also logged.

### Bias Risk in Individual and Systematic Studies

To avoid biases in the present review, the methodological excellence of the various studies was not considered, because the possibility of biased papers being included may have grown as a result, a large number of papers were included, though, as the aim of the study was to evaluate whether there was evidence of schistosomiasis in Sokoto state completely. Performing high-quality prevalence surveys will allow for more precise prevalence estimates if there is evidence of schistosomiasis in the state. The review contains a bias toward works published in English because only works having English-language abstracts or those that were available in English were included.

## Results and Discussion

### Distribution of Schistosomiasis Across the Sokoto State

The distribution of schistosomiasis around Sokoto state local government areas was illustrated in Table 1, it was observed that

infection with schistosome changes from year to year, and also increases in some parts of the state, The Majority of the conducted research on schistosomiasis in the state were concentrated on the infection among the schools' children precisely primary school children. Scanty research on *S. mansoni* identified very low infection.

Riverine areas of Sokoto South and Kware were observed to be more prevalent (61.8%) with the disease while, while the lowest infection rate of 21.3% was reported among the primary school children of the Silame local government area of the state. Although previous findings on schistosomiasis showed a scanty focus on *S. mansoni*, 2.92% of the riverine pupils were reported to be infected with the parasites. According to previous reports, the intensity was reported to be heavier among the people residing at Goronyo Dam settlements (499.0 egg/10 ml of a urine sample) also, there was a lighter intensity of 12.05 egg/ 10ml of urine and 1.75 egg/50g of stool sample among the primary school pupils of Wamakko.

Schistosomiasis in Sokoto State was found to be more prevalent when compared with numerous epidemiological studies on schistosomiasis carried out in various parts of Nigeria: In Minjibir Local Government Area of Kano State, the prevalence and intensity of urinary schistosomiasis among primary school students revealed that 44.2% of students were afflicted<sup>50</sup>. In Ogbadibo Local Government Area, Benue State, the prevalence of urinary schistosomiasis showed that 46.6% of people were infected<sup>51</sup>. Furthermore, a study of urinary schistosomiasis in some areas around the Gusau Dam Site in Zamfara State revealed that 47% of those surveyed were infected<sup>52</sup>. according to another research on the frequency of *S. haematobium* infection among primary school students in Keffi Town, Keffi Local Government Area,

Nasarawa State, 30.5% of the students were infected<sup>54</sup>, 12.9% of children in selected Minna, Niger state schools tested positive for urinary schistosomiasis<sup>55</sup>, 19.0% of people in central Ebonyi State tested positive for *Schistosoma haematobium* infections, according to another study<sup>56</sup>. Salwa *et al.*<sup>57</sup>, in the study of the prevalence and risk factors of schistosomiasis among Hausa communities in Kano State, reported 17.8% infection. Additionally, among junior high school students in two local government areas near Zobe Dam in Katsina State, the prevalence and intensity of genito-urinary schistosomiasis and associated risk factors revealed that 22.7% of the students were found to be infected<sup>58</sup>. However, the infection was found to be lower than the 74.0% of those examined in the Abarma district of the Gusau Local Government Area of Zamfara State<sup>53</sup>.

### **Risk Factors Associated with *Schistosoma* Infection in Sokoto**

#### **i. Occupational Activities**

Any work, deal, advisory services, or other work or service activity, whether for pay or not, whether regular, part-time, irregular, temporary, or permanent. In Sokoto State, occupational activities responsible for contracting schistosomiasis include, farming, hauling water, fishing, washing inside irrigation canals, car washing, and gathering sand from lakes, rivers and dams<sup>33</sup>.

The state economy is partially or highly dependent on the people living around riverine areas who use fishing as their occupation, fishing activity results in higher infection with schistosomiasis because fishing with or without boats results in varying degrees of water interaction<sup>34</sup>.

People who move from endemic areas to non-endemic areas where the snail intermediate host is present in the water body may spread the disease to regions where it had previously been absent through their occupational and recreational activities that involve coming into contact with water contaminated with cercariae from the intermediate host snails<sup>35</sup>.

#### **ii. Education**

Educational awareness on the *Schistosoma* parasites, mode of transmission of the infective stage, life cycle pattern, clinical manifestations and pathogenic effects of the parasites, method of prevention, control, eradication and elimination were inadequate among the people in the state, therefore many people were predisposed to the infection with the parasite<sup>36</sup>.

In addition, the majority of the community members living around riverine communities in Sokoto state were not going for formal education, they rather go for irrigation farming, fishing activities and other activities related to freshwater bodies than for formal education, that why susceptibility rate is high in the state<sup>37</sup>.

Although the majority of the research articles conducted in Sokoto concentrated on school-age children precisely primary school students, many students were reported positive because no teaching subject emphasised teaching the students the impact of neglected tropical diseases like schistosomiasis and others, the disease became more prevalent throughout the state<sup>38</sup>.

#### **iii. Socio Economic Status**

The term "socioeconomic status" in this context refers to a person's or a group's place on the socioeconomic hierarchy. This position is based on a variety of social and

economic factors, including income, the level and type of education, the type and prestige of occupation, the location of the home, in certain communities, segments of society, ethnic origin or religious background<sup>29</sup>

Statistical analysis showed that Sokoto state is one of the Nigerian states that has a higher number of people that are said to be at the lower class of socioeconomic status and also residing very close to the freshwater body, as a result, these people have multiple occupations that are link with fresh water body, for example, an individual may engage him/herself as an irrigation labourer, fisher, nomadic, and washing cars, for him/her to get food for survival<sup>39</sup>.

Similarly, many people are substantial farmers, and they cannot afford modern farming techniques due to lack of money and other means that will prevent them from direct contact with water bodies infested with cercaria<sup>40</sup>, it was also observed that many people from riverine areas of Sokoto, doesn't have money to purchase Molluscicides that will kill the intermediate host which generally harbour the infective stage of the parasites<sup>22</sup>

Due to the poorness of the people living around the riverine areas of Sokoto, it was reported that many people were urinating and defecating in and around the freshwater body because they don't have toilet facilities in their residences, hence a large number of *Schistosoma* eggs are deposited directly or directly into the water body<sup>28</sup>.

#### **iv. Age Group**

Findings from previous research indicated that children and youths are the most susceptible group for *Schistosoma* infection in most areas of Sokoto state because the majority of these age groups engaged themselves with activities that predisposed

them to water bodies infested with the parasite infective stage<sup>31</sup>.

For example, there is clear evidence that the majority of the children in riverine communities were not going to formal school, instead, their parents preferred Almajiri school because Almajiri school give the children more ability to help their parents with other activities that are related with rivers and lakes contact (such as fishing, watering animals, irrigation etc) than the formal school<sup>41</sup>, as a result of that, there is higher contact with cercaria in the freshwater body<sup>22</sup>.

Additionally, children have weaker immune systems than the other group, hence whenever there is cercaria penetration into their body through the skin, the developmental stage of the parasites may withstand antigen-antibody fight inside the body system of the children and heavier infection could result in many pathogenicity and clinical manifestations<sup>42</sup>.

Also, youths living around riverine areas of Sokoto State have the habits of swimming, laundering, washing cars watering animals, and many other activities that are linked with water contact in the areas, hence the higher infection rate among the age group<sup>43</sup>.

#### **v. Residence Location**

Residence refers to a house or home that was or is utilized as the primary place of living. It can refer to a house for a single person or a family, an apartment, or a refuge that is used as a shelter. It could be a group of dwelling homes created to help children or people with long-term impairments for nursing and is such a place where elderly people who need help are cared for.

The location of the houses is one of the factors that cause the high distribution of schistosomiasis in the state. This is because

people with residences very close to the rivers and lakes are more highly infected than those that are not close to them<sup>44</sup>. This could be due to their habit of depending on the water bodies for many activities and also frequently passing into the water body on their way of going to neighbouring towns, villages or the main city of Sokoto state<sup>45</sup>.

Due to the nearness of the residents to the water bodies in the state, many people can visit the lakes and rivers for swimming, washing, watering, and fetching water for domestic uses, also Some children make a habit of playing inside the water body day and night<sup>46</sup>.

#### **vi. Personal Habit**

Habit is a pattern of conduct that is routinely practised and often happens unconsciously. It is a slightly set style of thinking, feeling, or doing that was learned by prior mental repetition. Habitual behaviour frequently goes unnoticed by those who engage in it since it is unnecessary to conduct self-analysis when performing everyday chores<sup>47</sup>.

Because the behavioural patterns that humans repeat become imprinted in neural pathways, old habits are difficult to break and new habits to form, but it is possible to form new habits through repetition. The relationship between the context and the action gradually strengthens when behaviours are repeated in the same environment<sup>30</sup>.

People of Sokoto state who are living around the riverine area are well equipped with a personal habit of river visits frequently, some visit rivers for tourism, fishing, swimming, lounging, playing, passing, and many other purposes, that is the reason why they were exposed to the infested water environment<sup>48</sup>.

Additionally, a large number of male and female children and young adults who are parasite-infected and do not receive treatment exhibit the behaviour of urinating or defecating within bodies of water. This leads to an increase in the parasite population in the water and increases the risk of reinfection<sup>49</sup>.

Furthermore, Numerous villagers in the Sokoto State exhibit the behaviour of refusing to take synthetic medications when given to them, and they avoid going to hospitals when they suffer from symptoms of schistosomiasis, such as bloody stool, difficulty urinating, difficulty urinating, and haematuria. As a result, the parasite greatly increased the morbidity rate among the state's residents<sup>27</sup>.

#### **Advantages and Disadvantages of the Present Review**

In terms of schistosomiasis in Sokoto, the current literature review aimed to offer an overview of the earlier studies and surveys conducted up till 2023. This review can provide a more thorough summary than would otherwise be feasible by including works for which only the abstract was accessible. The same holds for the search period, which was extended back several decades to better comprehend how things have changed through time.

By finding and including additional studies by using the papers given as references in the studies found by the web search, the scope of the review may have been improved. It is also possible that some studies were overlooked because they did not include the terms Schistosomiasis, Prevalence, Distribution, Intensity, or Sokoto in the title, abstract, or keywords but did discuss the variations in schistosomiasis in the text. Even though the chosen keywords made an effort to avoid this, the issue might not completely be solved.

The review probably lacks several papers because publications in languages other than English were not included. Lastly, since documents with only abstracts were included, it was impossible to judge the calibre of the methodology used and the resulting data that were published. Therefore, it is important to exercise caution when concluding the provided data.

### **Advantages and Disadvantages of the Reviewed Articles**

Published manuscripts used for the present review were concentrated on prevalence, intensity, and risk factors associated with schistosomiasis in some selected areas in the state. Much attention was on finding the prevalence among the children (particularly primary school pupils). Numerous demographic, social, and behavioural aspects were examined as potential risk factors for schistosomiasis, with a large portion of the study focusing solely on riverine locations. Filtration techniques were also widely utilised to measure the parasites' intensity under a microscope.

The reviewed articles also provide much information on *S. haematobium* which is the most dangerous species globally causing urinary Bilharziasis, while few studies on *S. mansoni* were available documented across the state

On the other hand, there is a dearth of research information about the disease from

the people living in urban areas of the state even though people from urban migrate to other parts of the state by passing through the freshwater body contaminated with the snail intermediate host

Similarly, other age groups especially youths and old ages could be more obtained visiting rivers and lakes for fishing, washing clothes, bathing, irrigation farming, swimming, passing through, watering animals, fetching water for domestic use, and many other purposes than primary school children, however, previous documented articles across the state had inadequate information on schistosomiasis infection rate and intensity of youths and old age groups

Additionally, identified factors (demographic, socioeconomic, and behavioural) could not be the only factors responsible for the diseases in the state, since there is reoccurrence and persistent of the diseases, other factors such as resistant antigens, and resistant genes, which could result in parasite resistant even after taking treatment were not considered in the available documents

The majority of the previous study emphasised sensitivity identifications of the parasite (microscopy), specific methods such as molecular and immunological methods were inadequately deployed in epidemiological studies of schistosomiasis across the state.



**Table 1: Distribution and Intensity of Schistosomiasis Across the Sokoto State**

S/N	Study Area/ Location/LGA(s)	Population composition	Sample size	Prevalence (%)	Intensity	Reference
1	Goronyo	Children and adults	500	52.0 infected with <i>S.</i> <i>haematobium</i>	91.7	19
2	Settlement of Goronyo Dam	Children and adults	400	32.3 infected with <i>S.</i> <i>haematobium</i>	499.0	20
3	Wamakko Town	Children and adult	300	38.3 infected with <i>S.</i> <i>haematobium</i>	134.0	21
4	Riverine areas of Sokoto	School children	375	60.8 infected with <i>S.</i> <i>haematobium</i> while 2.92 infected with <i>S.</i> <i>mansoni</i> )	43.85 for <i>S.</i> <i>haematobium</i> ) And 1.75 for <i>S.</i> <i>mansoni</i>	22
5	Sokoto Metropolis and Hamma Ali District of Wurno	School children	375	60.8 infected with <i>S.</i> <i>haematobium</i>	43.85	23
6	Sokoto South and Kware	Primary school pupils	375	61.8 infected with <i>S.</i> <i>haematobium</i>	41.85	24
7	Wamakko	Primary School Children	50	60 infected with <i>S.</i> <i>haematobium</i>	NILL	25
8	Wamakko	Primary school pupils	400	48.0 infected with <i>S.</i> <i>haematobium</i>	12.02	26
9	Kware and Sokoto South	School children	375	60.8 infected with <i>S.</i> <i>haematobium</i>	43.87	27
10	Riverine Areas of Wamakko	School Children	400	32.8 infected with <i>S.</i> <i>haematobium</i>	NIPA	28
11	Kware	Children	206	17.8 infected with <i>S.</i> <i>haematobium</i>	NIPA	29
12	Goronyo and Taloka Communities	Children and adolescents	300	37.0 infected with <i>S.</i> <i>haematobium</i>	NIPA	30
13	Salame	Primary school children	188	21.3 infected with <i>S.</i> <i>haematobium</i>	22.10	31
14	Wamakko	Primary School children	100	12.5 infected with <i>S.</i> <i>haematobium</i>	NIPA	32

**Key:** NIPA= Not in the published article

### **Conclusion**

From the present review it was observed that schistosomiasis is present in Sokoto State with higher intensity, the prevalence of the parasite ranged from 60.8 to 2.92% while intensity was reported to be between 499.0 to 1.75 egg/10ml of the sample. Risk factors associated with the infection of the parasite in the state were; occupational activities, level of education, personal habit, personal hygiene, residence location, age group and socioeconomic status

### **Recommendations**

There should be more research from other parts of the state especially in urban areas because infection may be prevalent among the traveller and if not investigated the urban people could serve as a source of retransmitting the disease in riverine communities after treatment, prevention and control of the disease in the areas, hence could result in persistent, and resistant of the parasite throughout the state

Molecular and immunological techniques should be used in the future research for the diagnosis of the *Schistosoma* infection since the use of these techniques in the study area was inadequate, despite they being more reliable, because they provide specific information on the parasites

There should be more emphasis on the detection of the resistant antigens of the parasites in the areas of Sokoto State because they could be among the factors that cause persistent parasite infection among the individuals in the state.

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### **Conflict of Interest**

The authors declared no conflict of interest.

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