MULTI-ANTIGEN-CHEMILUMINESCENT-ELISA FOR THE DIAGNOSIS OF *TRYPANOSOMA CRUZI* INFECTION IN CHIHUAHUA, MEXICO

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by

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THESIS

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Introduction

The genus *Trypanosoma* consists of flagellated protozoa parasites that cause infections in humans and animals. The most relevant infectious diseases to humans are African trypanosomiasis and Chagas disease caused by *Trypanosoma brucei*, *Trypanosoma cruzi*, respectively, which are considered as neglected tropical diseases (NTDs) [1]. Most affected by these parasitic diseases are low-income populations of countries located in tropical and subtropical areas of the world.

CHAGAS DISEASE

Chagas disease (ChD) or American Trypanosomiasis is caused by the protozoan parasite *Trypanosoma cruzi.* The parasite has a complex life cycle, which alternates between triatomine vectors and mammals, including humans. The disease can cause cardiac disorders, digestive or neurological alterations. *T. cruzi* is genetically diverse; it has been classified in six discrete typing units (DTU)s: TcI, TcII, TcIII, TcIV, TcV, and TcVI, which present different antigenicity, eco-epidemiological, clinical, and geographic associations [2]. It is considered a neglected tropical disease with endemic regions located in 21 Latin American countries, where it is mostly vector-borne when humans come across the feces or urine of the infected triatomine bug [3, 4].

Epidemiology

According to the World Health Organization (WHO), about 6 to 7 million people worldwide are estimated to be infected with ChD. Over the past half of the 20th century, there has been an increased migration of Latin Americans to non-endemic countries, greatly modifying the epidemiology of the disease. In the last decades, it has been detected in the U.S and Canada. Even in the Old World, *T. cruzi* has been detected in countries such as Japan, Australia and most of the European continent, where an approximate large number of immigrants infected with the protozoan live in Spain and Italy [3, 5]. Solely looking at the U.S., there are an estimated 300,000

infected individuals with *T. cruzi* in the states of New Mexico, Texas, Georgia, Louisiana and California [6, 7]. It is estimated that most individuals with ChD are immigrants that came from El Salvador, Guatemala, Honduras, and Mexico that acquired the infection in their countries of birth; the last accounting for around 174,388 infected individuals living in the U.S. [8-10]

Mexico is a country with immense climatic variety and vast biodiversity, providing the conditions for the development of etiological agents of all kinds, including *T. cruzi*. There are at least 30 species of triatomines reported in the country, all known to be potential vectors [11]. ChD remains as the most important parasitic disease in the country. As of 2010, it was estimated that 876,458 people was infected with *T. cruzi* and 70,117 people had chagasic cardiopathy [12]. The poverty in the country has forced people from endemic areas of the country to migrate to industrialized cities like Mexico City, in search of jobs. Carabarin-Lima et. al. report that the children under 5 years of age infected with ChD are distributed regularly in urban rather than rural areas, suggesting that ChD is becoming urbanized in Mexico [13].

In Mexico, there are 18 endemic areas located in the southeast comprising the states of Oaxaca, Jalisco, Yucatan, Chiapas, Veracruz, Puebla, Guerrero, Hidalgo and Morelos. A high prevalence is observed in the northeastern region of the country, which corresponds to the central area of a tropical region known as La Huasteca [13]. But the highest prevalence (1.94% - 1.68%) was observed in the US neighbor states of Nuevo Leon and Tamaulipas [13, 14].

In the southeast of the state of Chihuahua, near the limits of the states of Sonora and Sinaloa there is an area known as Barrancas de la Sierra Tarahumara, where there have been reports of triatomines infected with *T. cruzi*. In a study conducted by the Immunoparasitology Laboratory of the Medical School at the Autonomous University of Chihuahua, a sample of *Triatoma recurva* collected in the Chihuahuan municipality of Urique was found to be infected with *T. cruzi* [15].