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Review Article

A Review of Human Toxoplasmosis with an Emphasis on the Status of This Parasitic Infection in Sudan

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Abstract

Toxoplasmosis is a parasitic disease that is caused by a protozoan called *Toxoplasma gondii*. This protozoan is a parasite of cats, which is spread among other animals and birds all over the world. Toxoplasmosis has diverse severity, and it depends on the number of entered parasites, the way of entry, and other factors. Toxoplasmosis has four forms: acute form, subacute form, chronic form, and recurrent form. Paraclinical tests are definitive diagnoses, which includes parasitology, radiology, biochemical and hematological, serological, and toxoplasmin skin tests. Pyrimethamine (Daraprim) and sulfonamides act synergistically against *T. gondii* tachyzoites. Up to now, no effective vaccine against *Toxoplasma* has been made, and the effort to make a vaccine to create antibody titer in the body and prevent the infection of women and cats is extremely important.

Keywords: Review, Human toxoplasmosis, Sudan

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Introduction

Toxoplasmosis is caused by a protozoan called *Toxoplasma gondii*. This protozoan is a parasite of cats, which is spread among other animals and birds all over the world and causes a disease that varies from mild to severe. The disease is seen in the forms of acquired toxoplasmosis and congenital toxoplasmosis, and the congenital form is more dangerous (1).

Transmission Ways of Toxoplasmosis

They are divided into two main and secondary groups.

A. The Main Ways of Transmission

1. Transmission by oocysts
2. Transmission by tissue cysts
3. Transmission by tachyzoite or congenital transmission

B. The Secondary Ways of Transmission

1. Transmission through blood or leukocyte or organ transplant
2. Transmission through laboratory contamination
3. Transmission through milk consumption
4. Transmission by birds and insects
5. Genital transmission

Immunization

Immunity

Toxoplasma gondii is an obligate intracellular parasite whose tachyzoite form multiplies inside the cell. When the amount of the organism inside the cell increases, the infected cell ruptures; as a result, the parasite invades other healthy cells. The resulting immunity in this parasite is concomitant immunity, meaning that as long as the parasite is present, a relatively significant titer of antibody is produced in the host's body (2). The immune response in toxoplasmosis is humoral and cellular.

Pathogenesis of Toxoplasmosis in Humans

Toxoplasmosis has different severity depending on the number of entered parasites, the way of entry, and other factors. Natural infections are caused by tissue cysts in infected meat or oocysts in food contaminated with cat feces (3).

The size, virulence of the organism, genetic background, sex, immunological basis, and animal models of toxoplasmosis are effective in the infection period in humans. Injection through the skin, cystic forms, or tachyzoites cause contamination. Most of the parasites are concentrated in the liver, lungs, and lymph nodes, and the injuries that occur in the organs are found in the same multiplication. It is different according to the vulnerability of the tissues; for example, this is more severe in the brain and eyes and less in the intestinal mucosa and lymph tissue (4,5).

The durability of tachyzoites in the spinal cord and brain may be longer than that in visceral tissues because immunity is less effective in nervous organs, and this

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situation is also different in relation to *T. gondii* strain and host species (6,7).

Toxoplasmosis has four forms: acute form, subacute form, chronic form, and recurrent form.

Toxoplasmosis infections with clinical symptoms include the following:

a. Acquired toxoplasmosis
b. Congenital toxoplasmosis
c. Toxoplasmosis in patients with disorders in the immune system, except AIDS
d. Toxoplasmosis in AIDS patients

Diagnosis of Toxoplasma gondii

Toxoplasma gondii infections are directly diagnosed by polymerase chain reaction (PCR), hybridization, isolation, and histology. However, the clinical signs of toxoplasmosis are non-specific, and a definitive diagnosis is not possible in this way; therefore, accurate paraclinical tests are used, which include parasitology, radiology, biochemical and hematological, serological, and toxoplasmin skin tests (8).

Toxoplasmosis Treatment

Pyrimethamine (Daraprim) and sulfonamides act synergistically against *T. gondii* tachyzoites. Spiramycin has also been widely used but has not been approved by the US Food and Drug Administration (FDA). These drugs are effective against *T. gondii,* but they do not affect the bradyzoites in the tissue cyst. Therefore, they may control the active infection, but they cannot eliminate the chronic infection (9,10).

Prevention of Toxoplasmosis

It is important to prevent two groups of women from contracting the disease, namely, pregnant women with a negative serum test and immune-compromised patients. Measures to prevent infection in such people should include two issues; that is, the prevention of eating infected cysts and the prevention of contact with oocysts excreted from cats (11).

In the prevention of *T. gondii* infection in humans, it is necessary to completely wash hands with soap and water after contact with meat. Disposable gloves should also be used when working with sand and soil and when transporting waste containers (12,13). Furthermore, using unpasteurized milk and raw eggs should be avoided. Oocysts can be transmitted through fruits and vegetables, so they should be washed and disinfected well. In addition, cat pollution should be prevented, and prevention is extremely important in pregnant women. Those who are at risk should be identified before pregnancy.

At present, no effective vaccine has been produced against *Toxoplasma*, and the effort to make a vaccine to create antibody titer in the body and prevent infection of women and cats is very important. Another highly important issue is the measurement of the antibody titer in newly married girls. If they are negative, it is recommended to perform a blood test to measure the toxoplasmosis antibody once a month as soon as the pregnancy begins, and if a high titer is detected, they should be treated immediately (14,15).

Moreover, eating uncooked meat should be avoided, and attention should be paid to the hygiene and cleanliness of hands after cleaning raw meat. In immunosuppressed patients, before the immunosuppression treatment, the patient's serology test needs to be performed, and in the absence of *T. gondii* antibodies, the treatment with pyrimethamine and sulfadiazine is started. Furthermore, it is especially desirable to treat patients receiving transplanted organs (16-18).

Suggestions

Considering the importance of life span in humans and the need for more help to maintain the health of humans, it is suggested to carry out a general investigation into the presence of *Toxoplasma* in these people, which turns from chronic to acute form. The identification of *Toxoplasma* in people is extremely important and should be implemented across the whole country (19).

It is also better for the Ministry of Health to allocate a budget for research on *Toxoplasma* and use more accurate methods than the enzyme-linked immunosorbent assay (ELISA) such as PCR, parasite isolation from blood, or body fluids, which include parasite isolation and tissue examination and are considered powerful diagnostic methods (20).

The specificity and value of the positive result of PCR is almost 100%, while the specificity of the ELISA test is 96.4%. The PCR method is not routinely performed today due to its time-consuming and expensive nature. In less developed countries, previous methods such as indirect immunofluorescence (IFA) can be used for the serological investigation of *Toxoplasma* (21).

Review of Studies on *Toxoplasmosis* in Different Regions in Sudan

Toxoplasmosis in humans was identified in Sudan when Carter and Fleck in 1966 used the Dye test (DT) and reported the prevalence of 61% in four different types of population from different parts of Sudan. They reported a seroprevalence rate of 22% in Kordofan and Darfur and southern provinces, whereas in the Northern provinces, the seroprevalence rate was as high as 70%, and the difference in the prevalence rates is thought to be due to racial habits which may affect the transmission of toxoplasmosis (22).

Another study was conducted in Khartoum State using IgG ELISA in Sudanese pregnant women and recorded a 34.1% prevalence. Abdelhameed in 1991 in the central of

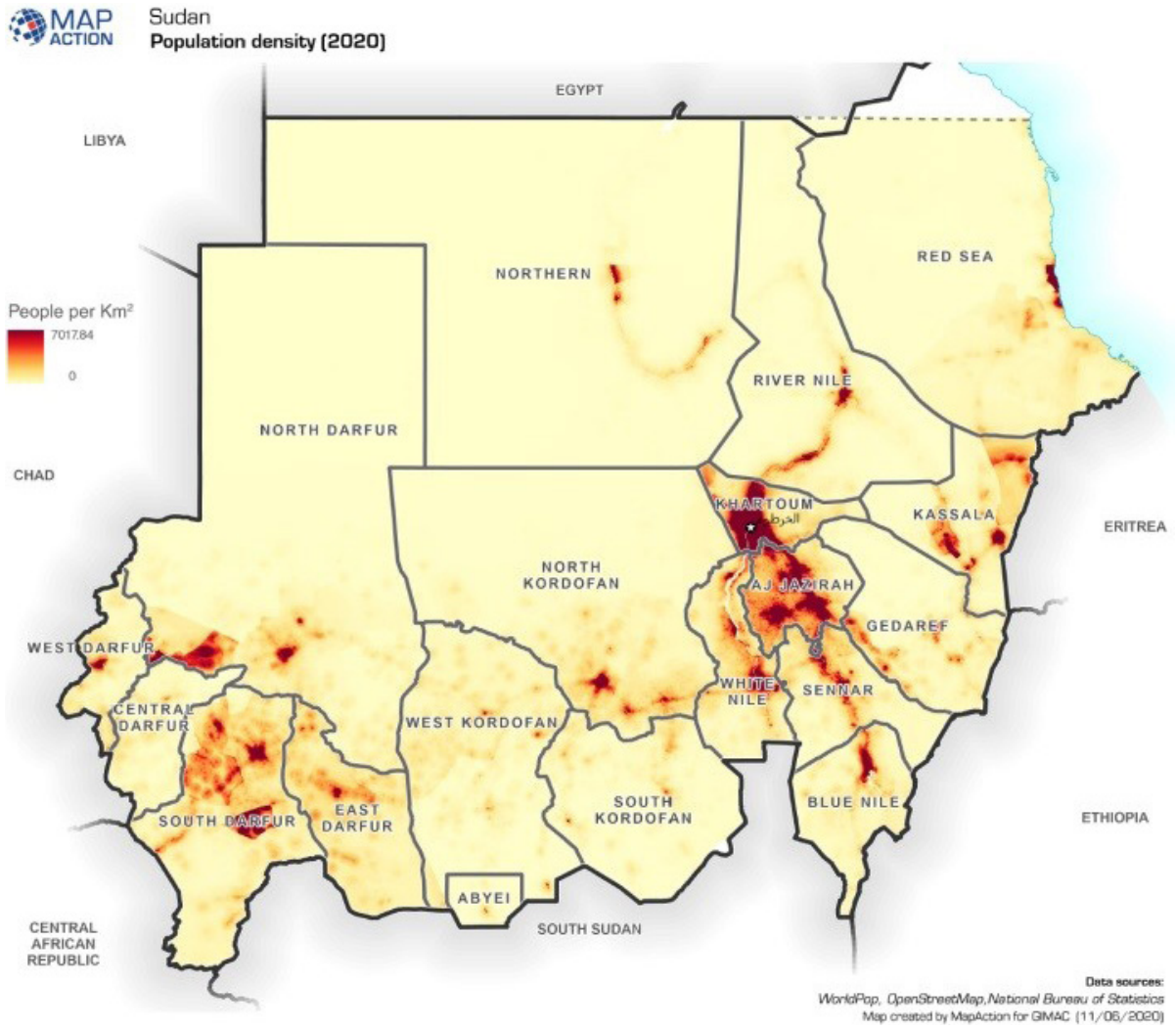

Figure 1. Topographical Distribution of Human Toxoplasmosis in Different Regions of Sudan

Geizera about 200 km distance from the capital reported a prevalence of 41.7% using the latex agglutination test (LAT), as depicted in Figure 1. Moreover, a study conducted in North Geizera in childbearing age women indicated a prevalence of 73.1% (23,24).

An overall prevalence rate of 41.7% was reported by Abd Elhameed among the residents of Gezira province aged 10 years and above using IgG by ELISA, immunosorbent agglutination assay (ISAGA), and LAT. In the study conducted by Carter and Fleck among the residents of Khartoum and Gezira, excluding children under 10 years, the overall *T. gondii* seroprevalence rate was reported to be as high as 72.8% (25,26,27).

Competing Interests
None.

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