

MASTER OF PUBLIC HEALTH (IMPLEMENTATION SCIENCE)

Resource allocation as a cost-effective method to overcome some challenges facing Egypt to eliminate schistosomiasis as a public health concern

PRACTICUM REPORT

By

Randa Samy Abass Ibrahim EL-ghandour

Cohort-01

2022 - 24

Under the Guidance of

Piyusha Majumdar

**Designation (Professor/Associate Professor/Assistant Professor)
IIHMR University**

Ahmad S. Kudos

Assistant Professor

National center for research and technology

CERTIFICATE BY FACULTY ADVISOR

This is to certify that the dissertation titled *“Resource allocation as a cost-effective method to overcome some challenges facing Egypt to eliminate schistosomiasis as a public health concern”* is a record of Research work undertaken by Ms. Randa Samy Abbas Ibrahim, Enrolment No. IIHMR-U/16/2022-24/0012 in partial fulfilment of the requirement for award of the degree **Master of Public Health (Implementation Science)** from IIHMR University, Jaipur, India under my guidance and supervision and his/ her approach to research study has been sincere, scientific and analytical.

Piyusha

Dr. Piyusha Majumdar
Associate Professor
IIHMR University, Jaipur

CERTIFICATE BY SCHOLAR

This is to certify that the Practicum Project titled submitted by me,
Randa Elghandour with Enrollment No. IIHMR-U\16\2022-24\0012

under the supervision of Piyusha Majumdar

University Faculty Advisor Name, Designation, IIHMR University,

Jaipur and Organizational Practicum Supervisor Ahmad Kodous ,

Assistant Professor , National center for research and technology,

Egypt for award of Master of Public Health (Implementation

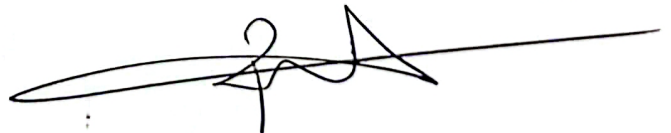
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IV

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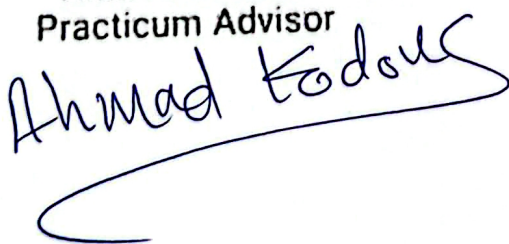
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Sd-

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A handwritten signature in blue ink that reads "Ahmad Kodous". The signature is written in a cursive style and is underlined with a long, sweeping horizontal stroke.

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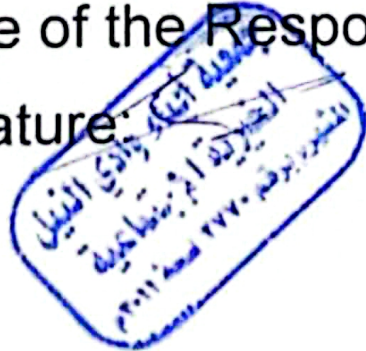
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ABSTRACT

The study aims to investigate the factors that help in the appearance of new cases of schistosomiasis and the challenges facing the elimination of Schistosoma in Egypt.

I employed a mixed methods approach to study this research problem, utilizing quantitative and qualitative data collection and analysis techniques. This approach allowed us to capture the breadth and depth of the issue, providing a richer picture than relying solely on one method. This survey was conducted in two villages, the first being Kafr Saad in Damietta Governorate, Egypt, and the second being Talbent Qaisar in Gharbia Governorate, Egypt.

The results of this study cleared that demographic characteristics like lack of education, married participants with many sons, working in agriculture, swimming, and using the canal's water in the life conditions are more suspected of infection with Schistosoma and more risk factors for Schistosoma incidences, such as the lack of visits to the health unit, showed a higher level of participants per month: 33 % visited the health unit 4 times per month, and 6% visited the health unit 1 time per month. Meanwhile, the times of receiving treatment for schistosomiasis showed a higher level of participants per month: 58% received treatment for schistosomiasis one time per month, also, the number of times a month that participants visited the home for treatment showed a higher level of participation. 71% visit the home for treatment once per month. The main challenges facing the planners in eliminating Schistosoma include changes in individuals' habits, such as swimming in water canals, using water canals daily, and wearing shoes while walking on agricultural land. The main challenges facing the planners in eliminating Schistosoma include changes in individuals' habits, such as swimming in water canals, using water canals daily, and wearing shoes while walking on agricultural land. According to the mean of the quantitative documentary analysis, for the complete control of schistosomiasis, resources should be provided to a program that employs cost-efficient approaches to alter the behavior of Egyptians residing in villages. Organize and conduct health promotion intervention and education for the enhancement of understanding of schistosomiasis, and how it is acquired, infected, and reinfected again. They will require school campaigns, community meetings, and health promotion campaigns to spread information regarding the issue and preventive measures. Also, to set aside resources that will enable students to visit the health units frequently at least two visits per month, especially for determination of schistosomiasis. This would result in early identification and management of the infections hence controlling the spread of the diseases.

This study **concluded** that, for the complete control of schistosomiasis, resources should be provided to a program that employs cost-efficient approaches to alter the behavior of Egyptians residing in villages. Also, organize and conduct health promotion interventions and education for the enhancement of understanding of schistosomiasis.

Keywords:

Resource -allocation - Cost-effective - Overcome – Schistosomiasis Egypt

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List of abbreviations

Abbreviation	Word
NGOs	Non-Governmental Organizations
MDA	Mass Drug Administration
WHO	World Health Organization
SRP	Schistosomiasis Research Project
NSCP	National Schistosomiasis Control Program
CR	Cure rate
S.	<i>Schistosoma</i>

1. Introduction

Schistosomiasis is a neglected tropical disease, the second parasitic disease after malaria in terms of its prevalence and impact on health and economics **(Inobaya et al., 2014)**. results from infection with parasitic worms belonging to the genus *Schistosoma*, which represents one of the health challenges that still exist and faces public health globally, and the resulting socio-economic repercussions, specifically in population centers in areas that suffer from poor services; Schistosomiasis affects more than 229 million individuals worldwide, causing damage to their internal organs and a concomitant decrease in their activity and production **(Hailegebriel et al., 2020)**; More than 90% of the infected people are concentrated in areas with the poorest sanitation services and limited clean water of sub-Saharan African countries, additionally some South American countries and Southeast Asia **(Barry et al., 2013)**.

To avoid the problems associated with schistosomiasis, which arise mainly from poor services in hotspots of parasite infection, it is necessary to follow a multi-pronged strategic approach to obtain the best possible results regarding disease resistance and reducing the number of infected people, here is a question arises strongly, which is: What are the axes or requirements necessary to achieve health well-being in this regard, or other words, what are the requirements to achieve sustainability and fair distribution of resources to reach a world free of schistosomiasis?

A good understanding of the biology of *Schistosoma*, represented by its life cycle and environment, is one of the strategic axes for combating the disease caused by *Schistosoma* as a parasite that infects humans **(Colley et al., 2014)**. Freshwater snails represent the intermediate host in the *Schistosoma* life cycle, which is dominated by species belonging to genera such as *Bulinus*, *Biomphalaria*, and *Oncomelania* **(Chadeka et al., 2017)**. Where sexually immature parasites are transmitted from the intermediate host to the human host during the latter's exposure to contaminated water such as canal water or freshwater ponds. The immature stages of the various species belonging to the genus *Schistosoma* penetrate and colonize the body of the human host, and part of the parasite's life cycle in human hosts ends with the production of fertilized eggs that are released into freshwater with urine

or feces due to a decrease in the efficiency or even the absence of sanitation services and the resulting repetition of the life cycle through a new generation **(Colley et al., 2014)**.

The effectiveness of MDA may be limited in areas with high population density, even if they are disease hotspots. This is because a low prevalence of schistosomiasis is often associated with low population density. Additionally, the potential for increasing drug prices due to rising production costs could further challenge the feasibility of MDA as a sustainable intervention strategy. **(Gao et al., 2020). (Yukich et al., 2020)**

To ensure the sustainability of treatment programs, integrated programs can be planned that combine MDA and preventive measures, which reduces reliance solely on MDA, especially with the possibility of its high price or its ineffectiveness to the extent required in reducing material costs with high population densities, which may result in higher costs compared to the available financial resources allocated to combating schistosomiasis **(WHO, 2024)**.

Among the complementary methods that can be effective in reducing the total cost compared to available resources is the combination of MDA. Methods of mechanical control of snails or biological control using natural enemies can work to reduce the number of snails and thus disrupt, even partially, the life cycle of the parasite and thus reduce or prevent infection considering the environmental dimension. So as not to disturb the natural balance, as well as spreading awareness among members of society in dangerous areas, especially remote ones, through awareness-raising convoys. In the end, the integration between MDA and other measures, such as establishing and improving water and sewage plants, as well as innovative methods for combating the disease and relying on accumulated knowledge about the biology and environment of the parasite and monitoring weak points in the parasite's life cycle to exploit them more effectively and with less harm to the environment, such as using biological control of snails as an alternative of chemical control. Also, spreading awareness among the residents of the areas located within the hotspots of schistosomiasis infection is one of the strategies that guarantee the sustainability of resistance to the disease, raising the efficiency of the use of financial resources, and maximizing the use of financial resources, even if they are limited **(WHO, 2022)**.

Study Objectives:

Schistosomiasis has been reported in Egypt since 1991, with close to one million people affected in 35 out of 41 governorates in Egypt in 2023. The goal of this paper is to map the challenges associated with schistosomiasis elimination in Egypt.

- To examine the risk factors (Human factors (Demographic, Behavioral), environmental factors) responsible for schistosomiasis cases
- To find out the challenges for schistosomiasis case treatment and other programmatic challenges and suggest recommendations

2.0 Review of Literature

Schistosomiasis, a parasitic disease caused by trematode worms, poses a significant global health challenge. Understanding the biology and ecology of schistosome parasites is crucial for developing effective control strategies. By unraveling the life cycle, transmission dynamics, and host interactions, researchers can identify key points for intervention. Resource allocation plays a pivotal role in implementing sustainable control measures, focusing on preventive measures such as clean water access and sanitation. Cost-effective interventions, including mass drug administration and snail control programs, reduce infection rates. A comprehensive approach, integrating biological insights with efficient resource utilization, is essential for managing schistosomiasis and alleviating its impact on public health (El-Kassas et al., 2024).

1.1. Biology and Ecology of the Schistosoma

Schistosomiasis is a tropical parasitic disease caused by blood-dwelling fluke worms belonging to the genus *Schistosoma* (Fig.1). The parasite depends on freshwater for its transmission from the intermediate host to the human host, which requires to ensure the continuity of successive life cycles of the parasite, the fulfillment of two conditions without which the parasite's life (Fig.2) cannot continue, which is the contamination of fresh surface water with waste, in addition to the spread of snails at the level that fulfills the parasite's condition of continuity. The intermediate host for the parasite is available in freshwater snails; there are dozens of species belonging to the genus *Schistosoma*, some of which have strong negative effects on humans, as infection with them results in several health complications that harm human life such as *S. mansoni*, *S. japonicum*, *S. haematobium*, in addition to a rarer species (Table .1), *S. mekongi*. *S. intercalatum* is less important in terms of its impact on human health, although this does not prevent it from playing a role in causing disease symptoms in the event of infection (Haggag et al., 2019 Rinaldo et al., 2021). According to estimates of the number of infections, the number of infections caused by parasites belonging to the genus *Schistosoma* is estimated at 200 million people. While other estimates indicate that infections may reach 250 million people,

and cases in sub-Saharan Africa (**Fig.3**) represent about 85% of the total cases (**Walz et al., 2015**).

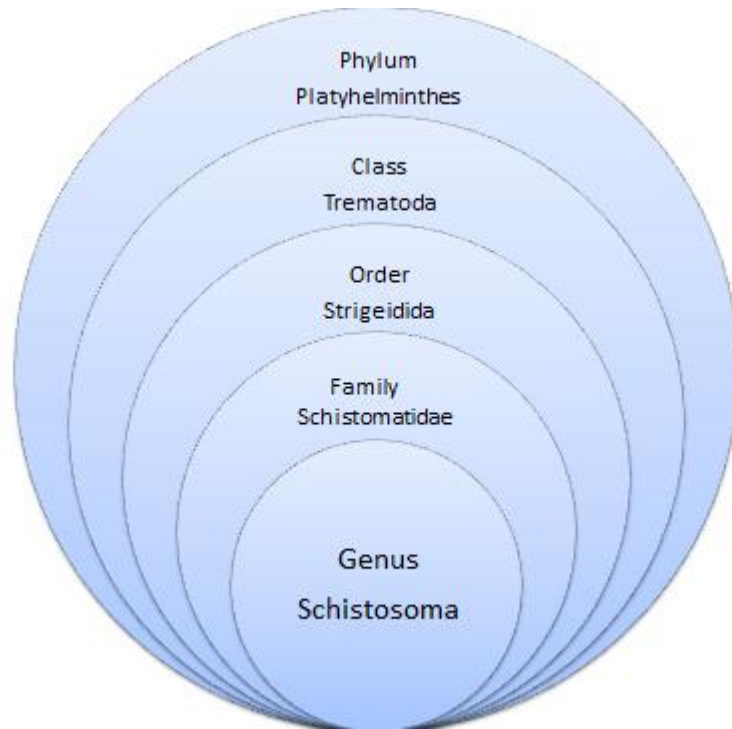


Figure (1): Taxonomic hierarchy of the genus *Schistosoma*

Morphologically adult schistosome worms separate sexes. The worms are cylindrical, ranging in length from 7 to 20 mm, with an average length of 10 mm and a width of 0.5 mm. The color varies between white and grey and contains two terminal suckers and a complex tissue structure (**Haggag et al., 2019**).

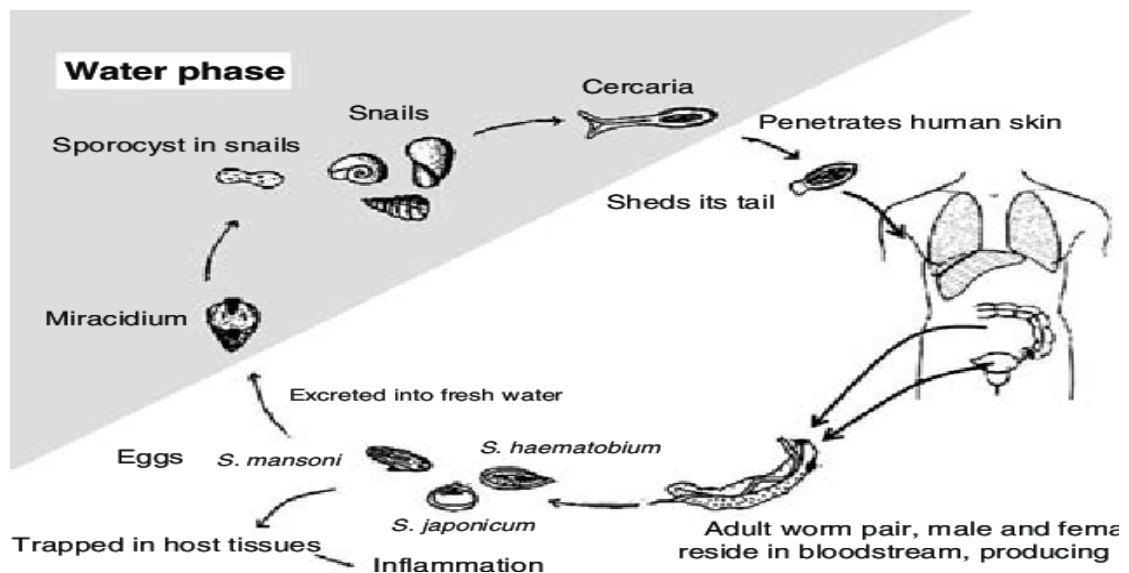


Figure (2): Life cycle of the schistosomiasis parasite

The life cycle of the schistosomiasis parasite consists of two stages, an asexual stage in which freshwater snails represent the intermediate host and a sexual stage that begins with the penetration of the ciliated schistosomiasis larvae into the body of the human host, while the sexual stage ends with the production of fertilized eggs, where a few fertilized eggs are excreted with urine and feces, while the bulk of the eggs accumulate in the tissues surrounding the bladder and intestines, where the patient suffers from chronic inflammation in the affected tissue positions (**Colley et al., 2014**).

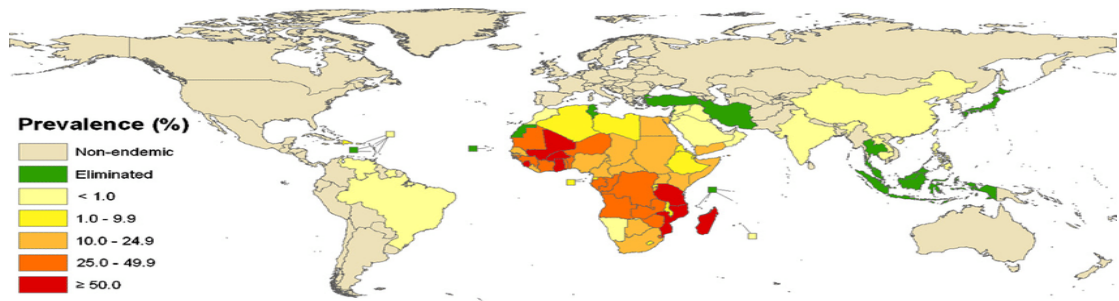


Figure (3): Global distribution of schistosomiasis, stratified according to country-specific prevalence estimates. Source: **Utzing et al. (2011)**.

Schistosomiasis, like other diseases, is accompanied by several symptoms; if the cercariae penetrate the skin of the human host, the infected person shows symptoms of a skin rash accompanied by itching that may last for a few days, but it is a temporary symptom that quickly disappears (**Lo et al., 2016**). Chronic symptoms are actually due to the eggs, not the adult worms; the eggs surrounding the bladder and intestines secrete proteolytic enzymes, which in turn ultimately lead to the appearance of ulcers at the sites of infection. In the case of infection with urinary *S. haematobium*, the eggs lead to ulcers of the bladder walls and the formation of bloody urine, and cases of dysuria also appear (**Haggag et al., 2019**).

Likewise, similar symptoms appear in the case of infection with intestinal schistosomiasis as *S. mansoni* and *S. japonicum*, where tumors and ulcers occur accompanied by bleeding that affects the intestines. In the advanced stages of schistosomiasis, patients suffer from kidney failure and/or cirrhosis, and it may develop into cancers such as bladder cancer, in addition to the possibility of contracting HIV (**Mbabazi et al., 2011**). Complexities related to immune mechanisms in the human host result in a slow immune response against the

Schistosoma in infected tissues, which is the reason behind all the health problems that the infected person suffers from, such as obstruction of the urinary system resulting from *S. haematobium*, and even failure of the liver and spleen to perform their functions in the case of intestinal schistosomiasis. Such as *S. mansoni* and *S. japonicum* infestation (**Haggag et al., 2019**). With a delayed immune response to the penetration of schistosoma worms into the human host's body, fever symptoms known as Katayama fever appear in cases of severe infection, after a few weeks (**Coulibaly et al., 2017**). Katayama fever is accompanied by muscle pain in addition to abdominal symptoms, which are due to the migration of mature worms to their places of residence in the body of the human host, with the observation of weight loss, shortness of breath, coughing, and diarrhea, in addition to cases of blood poisoning, hepatosplenic fibrosis, and portal hypertension (**Idress et al., 2020 and Nelwan, 2020**).

Table 1: Schistosoma species and site of effect

Schistosoma species	Urogenital schistosomiasis	<i>S. haematobium</i>
	Intestinal schistosomiasis	<i>S. Monson</i>
		<i>S. japonicum</i>

There are approximately 350 species of freshwater snails, some of which play the role of intermediate hosts in the life cycle of the parasitic schistosomiasis worms. Species belonging to the genera *Bulinus*, *Biomphalaria*, and *Oncomelania* represent the most important species that represent this class of snails that perform this role (**Inobaya et al., 2014**). Snails of the genus *Biomphalaria* are the intermediate host of the *S. mansoni*, (**Table. 2**) indicates that *Biomphalaria pfeifferi* of this genus, is the most common species in Africa (**Hailegebriel et al., 2020**). On the other hand, snails of the genus *Bulinus* act as an intermediate host for the parasite *S. haematobium*. Outside of the African continent, where patients with schistosomiasis represent the vast majority, we find that the genus *Oncomelania* represents the intermediate host for *S. japonicum*; the latter is a schistosomiasis parasite that represents the Asian type of schistosomiasis (**Hailegebriel et al., 2020**).

Table 2: Classification of snails associated with schistosomiasis (**Hailegebriel et al., 2020**)

Snail genus	Snail species	Schistosoma spp
<i>Biomphalaria</i>	<i>B. pfeifferi</i> <i>B. glabrata</i> <i>B. sudanica</i> <i>B. straminea</i> <i>B. tenagophila</i> <i>B. alexandrina</i> <i>B. choanomphala</i>	<i>S. mansoni</i>
<i>Bulinus</i>	<i>B. africanus</i> <i>B. forskalii</i> <i>B. truncates</i> <i>B. globosus</i>	<i>S. haematobium</i>
<i>Oncomelania</i>	<i>O. hupensis</i>	<i>S. japonicum</i>

The discussions regarding environmental factors and their role in the spread of schistosomiasis, the natural environment of the intermediate host, such as freshwater streams, lakes, and fresh ponds, represent good habitats for the parasite. From an environmental perspective, the concept of the anthropogenic environment refers to modifications to the natural environment due to human activity, which may result in severe changes in the ecosystem (**WHO, 2022**).

By applying the concept of anthropogenic environment in aspects related to the development of aquatic facilities and improving the services provided to citizens of the state, it became clear that such modifications to the environmental system provide artificial habitats suitable for snails and thus more disease centers in which the parasite spreads. This relationship between the establishment and development of aquatic facilities, where more beneficiaries of these projects (especially irrigation network projects) are exposed to water contaminated with the parasite in its sexually immature stage (**Mwai et al., 2021**). With the increase in the intensity of contact between humans and polluted water in agricultural

environments, the number of parasites increases as the number of intermediate hosts increases **(Diakité et al., 2017)**.

This strong relationship between water facilities and development projects and the spread of schistosomiasis is what explains why residents of rural areas are the most vulnerable to contracting schistosomiasis, as farmers are the most vulnerable to dealing with contaminated water due to the nature of their work in the agricultural field. African lakes, such as Lake Victoria, Lake Malawi, and Lake Volta, in addition to the Zambezi Delta, represent the most famous sources of infection with schistosomiasis in sub-Saharan Africa, especially with statistics showing that the majority of infected people are found in Africa and are concentrated south of the Sahara, as it is the hottest point among doctors and public health scientists regarding schistosomiasis **(CDC, 2024)**.

1.2. Schistosomiasis in Egypt

Schistosomiasis in Egypt is an endemic disease, and it poses a threat to public health, especially for people who deal with water regularly, such as farmers. This is the source of the risk mentioned above, as all the factors that ultimately lead to the spread of the disease among those exposed to water contaminated with the parasite may be present. Schistosomiasis in Egypt has a long history extending over thousands of years **(Yameny, 2017)**. It is not new, and many people suffer from it. This strongly motivates us to search for solutions and develop policies to limit its spread in Egypt by taking all possible measures to achieve that goal **(WHO, 2022)**.

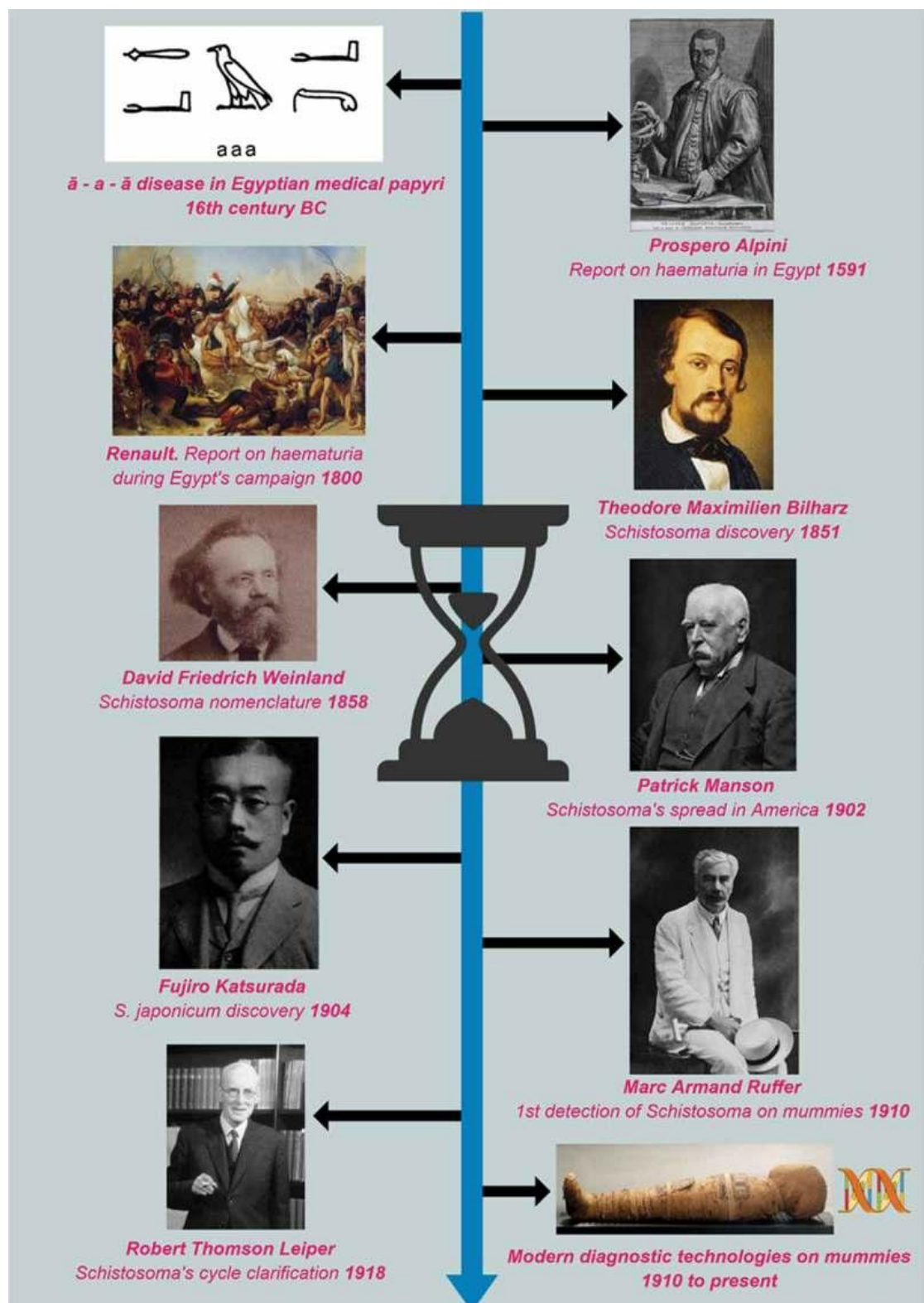


Figure (4): The historical path of schistosomiasis and the contributions of pioneers in uncovering the disease

1.2.1. History of schistosomiasis

Based on the historical perspective of schistosomiasis (**Fig.4**), schistosomiasis is one of the most endemic parasitic diseases in Egypt since the time of the ancient Egyptians. Given that the ancient Egyptian civilization was a river civilization that arose on the banks of the Nile, the appropriate environment was available for the spread of the disease, as there was an abundance of freshwater snails of the species belonging to *Biomphalaria* and *Bulinus* as an intermediate host in this riverine environment (**Leiper, 1916**). It was a familiar custom among the ancient Egyptians to record the smallest details, even the events of daily life. Despite this accuracy in recording, the medical papyri in that period of history did not indicate schistosomiasis. However, there is a belief, albeit unconfirmed, that there is an indication of a disease known as “â — a —â”, according to this belief is the disease schistosomiasis. This belief may be supported by the discovery of *Schistosoma* eggs in mummies dating back to the 20th Dynasty (1250-1000 BC), along with the presence of calcifications in the bladder of those mummies, which strongly indicates the spread of the disease (**Ziskind, 2009**). Radiological studies conducted on the mummies of ancient Egyptians also showed sweating on calcified eggs of the schistosomiasis parasite, which demonstrates the strong influence of riverine civilizations and the employment of a large segment of these societies in agriculture, which increased their exposure to water sources contaminated with the parasite. Such an ecosystem also represents an example habitat for snails; consequently, infections with the disease increased. Likewise, what has come down to us from that period about the history of endemic diseases and treatments indicates that the Egyptians knew about schistosomiasis and provided patients with various types of treatments, including antimony compounds (**Othman and Soliman., 2015**).

Applying immunodiagnostic testing techniques, ELISA to determine the oldest infection with schistosomiasis, and the results were documented for the oldest infection in Egypt with the type *S. haematobium*, which was in an Egyptian child in his teenage years, 5000 years ago (**Deelder et al., 1990**). In the context of the history of schistosomiasis in Egypt, and at the beginning of the second half of the nineteenth century, the actual beginning of the study of schistosomiasis occurred using the approved methods through which it was possible to discover the cause of the disease when the German Theodor Bilharz performed an angioplasty (**Bilharz, 1853**). That parasite was initially known as

Distomum haematobium before it changed to the name known today, which is *Schistosoma haematobium* (Di Bella et al., 2018). Based on two sets of data, the first a group of samples estimated at two million collected from Egyptian health departments, and the second representing the results of examining 40,000 people, a description of the pattern of infection with parasites of the type *S. mansoni* and *S. haematobium* was provided (Scott, 1937). According to Scott's study, the Egyptian territory was divided into four regions (Table.3) to the northeastern part of the delta. The second region is located south of the delta, while the third and fourth regions represent the Nile Valley (Barakat, 2013). According to the survey results (Table.3), we find in the survey results that the dominant species in the northern and eastern Nile Delta is *S. mansoni*, noting a sharp decrease in the volume of infection with the parasite in the area south of the Nile Delta, which reaches 90% compared to the northern and eastern Nile Delta, despite the abundance of the intermediate host *Biomphalaria alexandrina* (Yameny, 2017).

Table 3: Geographical distribution of the schistosomiasis parasite and the size of infections

Geographical distribution	The extent of infection among the population
North and East Delta region	<i>S. mansoni</i> represents the dominant species in this region, where infections constitute 60% of residents
South Delta region (south of Cairo)	In the areas south of the Delta, the infection rate did not exceed 6%, despite the abundance of the intermediate host of <i>Biomphalaria alexandrina</i> .
The Nile Valley	In the third region, which forms part of the Nile Valley, the parasite was <i>S. haematobium</i> , representing 60%.
	In the remainder of the Nile Valley, which constitutes the fourth part according to the Scott division, the prevalence of <i>S. hematobium</i> was less than 5%.

Source (Barakat, 2013).

Two decades after the survey carried out by Scott, the Egyptian state, represented by the Ministry of Health, in 1955 conducted another survey using the same areas and the same methods that Scott adopted during his work on his survey. The results of this survey indicated that the prevalence rate of the *S. haematobium* species was over of *S. mansoni* in the delta, 38% and 9%, respectively. The prevalence of *S. mansoni* also increased . On the other hand, the result also showed the dominance of *S. haematobium* in Upper Egypt, and the spread of the disease caused by this type rose to 42% under continuous irrigation systems **(WHO, 2022)**.

By the second millennium, the Schistosomiasis research project had achieved its goals. The results of the project revealed that the *S. haematobium* type was dominant in Upper Egypt, as the highest value of its prevalence rate recorded there was 13.7%, while the lowest prevalence rate was 4.8, and the peak incidence was in the age group of 10. -14 years, while the prevalence of *S. haematobium* in the north of the country is rare, its highest prevalence there was in Ismailia Governorate, which was 1.8% **(Othman & Soliman, 2015)**. On the other hand, we find that the type *S. mansoni* is rare in Upper Egypt, and its highest recorded rate there was 4.3%, while in Lower Egypt, where it prevails, its prevalence rate ranges between 17.5-42.9%, and its peak is found in the age group of 15-19 years. At the beginning of the second millennium, no nationwide surveys were conducted to assess the situation throughout Egypt. However, what was monitored in the records of the Ministry of Health indicates that by the year 2010, only 20 villages were found in which the prevalence rate exceeded 3.5% **(WHO, 2011)**. The Egyptian Ministry of Health planned to invest 10 million US dollars over five years (2 million/year) to eliminate schistosomiasis. The plan to be implemented included two axes **(Othman and Soliman., 2015)**. The **first** is awareness-raising measures and the **second** is the medical treatments as well as the management to control snails as an intermediate host **(Haggag et al., 2019)**. Due to the low sensitivity of urine and stool tests used to detect cases of schistosomiasis, the government health sector is working on conducting new tests to detect all cases of infection with it. In general, a clear decline in the number of infected people has been observed recently, and according to data from Preventive Affairs at the Ministry of Health, the number of infected people has decreased in the regions. In which the disease is

endemic, the results of the survey showed a record decrease in infections, reaching less than 0.2% (**Haggag et al., 2017**).

1.2.2. Mechanisms and measures of schistosomiasis control

Schistosomiasis has been endemic in Egypt for decades, which requires adopting several strategies to combat this disease and work to limit its spread, especially in rural areas, given the high probability of infection among farmers with the two species prevalent in Egypt, *S. mansoni* and *S. haematobium*, and the resulting symptoms of the disease. Schistosomiasis intestinal schistosomiasis and urogenital schistosomiasis, respectively; it all goes back to the nature of work in the agricultural sector and its constant contact with fresh water that is contaminated with schistosomiasis parasites (**WHO, 2023**). The Egyptian state's strategies were launched through the Ministry of Health's adoption of the National Schistosomiasis Control Program (NSCP) in 1976, followed by the launch of the Schistosomiasis Research Project (SRP) in 1988 in cooperation with the Egyptian Ministry of Health with USAID (**Yameny, 2017**).

The strategies used to control schistosomiasis are varied, and all strategies applied to control the disease are based on the following pillars: (1) spreading awareness among people and identifying behaviors that can contribute to the spread of the disease and replacing them with other positive behaviors (2) using the MDA strategy of chemotherapeutic (3) Combating snails to interrupt the schistosomiasis life cycle and work to prevent its completion by getting rid of snails in freshwater environments, the ideal environment for the spread of the parasite (**Ghazy et al., 2021**).

Chemotherapeutics is one of the most widely applied procedures in controlling schistosomiasis disease. Although the use of drugs in the sequence of procedures is the last step, as it is supposed to be used in cases of confirmed infection, according to the MDA strategy, it can be used as a precaution in infection hotspots, even with those whose infection has not been confirmed (**Othman & Soliman, 2015**). Praziquantel, known by the abbreviation PZQ, is the chemical preparation used in the treatment of schistosomiasis in Egypt (**Abaza, 2013**). This drug was a promising step in this regard when it appeared in the 1970s. It was produced for the first time in Germany as a derivative of pyrazino-

isoquinolone and was approved in China as a treatment shortly after its discovery and production **(Chai, 2013)**. It targets the killing of the parasite in the human host, as PZQ effectively treats the two types prevalent in Egypt **(Gyapong & Boatin, 2016)**.

The two drugs Oxamniquine and Praziquantel were compared, and the results indicated that Oxamniquine is less effective and has more side effects than PZQ **(da Silva et al., 2017)**. PZQ cure rate (CR) is higher than other drugs used for the same purpose, such as artesunate, mefloquine, and metrifonate **(Zwang & Olliaro, 2014)**. The effectiveness of PZQ is measured by the CR in addition to the egg reduction rate (ERR), WHO recommended that the patient be given two doses, approximately one month apart, at a rate of 40 mg/kg for each dose **(Zwang & Olliaro, 2017)**.

The results of some studies conducted to estimate the effectiveness of PZQ indicated that giving patients a single dose of the drug had a CR ranging between 60-80% after one to two months of the dose, while applying the two-dose regimen according to WHO recommendations led to an increase in the CR to 90%. The ERR also increased in children, in particular, from 71.2 to 77.2%, which clearly demonstrates the high effectiveness of PZQ **(Barakat & El Morshedy, 2011; Cioli et al., 2014)**. These advantages prompted the government to use PZQ as an approved treatment and provide it and facilitate access to it; however, this abundance led to its use without controls, which resulted in the emergence of signs of resistance to the drug; another disadvantage is that it does not prevent the recurrence of the infection **(Barakat, 2013)**.

A laboratory study was conducted aimed at studying the ability of schistosomiasis to acquire resistance against PZQ by exposing successive generations of the parasite to doses like the recommended therapeutic doses. The result was that, after several generations, the schistosomiasis would acquire the ability to resist the drug, and the indicators of CR and ERR would decrease with time **(Vale et al., 2017)**.

Schistosomiasis is one of the most common diseases in tropical regions and represents a problem facing those in charge of health institutions in the areas where the disease is most widespread **(Haggerty et al., 2020)**. One of the dilemmas facing health

institutions in dense infection hotspots is the unavailability of treatments such as Praziquantel in quantities commensurate with the density of cases in those hotspots despite its low cost **(Carlton et al., 2011; Rollinson et al., 2016)**; this deficiency in distribution is considered a problem that requires collecting data in areas of dense infection hotspots related to the ratio of infected people to the population in the infection hotspots or the number of health service units to the population, as well as the availability of treatment in appropriate quantities or not, and other data that contribute to developing effective strategies solutions to problems that may occur in the field of health services. One of the strategies that can be relied upon to reduce infection levels and that complement the distribution of medications into infection spots are chemical or biological control systems for freshwater snails, which represent the intermediate host in the life cycle of the schistosomiasis parasite, in the absence of the intermediate host, the parasite's life cycle will not be complete with a decrease in the number of immature stages as a result of the decrease, the number of snails and the consequent decrease in the number of people infected with the parasite and consequently the disease **(Sokolow et al., 2016)**.

Resource allocation can be described as the process of determining the amount of money to be spent on a particular project, needed personnel, equipment, and other materials among various groups, programs, and individuals. It is critical, especially in developing health systems that are funded through the public domain because of the high demand for the service. Hence, resource management is crucial in ensuring the efficiency of health care while at the same time promoting equity. Equity means that resources in each setup should be well divided to meet all societal needs. Efficiency therefore is the utilization of resources in such a manner that the accruing impacts are positive, or the detrimental ones are low **(Yameny , 2017)**.

Healthy resource management enhances health as an asset of living creatures and the well-being of every society. It affects the availability of health services, the health status of the population, and the perception of the health care system **(Gyapong & Boatin, 2016)**.

To accomplish a high level of resource management, it is appropriate to control the costs of resources and determine realistic health goals that can be met at relatively low cost. It

means a considerable number of necessary decisions and cooperative actions in special preserving and improving the health of the people organization among patients, doctors, schools, and other organizations. It is recommended to make decisions on ethical grounds, backed up by what is scientifically proven and Clinical best practice. For instance, it is possible to set objective criteria to screen patients at higher risk so that the organization of triage can enhance cooperation. Teamwork and optimal utilization of resources can guarantee that all people retain the capability to lead healthy lifestyles and assist in the enhancement of general community health. **(WHO, 2014)**

Chapter 3 - Material and Methods

3.1.Type of the study: Mixed Methods Approach

The study aims to investigate the factors that help in the appearance of new cases of schistosomiasis however the incidence rate is less than 1%. The study investigates two factors human factors and environmental factors.

We have employed a mixed-methods approach to achieve this topic comprehensively, utilizing quantitative and qualitative data collection and analysis techniques. This approach will allow us to capture the breadth and depth of the issue, providing a richer picture than relying solely on one method.

3.2-Methodology:

Sampling :

This survey was conducted in two villages, the first being Kafr Saad in Damietta Governorate, Egypt, and the second being Talbent Qaisar in Gharbia Governorate, Egypt.

Kafr Saad Village: With a population of 8612, random surveys were conducted at different intervals on nearly 5000 individuals. In the last survey conducted in January, 790 individuals were examined, revealing 26 new bilharzia cases. Consequently, questionnaires were collected from 150 individuals in the village, including the 26 new cases, representing 17% of the total questionnaires in this village.

Talbent Qaisar Village: With a population of 8449, there were no new bilharzia cases. The last survey was conducted in August, yielding negative results for new cases. 150 questionnaires were collected from this village.

Total Questionnaires: 300 questionnaires were collected from both villages. The questionnaires were taken from the new cases that appeared, representing 8.6% of the total population

Questionnaire Cases: The cases included 26 new cases, 203 families of previous cases, and 71 previous schistosomiasis cases.

Interviews and Discussions: Interviews and discussion sessions were conducted with 100 individuals, including medical professionals and previous cases, in both villages.

New Schistosomiasis cases: The new cases included farmers, fishermen, craftsmen who use canals, and children, with a total of 2 children out of the 26 new cases.

b. Quantitative Methods:

- **Data Collection:** Quantitative data is collected through the research questionnaire method.
- **Sampling:** A random sample of 300 participants will be selected from 2 villages, one village has no cases, and the other village has new schistosomiasis cases. The sample contains schistosomiasis new cases, past cases, their families, and other villagers.

c. Qualitative Methods:

- **Data Collection:** The qualitative data collected through interviews, focus groups, and observations.
- **Sampling:** A purposive sample of 100 participants will be recruited based on the need of the study as most of them are health workers, and targeted cases of schistosomiasis. This sample represents about 3-5 % of the village population.

3.3.-Statistical analysis:

The quantitative analyzed using SPSS to identify patterns, trends, and relationships between variables. Also, the qualitative data was analyzed using Excel and SPSS for Chi square test to identify themes, meanings, and experiences related to the research question.

The Chi²-test was used to estimate the significance of the incidence of Schistosoma, methods of treatment, precautions, and prevention among the different participants between the two villages, village with no cases (A) village with cases (B) in case needed to be marked in interpretation.

We have also employed content analysis to analyze qualitative data.

CONTEXTUAL ANALYSIS

Domain	Definition	Analysis
Geographical	Context refers to the broader physical environment, landscapes and resources, both natural and transformed by humans (e.g., infrastructure).	The physical environment, landscapes, and resources (natural and human-made). The Nile River and its irrigation systems are central to schistosomiasis transmission in Egypt. The presence of freshwater canals and agricultural areas creates suitable habitats for snails, the intermediate hosts of the parasite. Human transformation of the environment through irrigation projects and dam construction has influenced the distribution and prevalence of the disease
Socio -Cultural	Context comprises explicit and implicit behaviour patterns, including their embodiment in symbols and artefacts; the essential core of culture consists of historically derived and selected ideas and values that are shared among members of a group.	The shared beliefs, values, behaviors, and practices of a community. In Egypt, certain cultural practices and behaviors can contribute to schistosomiasis transmission. These include swimming in canals, using canal water for domestic purposes, and walking barefoot in agricultural fields. Traditional beliefs and practices may also influence healthcare-seeking behavior and adherence to

		preventive measures
Socio-Economic	Context comprises the social and economic resources of a community and the access of a population to these resources	The social and economic conditions that influence health and access to resources. Poverty, limited access to clean water and sanitation, and low levels of education are significant socio-economic factors contributing to schistosomiasis in Egypt. These factors can affect individuals' ability to adopt preventive measures and seek timely treatment. The economic burden of the disease on individuals and communities can also be substantial
Legal	Context is concerned with the rules and regulations that have been established to protect a population's rights and societal interests	The laws, regulations, and policies that govern health and disease control. The Egyptian government has implemented various legal and policy frameworks to address schistosomiasis, including the National Schistosomiasis Control Program. These frameworks aim to regulate water and sanitation practices, promote health education, and ensure access to treatment. The effectiveness of these legal measures depends on their enforcement and

		implementation at the community level
Political	Context refers to the distribution of power and assets	The distribution of power, decision-making processes, and governance structures. Political commitment and leadership are crucial for effective schistosomiasis control. Government priorities, resource allocation, and inter-sectoral collaboration can significantly impact the success of control programs. Political stability and effective governance are also essential for sustained efforts to combat the disease
Health System	Context refers to functionality of health system	The organization, resources, and delivery of healthcare services. The capacity and functionality of the health system play a vital role in schistosomiasis control. This includes the availability of diagnostic tools, medications, trained healthcare workers, and accessible healthcare facilities. The efficiency of surveillance and monitoring systems, as well as the integration of schistosomiasis control into primary healthcare services, are also critical factors

Stakeholders mapping and analysis

Along with the other activities that should not be neglected in tackling Schistosomiasis, an essential activity is the study of the stakeholders engaged in controlling and eradicating the disease in Egypt. Studying the various stakeholders helps policymakers and program administrators prevent failure as they can change the strategies they will adopt depending on every influential party involved in a plan. Thus, guaranteeing that control efforts are equal and long-lasting is possible only through a cooperative attitude as the working method.

Governmental organizations are central to leading in managing schistosomiasis because of their input in developing policies, funding, and implementation of such schemes. I wish to acknowledge their continued support as the key to achieving these objectives. For this reason, one should not allow lengthy periods for communication with government representatives, providing them with the needed updates on the progress achieved and addressing such concerns as needed. This ensures that control of schistosomiasis will always be a priority in the country or national issues meeting agenda.

Sustainable Control of Schistosomiasis outcomes are essential beneficiaries of affected communities. It, therefore, means that without their active input, these interventions can hardly be deemed fully effective and sustainable. Inviting communities into the aspects of decision-making processes as well as in the promotion of health to enhance health education and awareness programs for schistosomiasis positive changes, people will be empowered to take charge of their health.

It was established that support from international organizations is necessary for more effective national efforts to suppress schistosomiasis. As a type of practical experience, they provide knowledge, finance, and technical support, which often is a vital resource needed in conditions when you have a rather limited amount of everything. Maintaining harmonious relations with such organizations is critical to ensure their continued support. This can be achieved through the demonstration of the degree to which they deploy their

resources effectively, as well as presenting how their activities influence the management of schistosomiasis.

Research institutes prime the fight against schistosomiasis infections by determining the parasite's life cycle, mode of transmission, and response to treatment. Observing their research outputs can help generate new, better control strategies. Some ways they can apply these insights include policymakers and program implementers using research evidence to make sound decisions for their programs and adjust the delivery model where necessary based on the most current research.

Health care professionals include doctors, nurses, pharmacists, and other practitioners who deliver health care services to patients and are hence at the vanguard of combating schistosomiasis. This staff's expertise, abilities, and commitment level are challenging and compelling for the efficient running of control ventures. For schistosomiasis diagnosis among the population to be fully effective, medical professionals should be capable of diagnosing this disease correctly. For that, they need training and appropriate tools and support. Thus, all individuals within the public domain exercise a degree of control and partake in control activities regarding schistosomiasis. Mentioning the type of the disease, how it can be transmitted, and how it can be avoided could inform people of specific measures to prevent themselves from contracting it. Communication, media campaigns, Neighborhood association meetings, education /Extension, and other related activities can help create an environment/ climate to support the fight against schistosomiasis. The population approach must take extra effort to address farmers and control schistosomiasis because they are among the most affected. At specific periods, they derive their survival from working in environments where they are exposed to contaminated water. One reason is that the farmers can protect themselves and members of their households from being infected by being knowledgeable about the risks of schistosomiasis and possible prevention and treatment options. Hence, a comprehensive and integrative approach that includes stakeholder collaboration and interactivity is necessary to handle schistosomiasis in Egypt adequately. Specifically, by advocating for the interests, needs, and concerns of the people involved, policymakers and program implementers are better positioned to develop and execute plans that yield the best results sustainably, with maximum benefits conformed to

the people's needs. There is a need to embrace more coordination to achieve the long-term aim of eradicating schistosomiasis as a public health problem in Egypt.

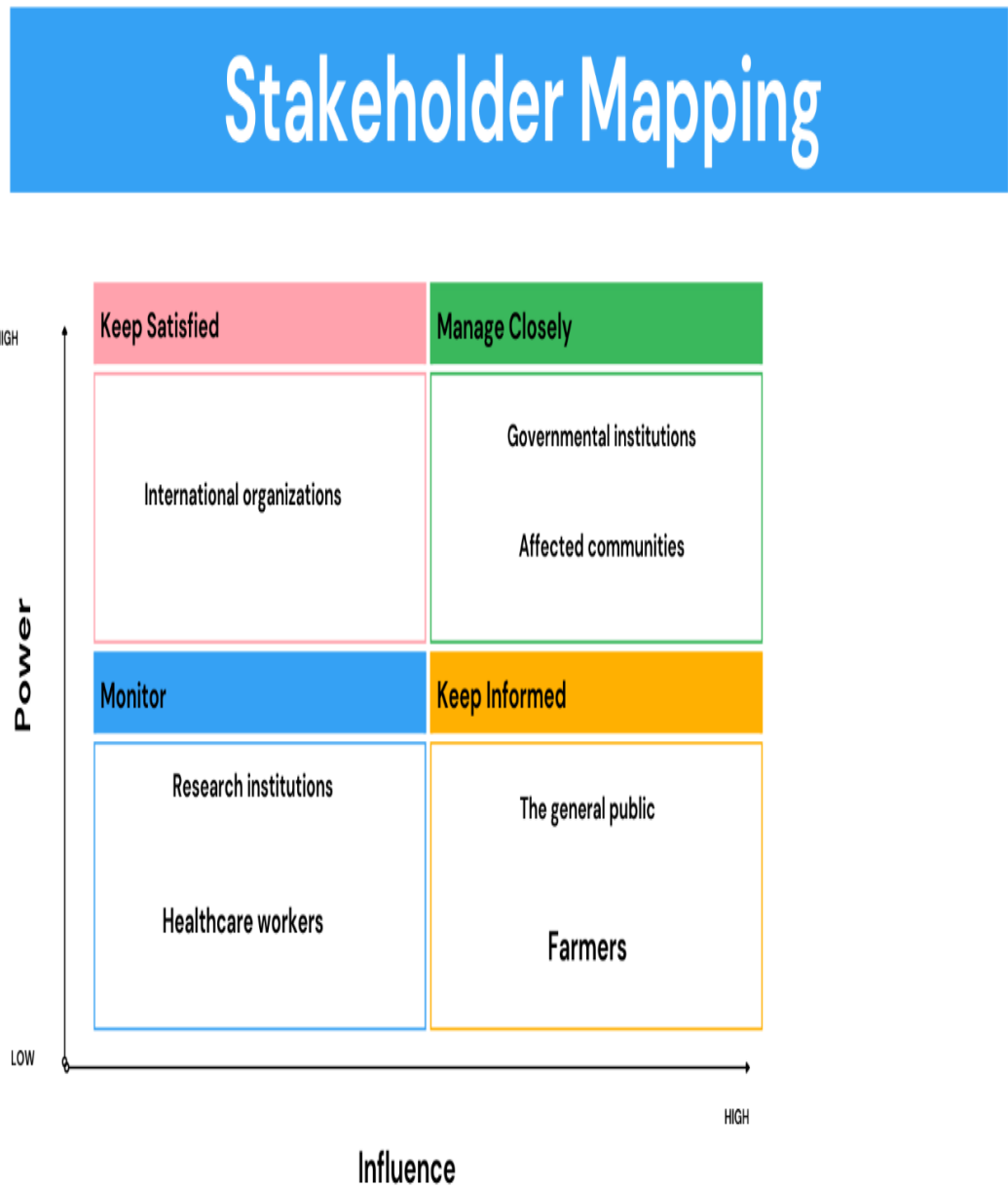


Figure (21) Represents the stakeholders' mapping (Onasanya et al., 2020)

4-RESULT

1- Number of new cases appeared in the village B

Based on secondary data collected that based on health care facility that includes (Total number of sample taken, number of positive and number of negative samples), out of 749 random samples collected from villagers, 26 had positive schistosomiasis cases, and 723 had negative. This represents about 3.2 % of the collected sample. 749 represents 10% of the total number of populations lives in villages B.

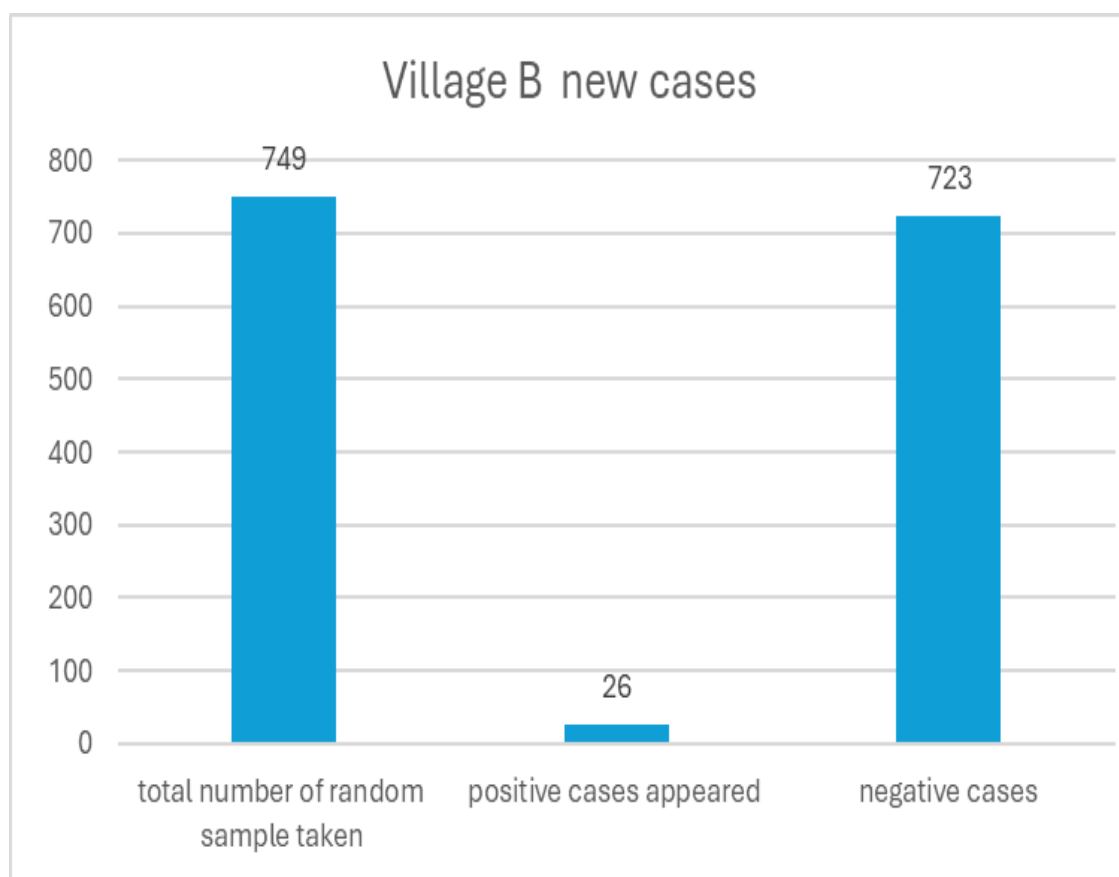


Figure (5) Represents the number of cases shown in the last random sampling in village B. The total sample represents 10% of village B's population.

Table (2): Results of the incidences of schistosoma among random samples collected from the 2 villages

	Positive		Negative	
	No	%	No	%
Village A	0	0	150	100
Village B	26	17.34	124	82.66

$\chi^2 = 7.28$

** = Significant at ($P < 0.01$)

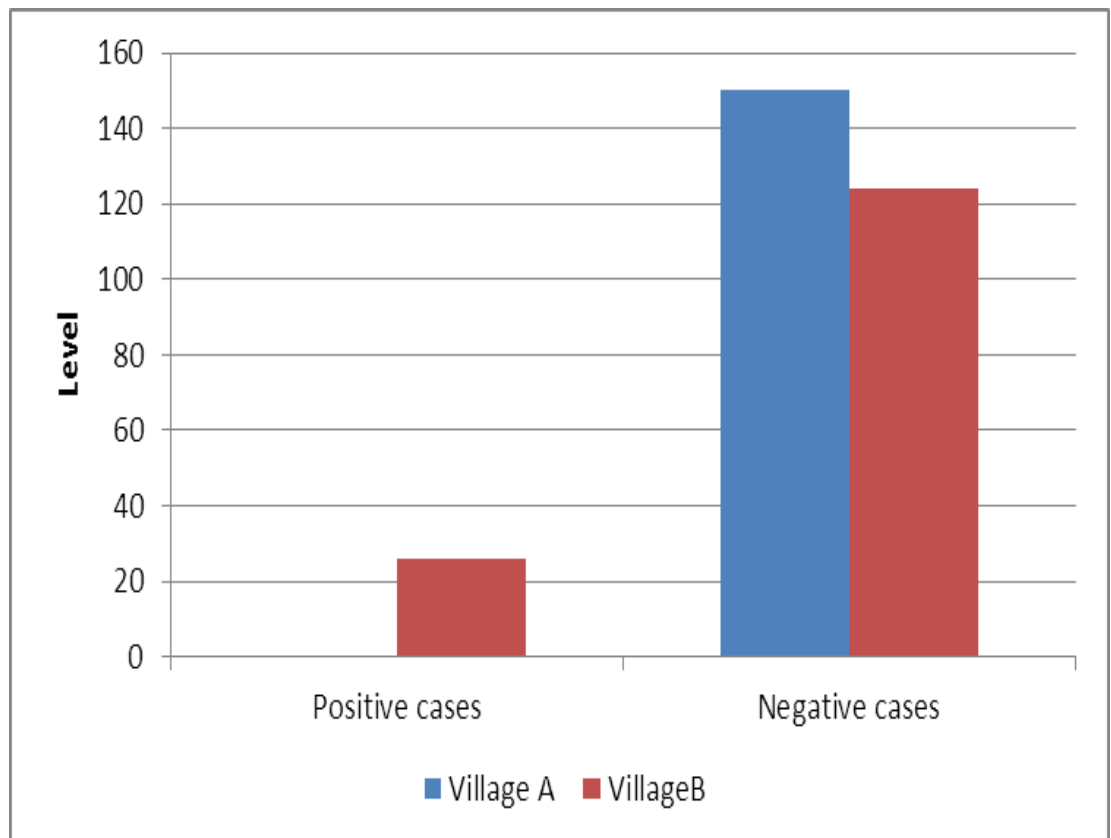


Figure (6): results of the incidences of Schistosoma among random samples collected from the 2 villages

2- The ages of the participants in both villages A and B

The age distribution of participants showed that the majority (45%) were between 30 and 40 years old. The next largest group (25%) was between 40 and 50 years old, followed by 15% between 50 and 60 years old. Participants under 10 years old constituted 5%, while those between 10-20 and 20-30 years old each represented 3% of the sample. Lastly, individuals over 60 years old made up 4% of the participants. The age distribution differed significantly among the participants ($p < 0.01$)."

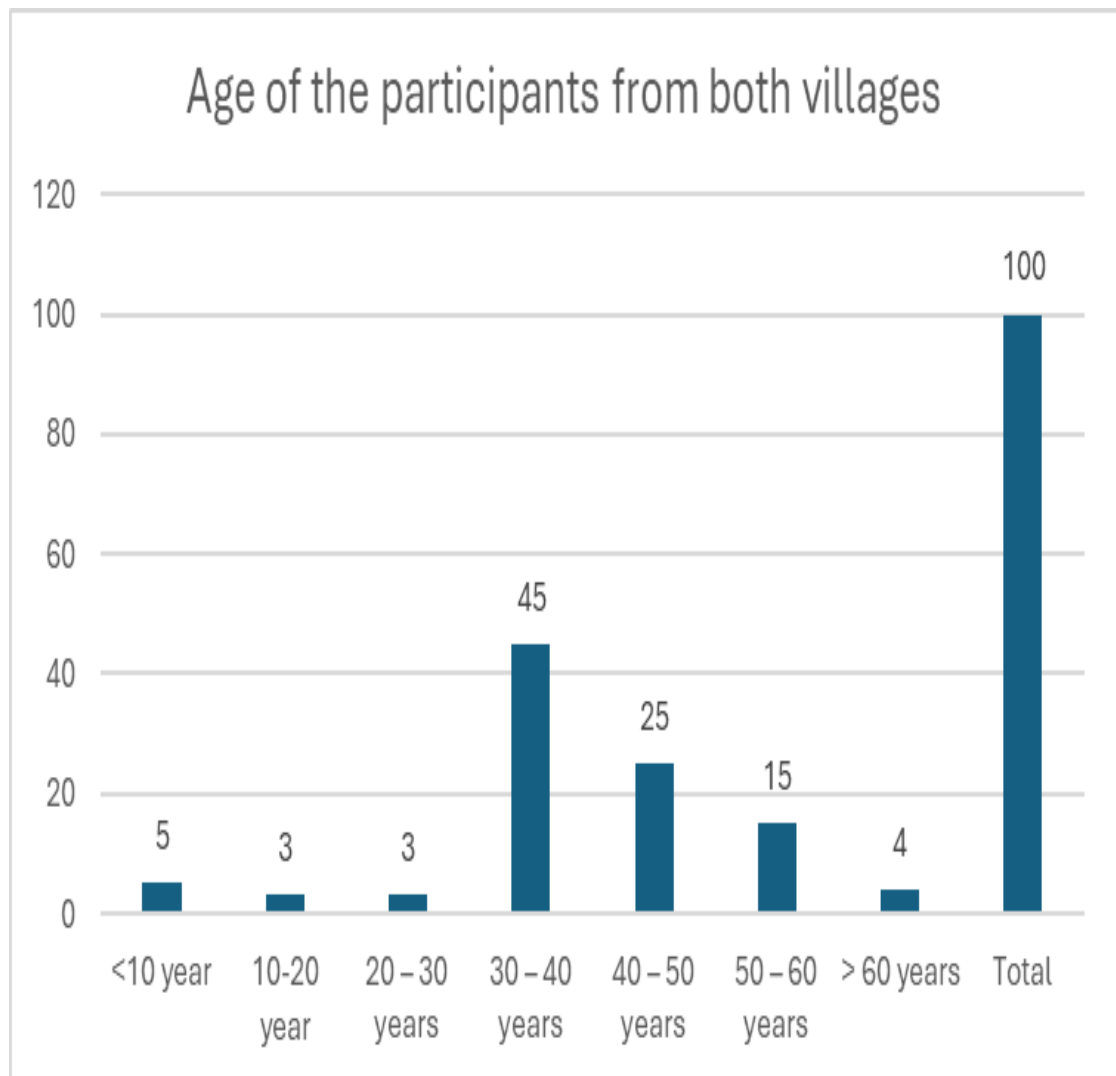


Figure (7) Represents the age of the participants in the study by percentage

3- Social status:

The social status of the patients was higher in married couples, reaching 94 %, while the single condition was 3 %, widowers 2 %, and divorced 1 %.

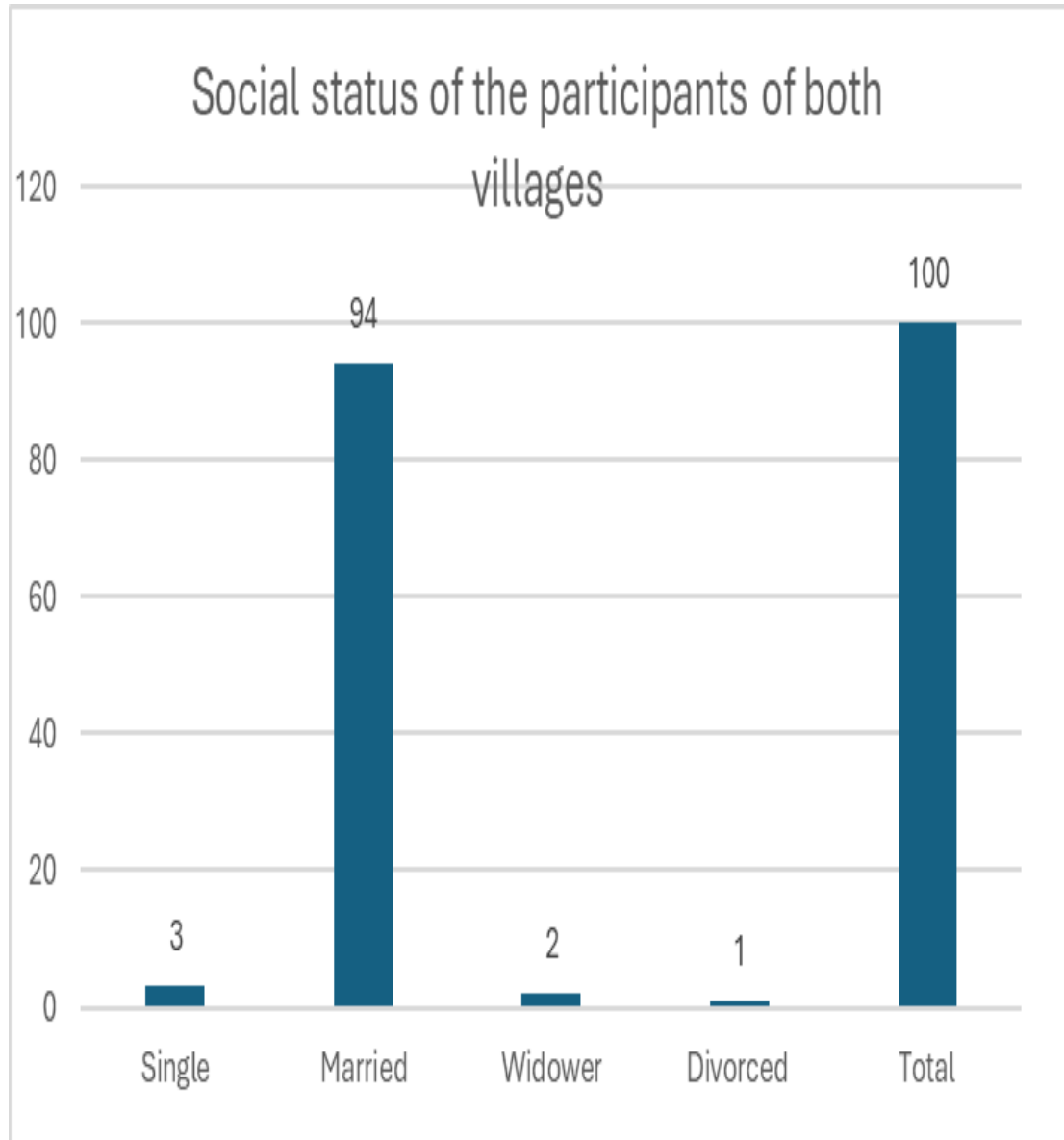


Figure (8): Social status of the participants in the study represented by percentage.

4- Number of children for participants who have children.

The number of children observed showed a higher level in 4 children, which was 41 %; 5 children, which 22 %; 3 children, which was 15 %; and 6 children observed in social 14 % of the studied participants, and a lower number of children observed in 2 children, which were 7 % of participants, and 1 child, which was 1 % of the studied participants.

This results indicated that, the number of children must be reduced to increase the general health status of the children and reduce the incidences of the Schistosomiasis among children

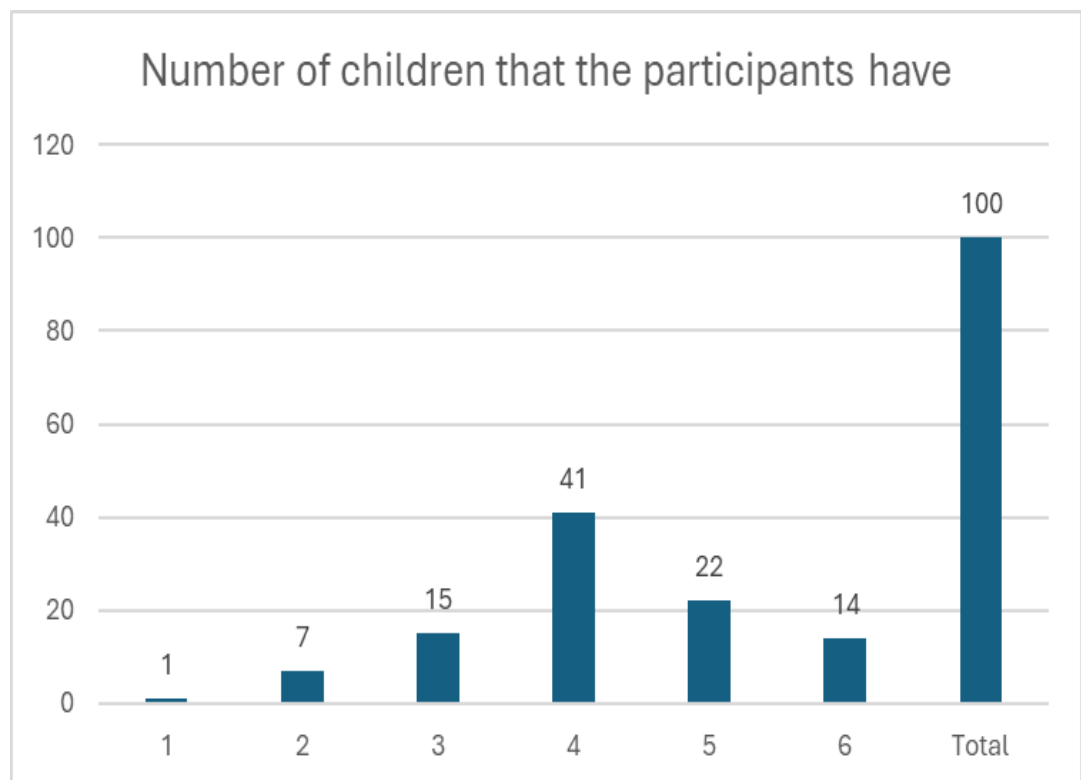


Figure (9): Represents the number of children for the participants who have children in the study

5- Education level of the participants

Our results observed in Table (4) cleared that the educational level of the participants differed significantly ($P < 0.01$) among the studied participants.

The higher educational level of the studied participants was observed in the secondary school level, which was observed in 37 % of the studied participants; the primary school level, which was observed in 22 % of the studied participants; tertiary school level, which was observed in 17 % of the examined participants.

The lower educational level observed in the non-educational level was 13 %, the university level was observed in 10 % of the examined participants, and the higher educational level was observed in 1 % of the examined participants.

These results indicated that, the educational level must be improved to increase the general health status of the individuals especially those living in the villages and near to the water drainage for reduction of the incidences of the Schistosomiasis among people.

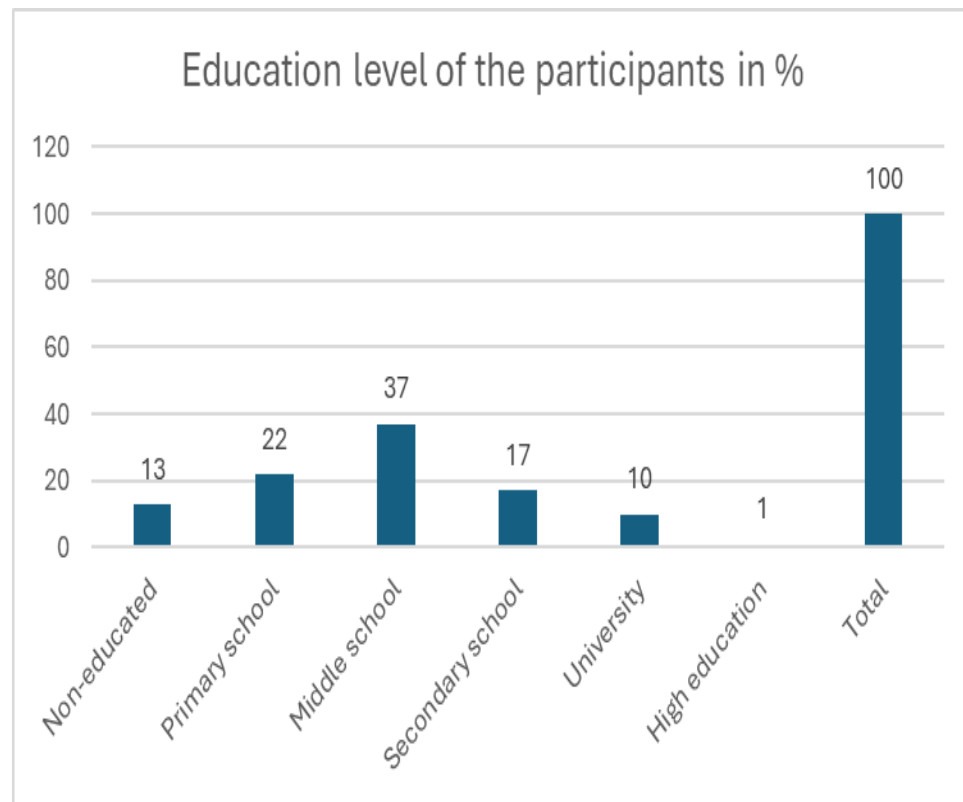


Figure (10): Education level of the studied participants

5-Education level for the children in case of presence of children:

The higher educational level of the study participants was observed at the university level, which was, observed in 45 % of the studied participants; tertiary school level, which

was observed in 25 % of the studied participants, and secondary school level, which was observed in 15 % of the examined participants.

The lower son educational level observed in primary school level was 11 %, the higher educational level that observed at 3 %, and the uneducated level of the examined participants was 1 %.

These results indicated that, the educational level must be improved to increase the general health status of the children especially those living in the villages and near to the water drainage for reduction of the incidences of the Schistosomiasis among children.

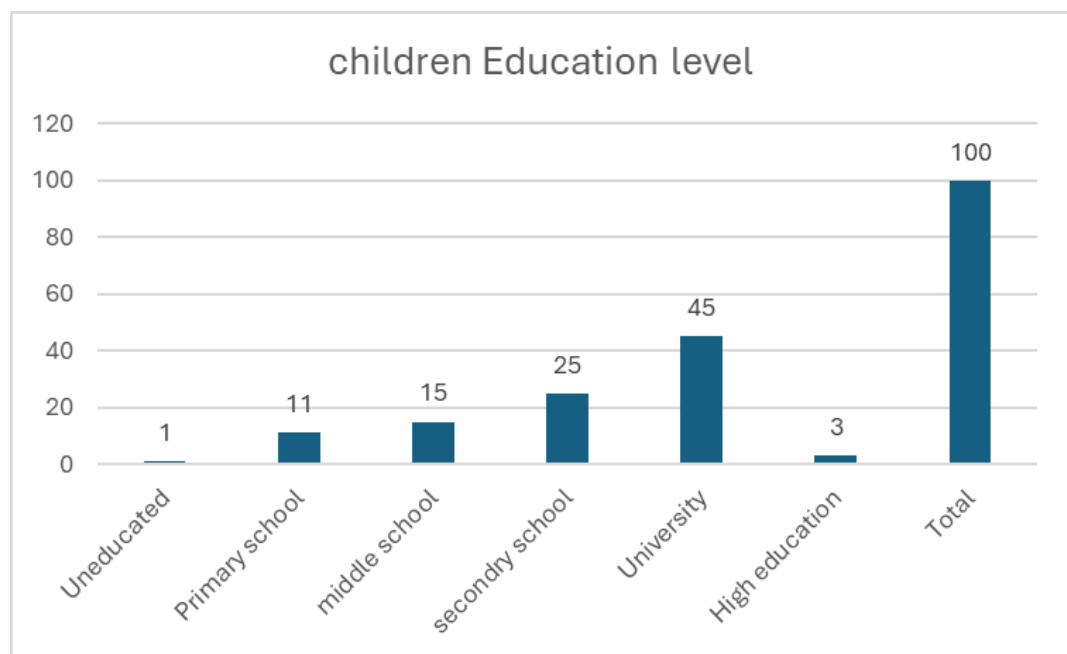


Figure (11): Education level for the children in case of presence of children by percentage

6-Occupation:

The higher Occupational level observed in working with agriculture was observed in 63 % of the studied participants, working with fishing was observed in 21 % of the studied

participants, and working with office work was observed in 10 % of the examined participants.

The lower occupational level observed in craftsmen artisans' work was 2 %. In other work, which was 10 %.

These results indicated that, the occupation of the individuals must be improved to increase the general health status of the individuals especially those living in the villages and near to the water drainage for reduction of the incidences of the Schistosomiasis among them.

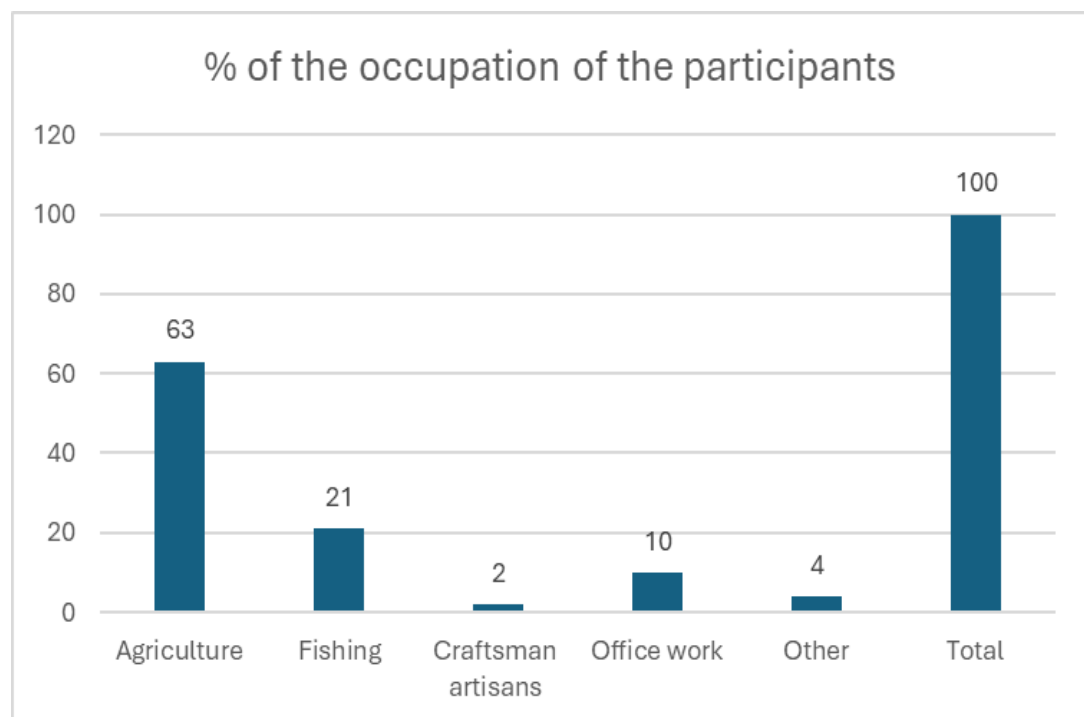


Figure (11): Occupational level for the participants.

Information on Schistosoma:

The higher information levels observed on diseases that come from the drainage water was 99 %. While the lower information was observed on dangerous diseases over the long period, which was 1 %, and the information about dangerous diseases, which was 0 %.

ved on diseases that come from the drainage water was 99 %. While the lower information was observed on dangerous diseases over the long period, which was 1 %, and the information about dangerous diseases, which was 0 %.

This results indicated that, the information of the individuals about Schistosoma and the methods of its transmission must be improved and increased to improve the general health status of them especially those living in the villages and near to the water drainage for reduction of the incidences of the Schistosomiasis among them through reduction of using this types of water.

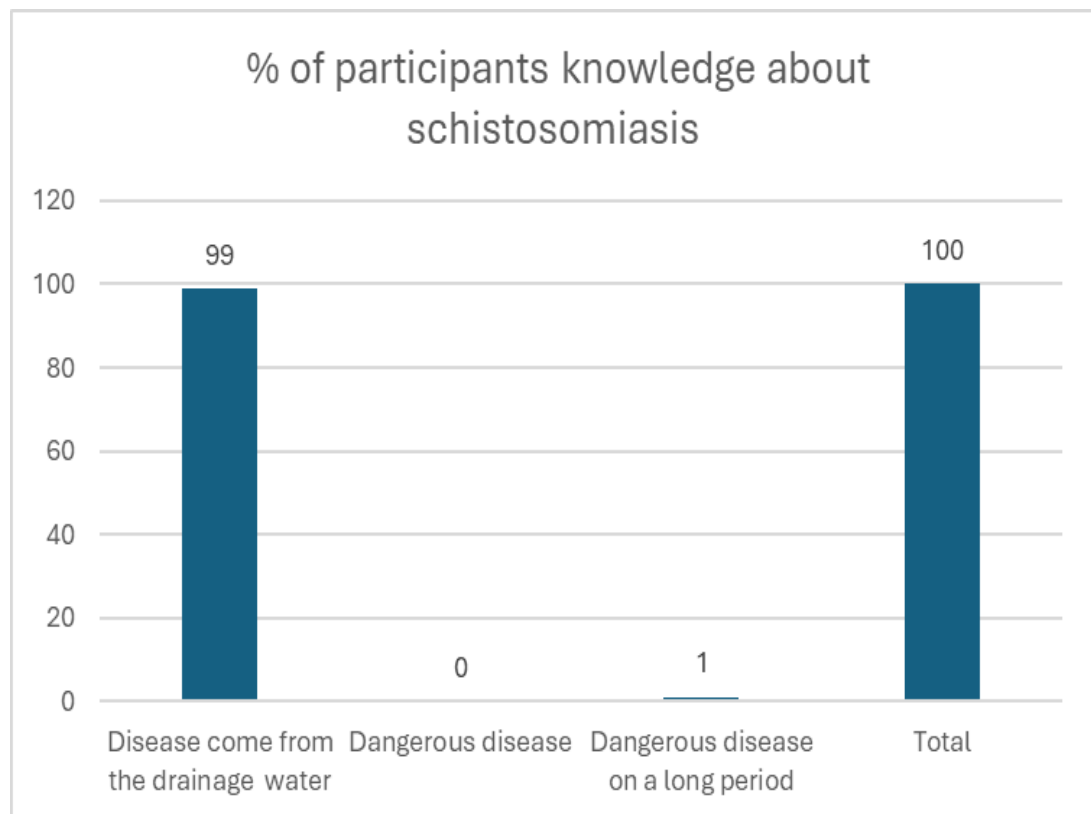


Figure (12): Information on Schistosoma among studied participants

Risk factors for Schistosoma incidences:

Our results observed in Figure (13) clearly that the risk factors of Schistosoma incidences differ significantly ($P < 0.01$) among the studied participants. By comparing village, A which has no cases, and village B which has new cases

The higher risk factors level observed in working near water stream reached 96 %, ownership of agricultural land was 72 %, the health unit is close was 68 %, and attendance of health education sessions was 64 %.

The lower risk factors observed in Educating your family to prevent schistosomiasis were 49 % and Washing dishes or showers in a stream near the house was 29 %.

These results indicated that, the risk factors of the incidences of schistosoma must be improved to increase the general health status of the individuals especially those living in the villages and near to the water drainage for reduction of the incidences of the Schistosomiasis risk factors.

Table (2): Results of the incidences of schistosoma among random samples collected from the 2 villages

	%	
	Positive	Negative
Ownership pf the land	72	28
Working near water	96	4
Woshing dishes	29	71
Health unit	68	32
Attendance health	64	36
Educating your family	49	51

Chi² = 9.55

**** = Significant at ($P < 0.01$)**

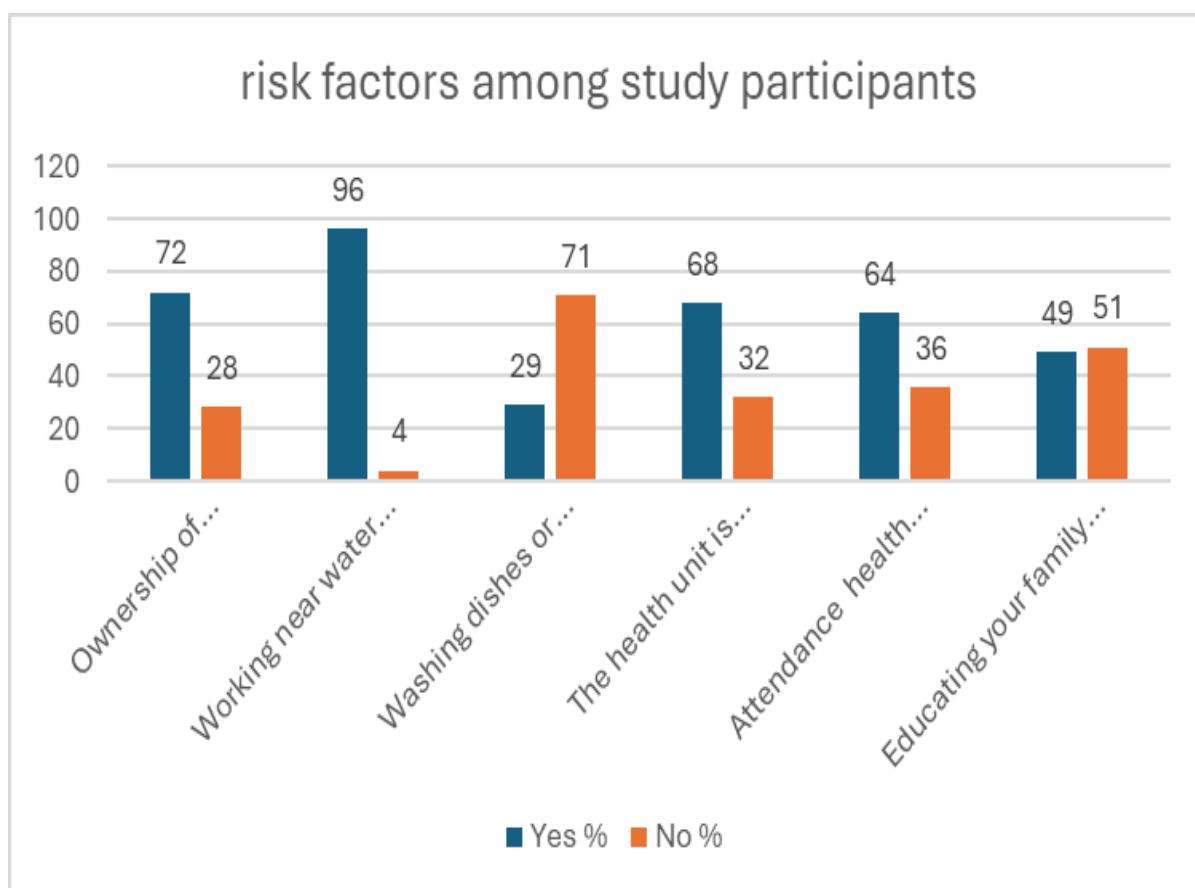


Figure (13): Risk factors for Schistosoma incidences among studied participants

Period of last infection:

The infection period of a higher level was 10 years that observed in 70 % of the examined participants, followed by 15 years infection period that observed in 15 % of the examined participants and 2- years infection period that observed in 12 % and less than a year that observed in 3 % of the examined participants. The results cleared that, the infection of the patients from the last 10 – 12 year.

This results indicated that, the infected participants with schistosoma must be go to the hospitals for examination on the infection with schistosoma to determine the degree of infection with schistosoma.

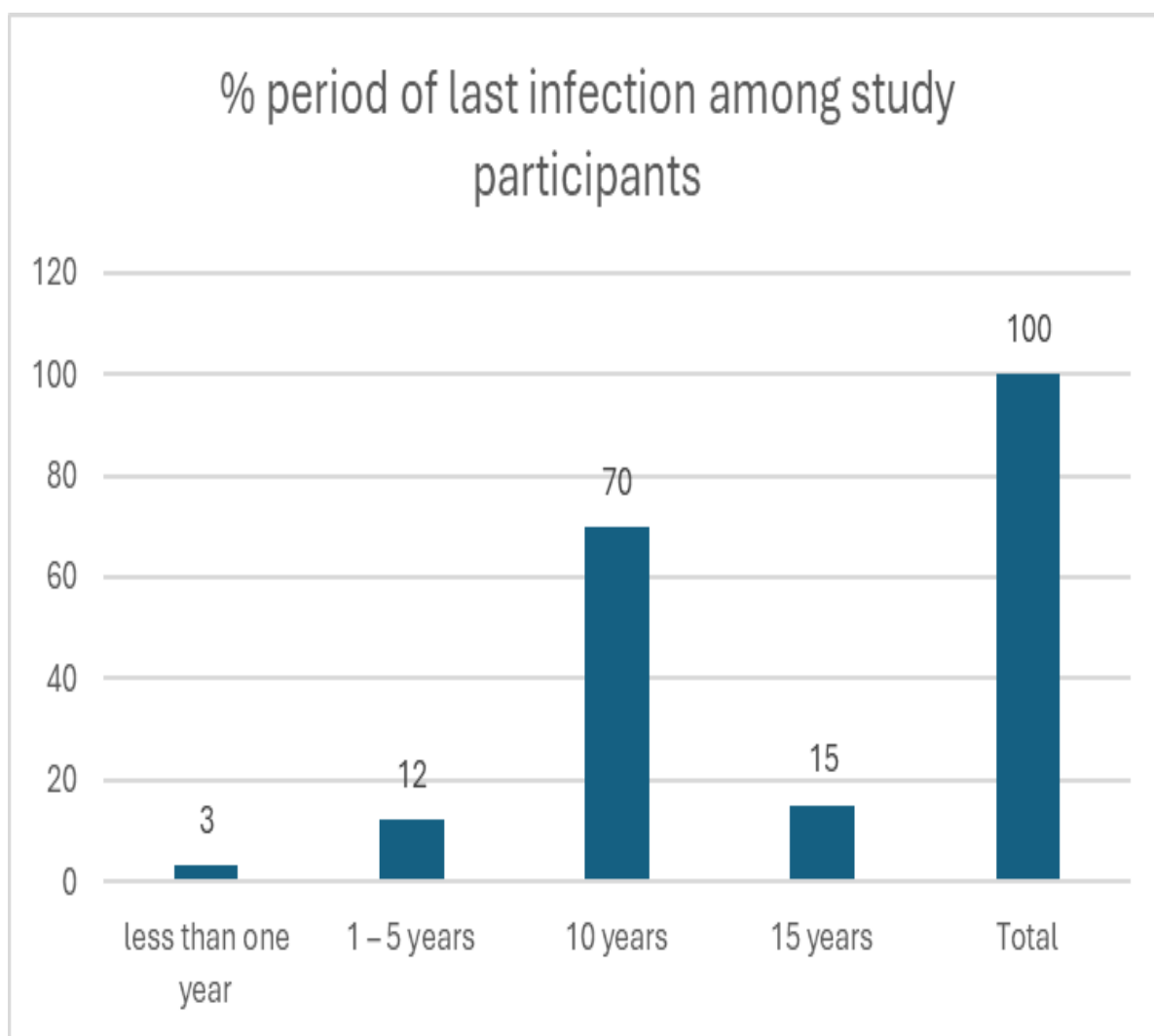


Figure (14): Time of last infection of schistosomiasis

Behavior of the participants towards treatments of schistosomiasis

Our results observed clearly that the items of treatment of *Schistosoma* include, times a month of visiting the health unit, Times of receiving treatment for schistosomiasis, Number of visits for treatment of *Schistosoma* at home, The number of cases of schistosomiasis in your family and Number of times have you been infected with bilharzia period of infection differ significantly ($P < 0.01$) among the participants under the which are 749 participants from them 26 participants infected with schistosoma.

The times a month of visiting the health unit showed a higher level of participants per month where 33 % visited the health unit 4 times per month, 16 % visited the health unit 6 times per month, 15 % visited the health unit 3 times per month. while the lower visits of health units were observed in 16 % of the participants visited the health units 6 times per month, 15 % of the participants visit the health units 3 times per month, 13 % of the participants visit the health units 2 times per month and 6 % of the participants visit the health units 1 time per month.

The times of receiving treatment for schistosomiasis showed a higher level of participants per month where 58 % receiving treatment for schistosomiasis 1 time per month, 26 % receiving treatment for schistosomiasis 2 times per month, 9 % receiving treatment for schistosomiasis 3 times per month. while the lower receiving treatment for schistosomiasis observed in 1 % of the participants receiving treatment for schistosomiasis 5 times per month, 0 % of the participants receiving treatment for schistosomiasis 6 times per month, 0 % of the participants receiving treatment for schistosomiasis 7 times of the receiving treatment for schistosomiasis 1 times per month.

The number of times a month of visiting for treatment at home showed a higher level of participants per month, where 71 % visited the home for treatment 1 time per month, 25 % took the treatment per home 3 times, 1 % took the treatment in home 4 times and no visits for home treatment at 6 and 7 times per month.

The number of cases of schistosomiasis in the family showed a higher level of participants per month where 87 % of participants showed 1 case per family, 8 % of the participants of 2 cases, 4 % showed 3 cases per month and 1 % showed 4 cases in the family while, the incidences of 5, 6 and 7 cases showed a 0 % this results due to the health office repeat the treatment and examination of this cases that causes complete treatment of the infection with schistosoma.

The number of times you have been infected with schistosomiasis showed a higher level of participants where 81 % of participants showed 1 infection times, 16 % of the participants infected 2 times, 2 % of the participants infected 3 times and of 2 % of the participants infected 4 times while, the incidences of 5, 6 and 7 times of infection showed a

0 % this indicated the effective treatment of the health office responsible for treatment of schistosoma.

These results indicated that, the infected participants with schistosoma must be go to the hospitals for examination on the infection with schistosoma to take the possible treatment against schistosoma.

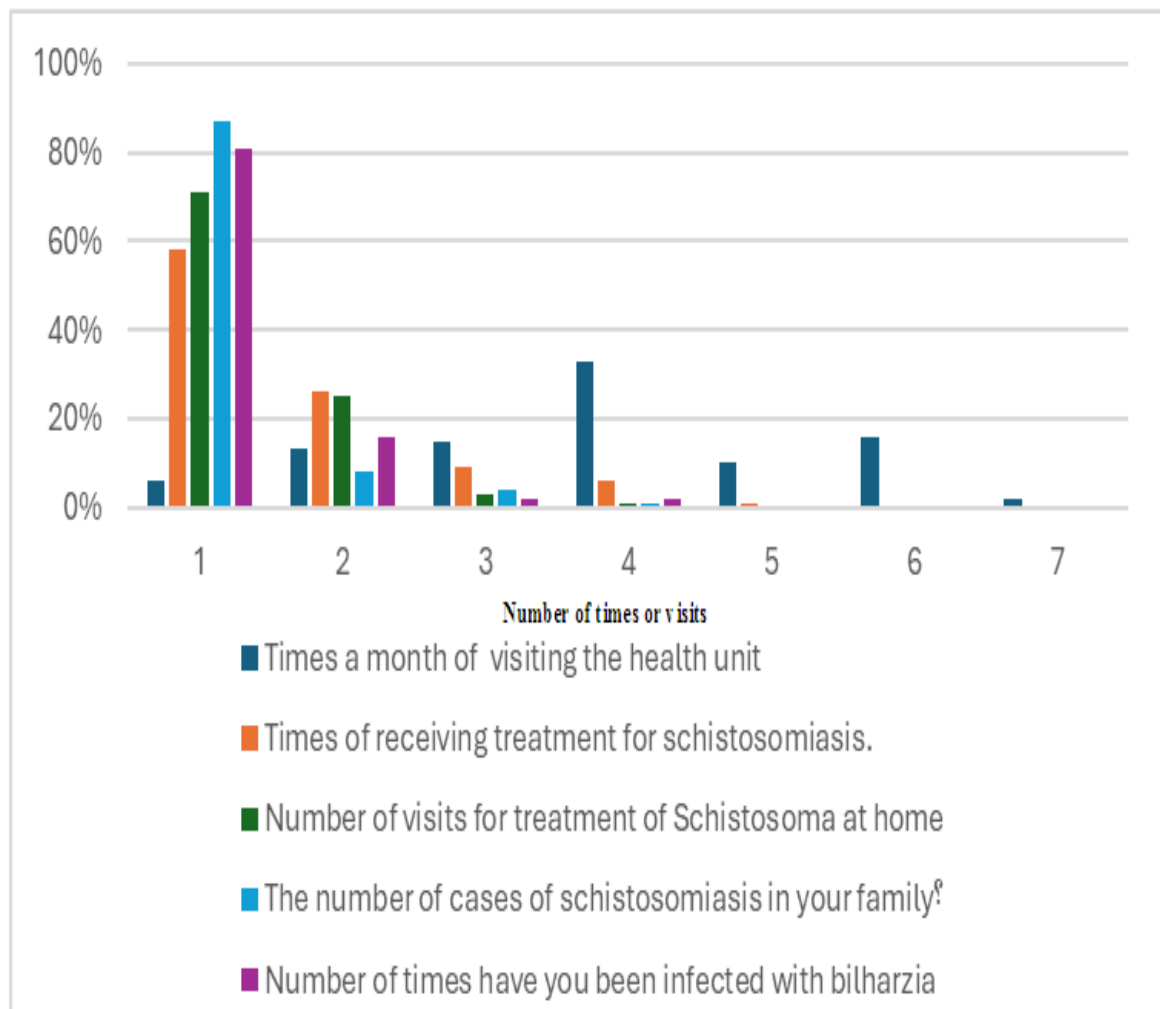


Figure (15): Represents behavior towards treatment of the participants in the study.

Efficiency and presence of treatment and medical care

Our results observed cleared that the items of treatment efficiency of Schistosoma include Times a month of visiting the health unit, Times of receiving treatment for schistosomiasis, Number of visits for treatment of Schistosoma at home, The number of cases of schistosomiasis in your family and Number of times have you been infected with bilharzia period of infection differ significantly ($P < 0.01$) among the participants under the study which includes the availability of treatment cover the needs of the village if schistosomiasis cases increase, the treatment supplies provided regularly, all employees trained to serve patients with schistosomiasis and advise the patient to go to another place when no service is available, to another unit or to another place if the number of workers decreased than the number of infection and visitors or if the drugs are unavailable.

The results cleared that most participants considered the efficiency of treatment depends mainly by 95 % on the availability of treatment must cover the needs of the village if schistosomiasis cases, 80 % of the measures considered the treatment supplies provided regularly, all employees trained to serve patients with schistosomiasis by about 55 % of the examined participants and 10 % considered the treatment efficiency must advise the patient to go to another place when no service is available, to another unit this is based on the data collection

These results indicated that the infected participants with Schistosoma must go to the hospitals for examination on the infection with Schistosoma after treatment to determine the treatment efficiency.

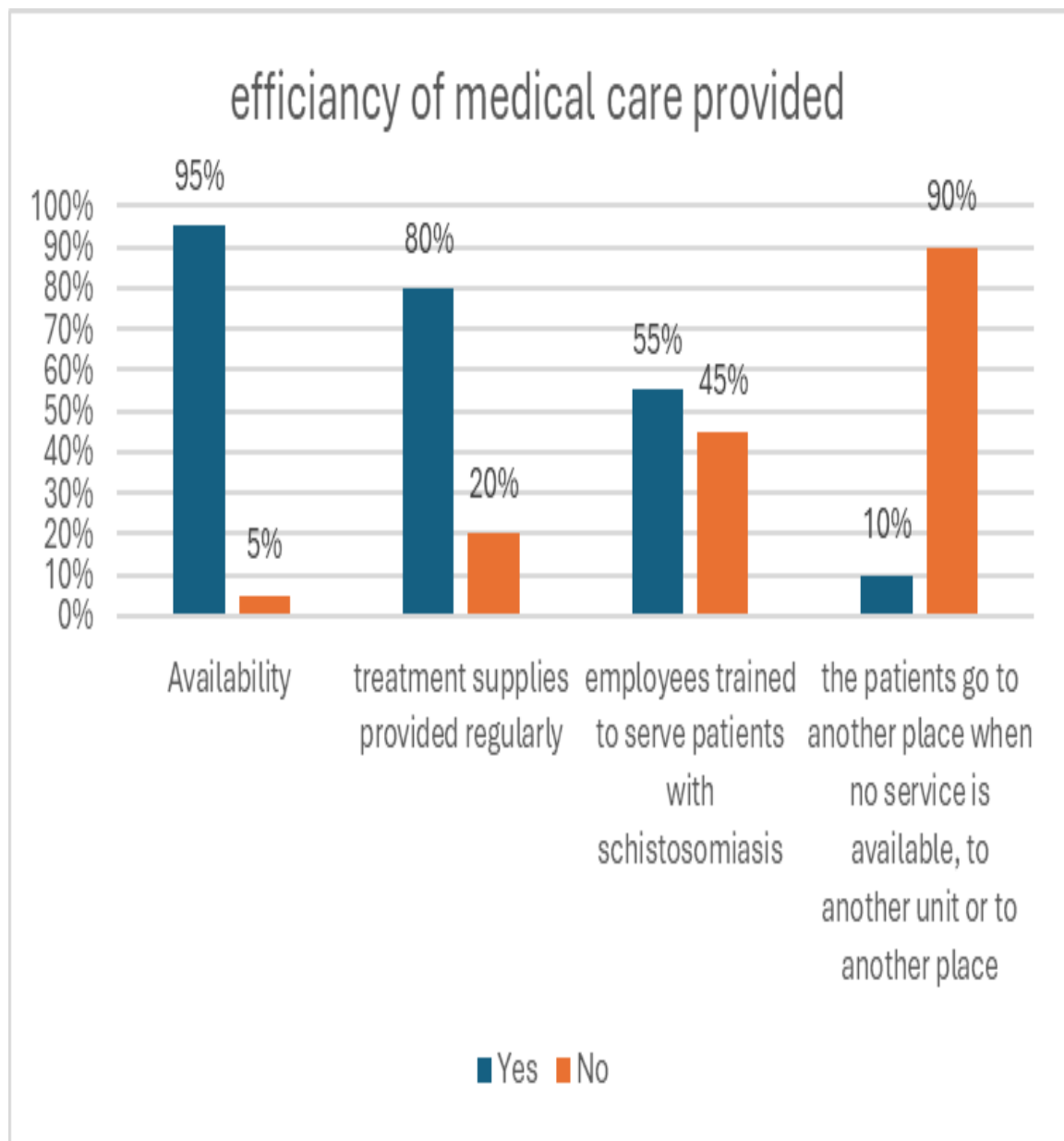


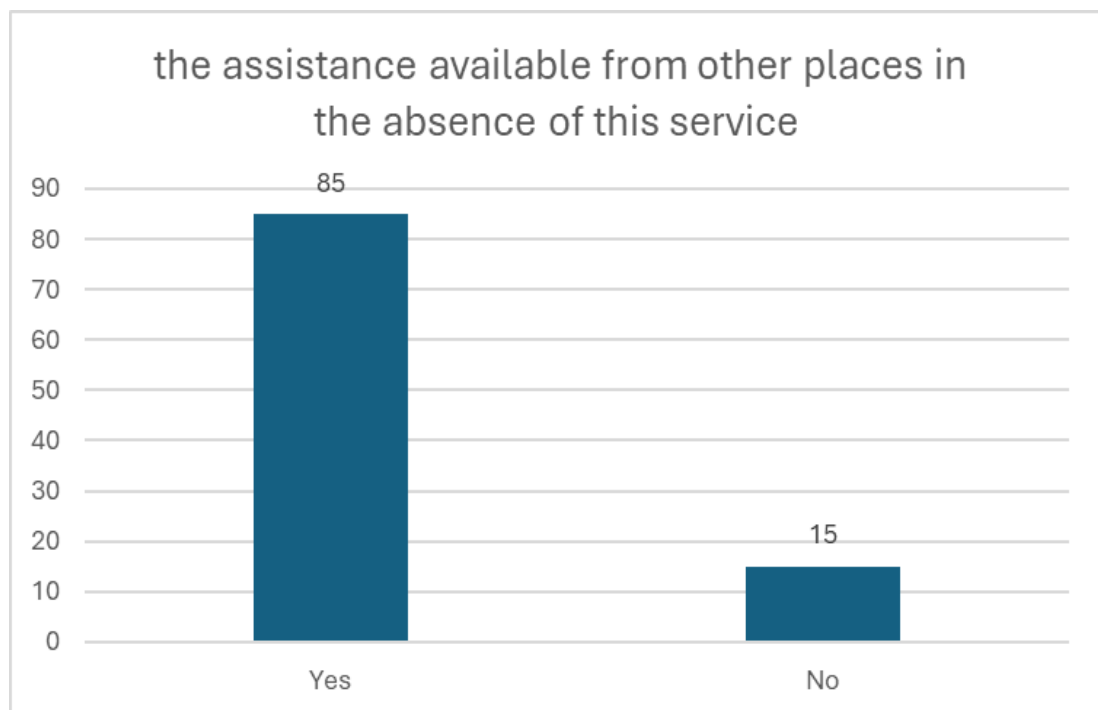
Figure (16): Efficiency of Schistosoma medical care provided.

Other services for prevention of schistosomiasis

Our results observed clearly that other services for the prevention of infection differ significantly ($P < 0.01$) among the participants in the study, which includes the assistance available from other places in the absence of this service.

Where 85 % of the studied participants considered assistance available from other places in the absence of this service considered as the best item for prevention of Schistosoma.(snail control).

This results indicated that, other services for prevention of schistosoma must be take in our considerations as controlling snails, risk prevention factors that will reduce the incidences of the of schistosoma, gave the people information for prevention of schistosoma, frequent visiting of the health office to for examination against schistosoma and take the effective treatments ..



** = Significant at ($P < 0.01$)

Figure (17): Precaution for prevention of Schistosoma.

Degree of conduction of the survey

Our results showed that the Degree of conduction of the survey for Schistosoma prevention differs significantly ($P < 0.01$) among the study participants, including a random survey conducted periodically. And to what extent targets respond to schistosomiasis campaigns. While 85% of the studied participants considered the conduction of the survey for the prevention of Schistosoma, 85% of the participants considered a random survey conducted periodically to be good, and 15% thought it not conducted.

The targets responded to schistosomiasis campaigns, where 60 % of the participants considered it yes, and 35 % considered it a good no.

This results indicated that, the degree of conduction of the survey must be completed rapidly for treatment of the infected individuals and prevention of the risk factors of schistosoma.

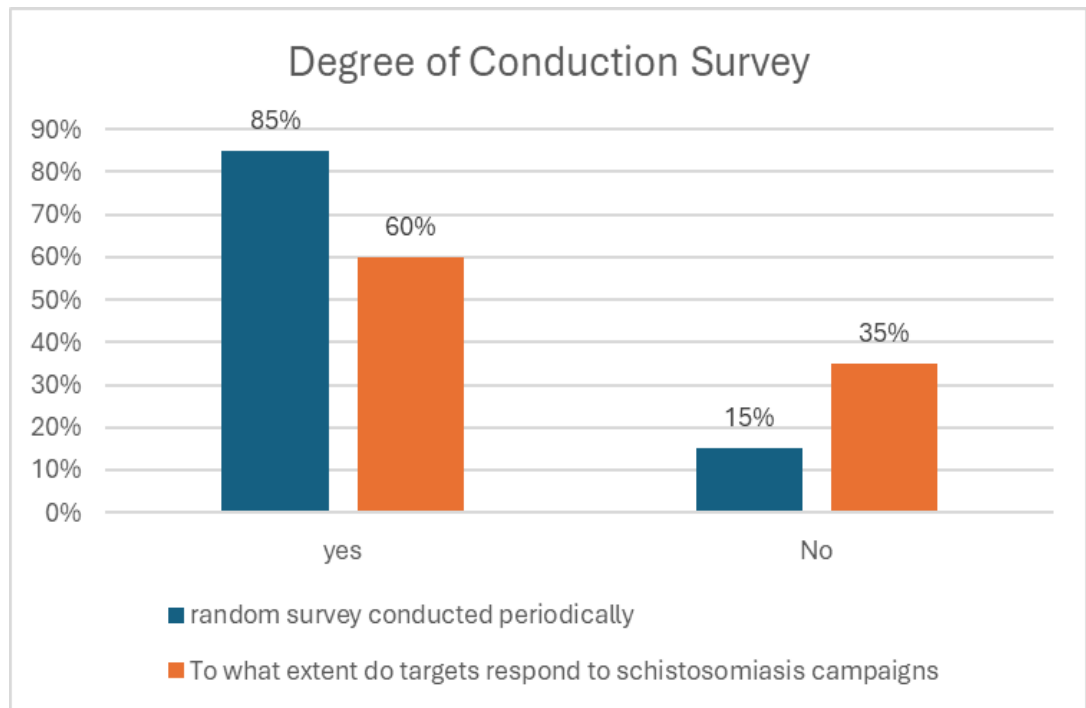


Figure (18): Degree of conduction of the survey for Schistosoma prevention

Challenges in Schistosomiasis

Challenges in Reinfection (Factors causing reinfection)

Our results observed clearly that the reinfection with *Schistosoma* differs significantly ($P < 0.01$) among the participants in the study, which includes most of the participants who work in agriculture, and most of the participants have not changed their customs and traditions that include (Canal bathing, walking barefoot while working in agriculture and hunting, failure to line some canal branches, most of the sewage drains for homes are drained into canals. The results are clear: most of the participants (90 %) considered that working in agriculture causes reinfection with *Schistosoma*. Also, there were some customs and traditions that were difficult to change.

These results indicated that the factors causing the infection with schistosoma must be decreased to reduce and prevent the risk factors of schistosoma.

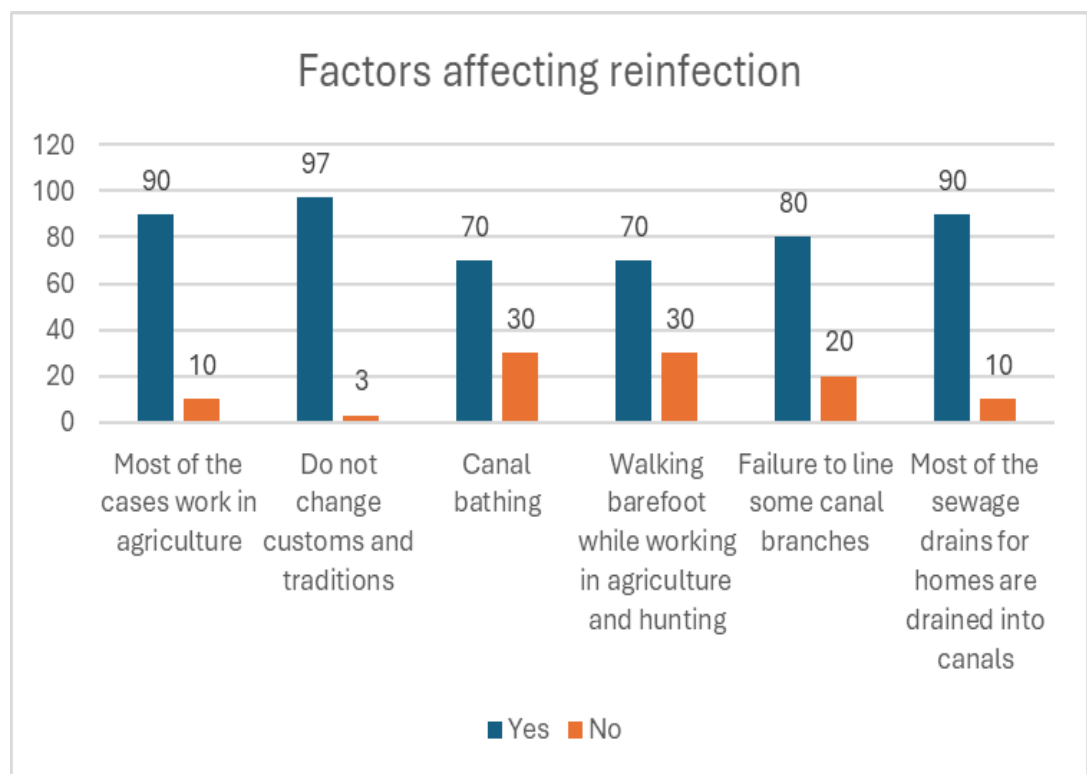


Figure (19): Factors causing reinfection among participants

Challenges facing planners in eliminating schistosomiasis in this unit

Our results clearly show that the planners' main challenges in eliminating *Schistosoma* include the 90 % of the participants not changing their habits. The second challenge is that 95 % of the participants considered Farmers do not respond to wearing shoes.

These results indicated that the challenges facing planners must be taken into consideration for eliminating the risks of the incidences of schistosomiasis.

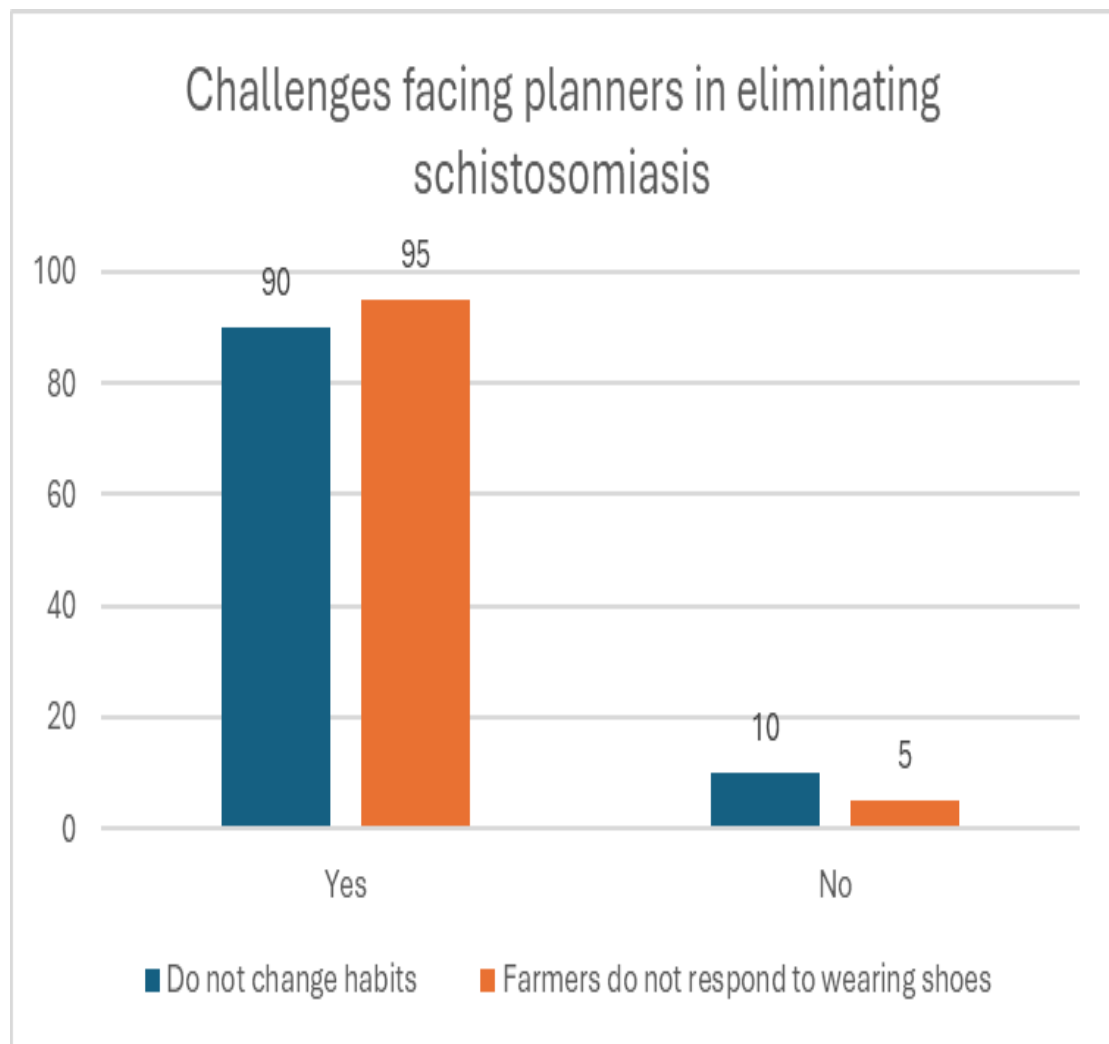


Figure (20): Challenges in eliminating schistosomiasis facing planners

Findings from qualitative data:

Human Factors

- **Lack of Education and Awareness:** it is indicated that many individuals, particularly in rural areas, lack sufficient knowledge about schistosomiasis transmission and prevention. This can lead to risky behaviors such as swimming in contaminated water or walking barefoot in agricultural fields.
- **Poor Healthcare-Seeking Behavior:** it is found that infrequent healthcare utilization is associated with a higher risk of schistosomiasis. Many individuals do not seek timely diagnosis and treatment, contributing to the continued transmission of the disease.
- **Occupational Risks:** Certain occupations, such as farming and fishing, involve frequent contact with contaminated water, increasing the risk of infection. The report notes that the majority of new schistosomiasis cases were among individuals engaged in agriculture-related activities.

Environmental Factors

- **Contaminated Water Sources:** The presence of freshwater canals and irrigation systems provides suitable habitats for snails, the intermediate hosts of the parasite. Contamination of these water sources with human waste perpetuates the transmission cycle.
- **Agricultural Practices:** The use of contaminated water for irrigation and the practice of walking barefoot in agricultural fields can expose individuals to the parasite. The report highlights that most participants considered working in agriculture as a major cause of reinfection.
- **Inadequate Sanitation:** Poor sanitation and open defecation can lead to the contamination of water sources with parasite eggs, contributing to the spread of the disease.

Cultural Factors

- **Water-Related Practices:** Certain cultural practices, such as swimming in canals and using canal water for domestic purposes, can increase the risk

of exposure to the parasite. The report notes that changing these habits is a significant challenge in schistosomiasis elimination efforts.

- **Traditional Beliefs:** Traditional beliefs and practices may influence healthcare-seeking behavior and adherence to preventive measures. Some individuals may rely on traditional remedies or may not perceive schistosomiasis as a serious health threat.

Programmatic Challenges

- **Limited Resources:** The research emphasizes the need for adequate resource allocation to address schistosomiasis effectively. This includes financial resources for health education, mass drug administration, infrastructure development, and healthcare worker training.
- **Inadequate Healthcare Infrastructure:** Limited access to healthcare facilities, diagnostic tools, and medications, particularly in rural areas, can hinder the diagnosis and treatment of schistosomiasis.
- **Resistance to Behavior Change:** Changing ingrained behaviors and cultural practices related to water use and sanitation can be challenging. The report notes that farmers' reluctance to wear shoes while working in fields is a significant obstacle to reducing infection rates.

5-DISCUSSION

Schistosomiasis is a parasitic disease caused by blood flukes (Trematodes) of the genus *Schistosoma* (S.). It is well documented that schistosomiasis haematobium was endemic in Ancient Egypt. Infection was diagnosed in mummies 3000, 4000, and 5000 years old. Scott was the first to describe the pattern of schistosomiasis infection in Egypt. Schistosomiasis haematobium was highly prevalent (60%) both in the Nile Delta and Nile Valley South of Cairo in districts of perennial irrigation, while it was low (6%) in districts of basin irrigation. *Schistosoma mansoni* infected 60% of the population in the Northern and Eastern parts of the 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 (Barakat et al., 2013).

This study aimed to study factors and challenges to eliminate schistosomiasis as a public health disease; however, it has a low incident rate in Egypt

Our results on the demographic characters indicated that the Age of the patients of the lower level at 10 – 20 years was 3 %, from 20 to 30 years was 3 %, > 60 years was (4 %) and < 10 years (5 %), and the higher age level observed in the age range from 30 – 40 year (45 %), 40 – 50 % was 25 % and the age range from 50 – 60 year was 15 %. of the participants differ significantly. Our results on the social condition cleared that, the social condition of the patients showed a higher level in married reaching 94 %, while the single condition was 3 %, widower 2 %, and the absolute reached 1 %.

Our results on the number of children in married cases **found** clear that, the children number showed a higher level in 4 children that was 41 %, 5 children that were 22 %, 3 children that were 15 %, and 6 children observed in social 14 % of the studied participants and the lower number of children observed in 2 children that observed in 7 % of participants and 1 child that observed in 1 % of the studied participants. While our results on the educational level cleared that, the higher educational level of the studied participants observed in secondary school level that observed in 37 % of the studied participants, primary school level was observed in 22 % of the studied participants, tertiary school level that observed in 17 % of the examined participants. The lower educational level was

observed in the non-educational level that was 13 %, the university level that observed in 10 % of the examined participants, and the higher educational level that observed in 1 % of the examined participants. While the education level for the son in case of presence of children cleared that, the higher educational level of the son of studied participants observed in university level that observed in 45 % of the studied participants, tertiary school level that observed in 25 % of the studied participants, secondary school level that observed in 15 % of the examined participants. While the lower son educational level observed in the primary school level was 11 %, the higher educational level that observed at 3 % and the uneducated level of the examined participants was 1 %.

While our results on the Occupation of the participants cleared that, the higher Occupational level observed in working with agriculture that observed in 63 % of the studied participants, working with fishing that observed in 21 % of the studied participants, working with office work that observed in 10 % of the examined participants. The lower occupational level observed in literal work was 2 % and in other work that was 10 %.

These results agreed with those of **(WHO, 2023)**, who reported that schistosomiasis has been endemic in Egypt for dozens of centuries, which calls for taking measures to combat this disease and work to limit its spread, especially in the countryside, due to the high probability of infection among farmers, as they are the most vulnerable to infection, *S. haematobium* and *S. mansoni* are the two species that are endemic to Egypt, and infection with them leads to genitourinary schistosomiasis and intestinal schistosomiasis, respectively.

The results of the participants' information on *Schistosoma* showed that the higher information levels observed on diseases that come from the drainage water were 99 %. The lower information was observed on dangerous diseases over the long period, which was 1 %, and the information about being a dangerous disease, which was 0 %.

These results indicated that the increasing level of infection with *Schistosoma* is attributed to the lack of information about *Schistosoma*.

These results agreed with those of **(Inobaya et al., 2014)**, who reported that Schistosomiasis is a neglected tropical disease, which is the second parasitic disease after malaria in terms of its prevalence and impacts on health and economics

Our results on the risk factors for Schistosoma incidences reveal that the higher risk factors level observed in the participants that working near a water stream reached 96 %, ownership of agricultural land was 72 %, the health unit close was 68 %, attendance health education sessions that were 64 %. The lower risk factors observed in Educating your family to prevent schistosomiasis was 49 % and Washing dishes or showering in a stream near the house was 29 %.

These results agreed with those of **(Barry et al., 2013)**, who reported that more than 90% of the infected people are concentrated in areas with the poorest sanitation services and limited clean water in sub-Saharan African countries, some South American countries, and Southeast Asia.

Also, **(Grimes et al., 2014)** reported that the continuous improvement and strengthening of sewage networks by increasing their efficiency is also considered one of the basic measures to reduce the possibility of exposure to water sources contaminated with the parasite that causes the disease. Good insulation of sewage networks and preventing them from mixing and allowing sewage water to enter these networks with fresh water, which represents the natural environment for snails as a host. mediator. It is one of the promising methods that the Egyptian state can adopt as part of integrated control measures for the schistosomiasis parasite

The results on the period of infection showed that the higher infection period was 10 years, observed in 70 % of the examined participants, followed by a 15-year infection period observed in 15 % of the examined participants, a 2-year infection period observed in 12 %, and more than 1 year observed in 3 % of the examined participants.

The results on the treatment of Schistosoma revealed clearly that the number of visits in a month to the health unit showed a higher level of participants per month, where 33 % visited the health unit 4 times per month, 16 % visited the health unit 6 times per month, 15 % visits the health unit 3 times per month. while the lower visits of health units were

observed in 16 % of the participants visiting the health units 6 times per month, 15 % of the participants visiting the health units 3 times per month, 13 % of the participants visiting the health units 2 times per month, and 6 % of the participants visit the health units 1 time per month. Meanwhile, the times of receiving treatment for schistosomiasis showed a higher level of participants per month, where 58 % receiving treatment for schistosomiasis 1 time per month, 26 % receiving treatment for schistosomiasis 2 times per month, 9 % receiving treatment for schistosomiasis 3 times per month. while the lower receiving treatment for schistosomiasis observed in 1 % of the participants receiving treatment for schistosomiasis 5 times per month, 0 % of the participants receiving treatment for schistosomiasis 6 times per month, 0 % of the participants receiving treatment for schistosomiasis 7 times of the receiving treatment for schistosomiasis 1 times per month.

The number of times a month of visiting for treatment at home showed a higher level of participants per month, where 71 % visited the home for treatment 1 time per month, 25 % took the treatment per home 3 times, 1 % took the treatment in home 4 times and no visits for home treatment at 6 and 7 times per month. While the number of cases of schistosomiasis in the family showed a higher level of participants per month, where 87 % of participants showed 1 case per family, 8 % of the participants of 2 cases, 4 % showed 3 cases [per month, and 1 % showed 4 cases in the family while, the incidences of 5, 6 and 7 cases showed a 0 %.

This results indicated that, the information of the individuals about schistosoma and the methods of its transmission must be improved and increased for improving the general health status of them especially those living in the villages and near to the water drainage for reduction of the incidences of the Schistosomiasis among them through reduction of using this types of water..

This results agreed with those of (**Barakat et al., 2013**) where they reported that, good informations about the infection with schistosoma especially for those living in the villages or agriculture lands will reduce the infection with schistosoma.

The number of times you have been infected with bilharzia showed a higher level of participants: 81 % of participants showed 1 infection, 16 % of the participants were

infected 2 times, 2 % of the participants were infected 3 times, and 2 % of the participants were infected 4 times. The incidences of 5, 6, and 7 times of infection showed a 0 %.

Although the results about the efficiency of treatment revealed that, most participants considered the efficiency of a treatment depends mainly by 95 % on the availability of treatment must cover the needs of the village reporting schistosomiasis cases, 80 % of the measures considered the treatment supplies provided regularly, all employees trained to serve patients with schistosomiasis by about 55 % of the examined participants and 10 % believed the treatment efficiency is the main method for treatment of schistosoma , so under high pressure on the health unit from the over visiting of the diseased individuals to take the treatment from this units so the treatment may decrease , so we must advise the patient to go to another place when no service is available, to another unit or another place.

This results attributed to the maximizing the use of available resources through the planned program that aimed for combating the schistosoma, which are mounted in the financial resources necessary to raise the efficiency of health and environmental institutions in combating the disease and its causes by pumping investments in preventive measures and working to conclude agreements for partnerships between local and international health institutions to work to ensure sustainability in combating schistosomiasis disease **(Barakat et al., 2013, Knopp et al., 2019 and Erlan et al., 2024).**

While, the results about the precautions for the prevention of Schistosoma cleared that 85 % of the studied participants considered the assistance available from other places in the absence of this service as the best item for the prevention of Schistosoma. Also, the results about the degree of conduction of the survey cleared that 85 % of the studied participants considered the conduction of the survey for the prevention of Schistosoma where, 85 % of the participants considered a random survey conducted periodically to be a good %, 15 % considered as good and 0 % considered as fair. Also, the targets respond to schistosomiasis campaigns where 60 % of the participants considered it equal, 15 % it a good %, 25 % considered it good %, and 0 % considered it fair where the individuals not respond to this treatment or advices especially when the service of a high expensive.

These results agreed with those of **(Oyeyemi et al., 2020 and El-Kassas et al., 2024)**, who reported that preventive measures include improving the infrastructure of water

stations and sewage units, in addition to pumping financial resources into investments to produce new treatments as a second line of defense in cases of infection, as well as investing in the human factor by training workers in the health care sector to raise the efficiency of the performance of workers in the industry and the resulting consequences. Improving health services provided to patients. Cooperation between governmental institutions, local Non-Governmental Organizations (NGOs), and relevant international organizations in the form of partnerships, may offer more financial and highly trained human resources to enhance the efficiency of preventive measures and ensure their sustainability.

The results about the reinfection with *Schistosoma* cleared that, most of the participants (90 %) considered working in agriculture to cause reinfection with *Schistosoma* due to their contact with drainage water that is the main source of infection with schistosomiasis. Also, there were some customs and traditions that were difficult to change, and there were challenges facing planners in eliminating schistosomiasis in this unit. Also, the main challenge to planners in eliminating *Schistosoma* is that 90 % of the participants do not change their habits. Also, the second challenge is that 90 % of the participant's considered Farmers do not respond to wearing shoes, this attribute to the most of the farmers that act in agriculture suffer from a high poverty that causes the farmers not respond to advices that given to them..

These results agreed with those of **(Yameny , 2017 and Hailegebriel et al., 2020)**, Schistosomiasis resulting from infection with parasitic worms belonging to the genus *Schistosoma*, which represents one of the health challenges that still exist and faces public health globally, and the resulting socio-economic repercussions, specifically in population centers in areas that suffer from poor services.

6-Conclusion

Our study concluded that:

1-The demographic characteristics like lack of education, married participants with many sons, working in agriculture, swimming, and using the canal's water in the life conditions are risk factors infection with Schistosoma.

2-The study also found that infrequent healthcare utilization is associated with a higher risk of schistosomiasis. Only 33% of participants reported visiting a health unit four times or more per month, while 6% visited only once a month. Furthermore, the majority of participants (58%) received treatment for schistosomiasis just once a month, suggesting inadequate treatment adherence."

3-The number of times a month that the health workers visited the home for treatment showed a higher level of participation, with 71% visiting the home for treatment once per month.

4-The main challenges facing the planners in eliminating Schistosoma include changes in individuals' habits, such as swimming in water canals, using water canals daily, and wearing shoes while walking on agricultural land.

5-According to the mean of the quantitative documentary analysis, for the complete control of schistosomiasis, resources should be provided to people under risk conditions through a program that employs cost-efficient approaches to alter the behavior of Egyptians residing in villages. This includes:

-Education and Awareness: Organize and conduct health promotion intervention and education for the enhancement of understanding on schistosomiasis, and how it is acquired, infected, and reinfected again. They will require school campaigns, community meetings, and health promotion campaigns to spread information regarding the issue and preventive measures.

-Healthcare Access: to set aside resources that will enable infected persons to visit the health units frequently concerning at least two visits per month especially for

determination of schistosomiasis. This would result to early identification and management of the infections hence controlling the spread of the diseases.

-Behavior Change Interventions: Interventions: It is recommended to design and apply specific behavior change interventions working towards the resistance of touching the canal water for purposes related to swimming or even taking a direct drink of it. Encourage the use of shoes especially when walking on farmland to reduce exposure to contaminated soil and water.

6-Infrastructure Development: Act on enhancing access to clean water and sanitation, especially in African rural all in a bid to reduce the likelihood of the vulnerable populace getting into contact with these dangerous contaminants. This could include drilling and raining water sources and taps, construction of latrines, and endorsing appropriate waste disposal. Concerning those areas, Egypt can tackle social determinants of schistosomiasis comprehensively and, thus, combating the disease.

Outcomes:

1. Reduced prevalence of schistosomiasis infection: This will be determined by: Lower rates of new cases and a reduction in prevalence rate among bad-risk neighborhoods.

2. Improved knowledge and awareness of schistosomiasis: This will be done through the utilization of questionnaires and curved questionnaires whereby the community members shall be tested on the knowledge they possess on the disease and how it spreads, and the preventive measures.

3. Increased access to and utilization of healthcare services: This will be assessed by measuring the epidemiology of the prevalence of the disease seeking diagnosis and treatment at the health facilities.

4. Adoption of healthy behaviors and practices: This shall be evaluated by tracking trends in the use of water and in function of hygiene practices, and the use of protective shoes in farming activities.

5. Strengthened healthcare infrastructure and capacity: This will be assessed by observing the level of diagnostic equipment, medical supplies, and manpower qualified in healthcare in the risky areas.

Outputs:

1. Implementation of comprehensive health education programs: Of these, WHO will develop and disseminate educational messages and materials for schools, community-based associations and healthcare institutions on transmission, prevention and control of schistosomiasis.

2. Regular mass drug administration (MDA) campaigns: Such campaigns will guarantee that every susceptible demographic would receive its preventive care irrespective of their infection status.

3. Provision of clean water and sanitation facilities: This will entail providing access to safe water or sources of water, provision of latrine facilities, and advocacy for hygiene facilities.

4. Distribution of protective footwear to farmers: This will effectively decrease their contact with water that is contaminated in agricultural areas.

5. Training of healthcare workers: This will amend and enhance their knowledge and skills to be able to diagnose and treat this disease of schistosomiasis.

6. Establishment of surveillance and monitoring systems: This will help detect early incidences and other emergencies which should be acted upon to reduce the spread.

Activities:

1. Develop and disseminate educational materials: Such d3f materials will include brochures and videos to be developed and targeted towards different ages and literacy levels, culturally sensitive language and pictures.

2. Conduct community outreach and engagement activities: This will include developing workshops, fairs, and awareness activities which will be targeted at sensitizing as many people as possible to the dangers of juvenile delinquency and the need to reform.

3. Partner with local NGOs and community leaders: This will ensure that interventions are appreciated by the community and responsive to their needs and aspirations.

4. Collaborate with international organizations: This will enlist them to commit both manpower and asset to the country's containment drive.

5. Advocate for increased funding and resources: This will in turn help ensure the sustainability of schistosomiasis control programs.

Inputs:

1. Financial resources: These shall be utilized for the support of educational and health-related events and programs, MDA, infrastructures, and healthcare skilled workers.

2. Human resources: These shall comprise of the health sector workers, teachers, community engagement individuals, and the program officers.

3. Technical expertise: These are skills coupled with an important field knowledge in epidemiology, medical parasitology, public health, and Interpersonal communication.

4. Infrastructure and equipment: This includes the instruments used for diagnosis, drugs, over vehicles for the mobile clinics, and pamphlets.

5. Partnerships and collaborations: This entails the establishment of contact and collaboration with governmental organizations, non-governmental organizations, international organizations, and heads of societies.

This theory of change, if applied, will help Egypt achieve impressive strides to reduce schistosomiasis to the level of a single reachable goal on the national disease elimination program. This will benefit millions of Egyptians in the aspects of health and their social welfare, as well as benefit Egypt in the economic and social realms

7-Recommendation

Based on the findings of this study, the following recommendations are proposed to enhance schistosomiasis control efforts in Egypt, with a particular focus on resource allocation:

1. **Prioritize Preventive Measures:** Allocate a significant portion of resources towards preventive measures, such as improving water and sanitation infrastructure, health education, and behavior change interventions. These measures can significantly reduce the risk of infection and transmission, leading to long-term sustainable control.
2. **Strengthen Healthcare Infrastructure and Human Resources:** Invest in healthcare infrastructure, including diagnostic tools, medications, and mobile clinics, particularly in rural and underserved areas. Enhance the capacity of healthcare workers through training and education on schistosomiasis diagnosis and treatment.
3. **Foster Collaboration and Community Engagement:** Establish strong partnerships and collaborations between governmental organizations, non-governmental organizations, international agencies, and community leaders. Encourage community participation and engagement in decision-making processes related to schistosomiasis control.
4. **Enhance Surveillance and Monitoring:** Strengthen surveillance and monitoring systems to enable early detection and prompt response to new cases of schistosomiasis. Utilize innovative technologies, such as mobile health applications and geographic information systems, to improve data collection and analysis.
5. **Promote Research and Development:** Invest in research and development to identify innovative and cost-effective approaches to schistosomiasis control, including the development of new diagnostic tools, treatments, and vaccines. Support research on the social and environmental determinants of schistosomiasis to inform the development of comprehensive and sustainable interventions.

8-Summary

This study aimed to study the possibility of resource allocation affecting incidences of Schistosoma in Egypt and methods of eradication and controlling the incidence of Schistosoma in Egypt.

The data was collected by two methods:

a. Quantitative Methods:

- Data Collection: Quantitative data was collected through the research questionnaire method.
- Sampling: A random sample, of 300 participants selected from 2 villages. One village has no cases, and the other village has new cases of schistosomiasis. The sample contains schistosomiasis new cases, past cases, their families, and other villagers.

b. Qualitative Methods:

- Data Collection: The qualitative data was collected through in-depth interviews, focus group discussions, and observations.
- Sampling: A purposive sample of 100 participants was recruited based on the need of the study, it included health workers and targeted cases of schistosomiasis who have two or more cases in their families.

The main result of the study include:

1-The demographic characteristics include age of the patients, the incidences of Schistosoma ranging from 10 to 60 days, and the social condition of the patients, ranged from married, which reached 94 %, to absolute, which was 1 %. While the number of children married ranged from 4 (41 %) to 1 (1 %). While the educational level cleared that, the higher level ranged from secondary school (37 %) to higher education (1 %). While the education level for the sun ranged from university-level, observed in (45 %) of the studied participants, to an uneducated level of (1 %). The occupation of the participants which cleared that, the participants work with agriculture of a higher infection level with

schistosoma showed a higher occupational level observed in working in agriculture at (63 %) than crafts work at (2%).

2-The results of the participants' knowledge on Schistosoma clarified that the higher knowledge levels observed on diseases from drainage water were 99 %. While the lower information observed on Dangerous diseases over a long period was 1 %.

3-Our results on the risk factors for Schistosoma incidences revealed that the participants had higher risk factors: working near a water stream, which reached 96 %; ownership of agricultural land, which was 72 %; proximity to the health unit, which was 68 %; and attendance at health education sessions, which was 64 %.

2-The results on the period of infection revealed that the infection period of a higher level was 10 years, which was observed in 70 % of the examined participants, followed by a 15-year infection period, which was observed in 15 % of the examined participants, a 2-year infection period, which was observed in 12 %, and more than 1 year, which was observed in 3 % of the examined participants.

3-The results on the treatment of Schistosoma cleared that the times a month of visiting the health unit showed a higher level of participants per month, where 33 % visited the health unit 4 times per month, 16 % visited the health unit 6 times per month, 15 % visits the health unit 3 times per month. while the lower visits of health units were observed in 16 % of the participants visiting the health units 6 times per month, 15 % of the participants visit the health units 3 times per month, 13 % of the participants visit the health units 2 times per month, and 6 % of the participants visit the health units 1 time per month. The times of receiving treatment for schistosomiasis showed a higher level of participants per month, where 58 % receiving treatment for schistosomiasis 1 time per month, 26 % receiving treatment for schistosomiasis 2 times per month, 9 % receiving treatment for schistosomiasis 3 times per month. while the lower receiving treatment for schistosomiasis observed in 1 % of the participants receiving treatment for schistosomiasis 5 times per month, 0 % of the participants receiving treatment for schistosomiasis 6 times per month, 0 % of the participants receiving treatment for schistosomiasis 7 times of the receiving treatment for schistosomiasis 1 times per month.

4-The number of visits to the home for treatment per month showed a higher level of participants per month: 71 % visited the home for treatment one time per month, 25 % took the treatment home three times, 1 % took the treatment home four times, and no visits for home treatment at 6 and 7 times per month.

5-While the number of cases of schistosomiasis in the family showed a higher level of participants per month where 87 % of participants showed 1 case per family, 8 % of the participants of 2 cases, 4 % showed 3 cases [per month, and 1 % showed 4 cases in the family while, the incidences of 5, 6 and 7 cases showed a 0 %.

6-While the number of times you have been infected with bilharzia showed a higher level of participants, where 81 % of the participants showed 1 infection, 16 % of the participants infected 2 times, 2 % of the participants were infected 3 times, and 2 % of the participants infected 4 times, while the incidences of 5, 6, and 7 times of infection showed a 0 %.

7-While the results about the efficiency of treatment cleared that most participants considered the efficiency of a treatment depends mainly by 95 % on the availability of treatment must cover the needs of the village if schistosomiasis cases, 80 % of the measures considered the treatment supplies provided regularly, all employees trained to serve patients with schistosomiasis by about 55 % of the examined participants and 10 % considered the treatment efficiency must advise the patient to go to another place when no service is available, to another unit or another place.

8-The results about the precautions for the prevention of Schistosoma cleared that 85 % of the studied participants considered the assistance available from other places in the absence of this service the best item for the prevention of Schistosoma.

9-The results about the degree of conduction of the survey cleared that 85 % of the studied participants considered the conduction of the survey for the prevention of Schistosoma, where 85 % of the participants considered a random survey conducted periodically be a good %, 15 % considered as good and 0 % considered as fair. Also, the targets respond to schistosomiasis campaigns where 60 % of the participants considered it equal, 15 % it a good %, 25 % considered it good %, and 0 % considered it fair.

10-The results about the reinfection with Schistosoma confirmed that most participants (90 %) considered that working in agriculture causes reinfection with Schistosoma. Also, there were some customs and traditions that were difficult to change

11- The challenges faced by planners in eliminating schistosomiasis in this unit are as follows: Planners' main challenge in eliminating the Schistosoma is that 90 % of the participants do not change their habits. Also, The second challenge is that 90 % of the participants considered Farmers do not respond to wearing shoes.

12- To eradicate of Schistosoma, we must make a program that depends upon the resource allocations by the best means of the cost-effective method for eradication of Schistosoma.

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لجنة الأخلاقيات

جمعية أبناء وادى النيل

المشهرة برقم 2770 لسنة 2011

Ethical Approval for a Scientific Research Project

February 5, 2024

Serial No: PT (456)

To Researcher: Randa Sami Abbas Ibrahim Abu El Magd El Ghandour

Subject: Approval of the Scientific Research entitled: "Resource Allocation as a Cost-Effective method to overcome Some challenges facing Egypt to Eliminate Schistosomiasis as a Public Health Concern."

After reviewing the scientific research you submitted, "Resource Allocation as a Cost-Effective method to overcome Some Challenges facing Egypt to Eliminate Schistosomiasis as a Public Health Concern," and after careful deliberation and review by the Ethics Committee at the Sons of the Nile Valley Institution, we are pleased to inform you that the research has been approved for conduct in accordance with the approved ethical standards.

The committee would like to emphasize the following points:

- **Adherence to the Research Protocol:** You must strictly adhere to the research protocol that has been submitted and approved, including data collection, analysis, storage, and publication procedures.
- **Protection of Participants' Rights:** You must respect the rights of research participants, ensure their safety and privacy, and obtain their prior informed consent before conducting the research.
- **Reporting Any Amendments:** You must inform the committee of any amendments to the research protocol or research procedures and obtain its prior approval before implementing these amendments.
- **Submitting Periodic Reports:** You must submit periodic reports to the committee on the progress of the research and any problems or difficulties encountered by the researcher.

Sincerely, The Ethics Committee of Sons of the Nile valley Institution principal

Dr Ahmed Hassan Sayed