

PREVALENCE OF *TRYPANOSOMA CRUZI* INFECTION IN BLOOD BANKS OF SEVEN DEPARTMENTS OF BOLIVIA

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Trypanosoma cruzi infection was studied in 1,298 sera samples of blood banks from 7 capital departments of Bolivia, using the immunofluorescence test (IFI) and Enzyme Linked Immunosorbent Assay (ELISA). The percentages of positivity in these 7 departments have an average of 28% and are distributed as follows: Sta. Cruz 51%, Tarija 45%, Cochabamba 28%, Sucre 39%, La Paz 4.9%, Oruro 6% and Potosi 24%. The prevalence is related with the altitude levels of the different departments. However in Potosi (3,945 m) we found a 24% of prevalence, probably due to the proximity of endemic valleys to the city. The authors suggest a strict control in blood donors since there exists a great risk of infection.

Key words: Chagas' disease – blood banks – blood transmission – serology – immunofluorescence – ELISA

Chagas' disease occurs in many geographic areas of Bolivia where it represents a major public health problem, especially within the lower socio-economic population. There is a strong relation of cause and effect between human infection and the triatome infection in Bolivia. The triatome's rate of infection reaches an average of 42% according to Tibayrenc (1984) and the infection rate in patients at the Instituto Boliviano de Biología de Altura (IBBA) in La Paz is of 35%, given that these patients come from different areas of Bolivia. Migration of people from rural areas where the disease is endemic to the urban cities increases the percentage of chagasic population in areas originally not endemic of this disease.

The possibility that Chagas' disease can be transmitted through blood transfusions was initially mentioned by Mazza et al. (1936). Later, this was proven by Freitas et al. (1952). Presently blood transfusions are considered the second most important mechanism of transmission of *Trypanosoma cruzi*. The seriousness of the problem was demonstrated by the significant prevalence of Chagas' disease found in

potential donors thru serological screening in different Latin American countries (Rassi & Rezende, 1976). In Bolivia, minute studies of blood banks were carried out in Sucre, Cochabamba and specially in Santa Cruz (Zuna et al., 1985).

The present study was conceived as a systematic investigation in the blood banks of the seven departments of the country: those of La Paz, Oruro, Potosi, Cochabamba, Santa Cruz, Tarija and Sucre. The aim of our investigation was to evaluate the prevalence of *T. cruzi* infection in blood of donors in order to use their ratios as an epidemiological marker of the Chagas' infection in Bolivia, as well as evaluate the risk level of infection thru blood transmission in the country. From an epidemiological point of view we intended to evaluate the relation between the positive level and the altitude of the collection areas.

MATERIAL AND METHODS

Human sera – Samples were taken from the blood banks of the capital cities in the departments of La Paz, Oruro, Cochabamba, Potosi, Sucre, Tarija and Santa Cruz. With most of the samples, the following information was obtained: sex, age, place of birth and site of collection.

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Serological procedures — The reaction of ELISA and indirect immunofluorescence (IFI) were carried out in the immunoparasitology laboratory of IBBA, La Paz. Epimastigotes of the Tulahuen strain were utilized as antigen. They were obtained in the same laboratory from cultures prepared in LIT medium. Soluble antigen for the ELISA technique as well as entire parasite fixed with glutaraldehyde for IFI were prepared.

IFI — For the indirect immunofluorescence technique the procedure described by Weller & Coons (1954) was followed. The anti-human sera IgG, IgA and IgM fluorescein labelled came from the Institute Pasteur (Paris-France) and was used in a titer of 1/200. The fluorescent microscope was a Leitz, model Dialux 20 EB with a HB-0200 mercury lamp and BH-12 filter.

ELISA — The indirect ELISA technique was carried out after Carlier et al (1980), using polystyrene microplates Greiner (W. Germany) with U bottom. The antigen concentration was 10 µg/ml. The anti-human sera IgG, IgA and IgM peroxidase labelled came also from the Institute Pasteur and was used to a dilution of 1/2500. The sera dilution was 1/200 and the absorbency values were measured with an ELISA reader Titertek Multiskan MCC/340 (Finland).

Fast hemagglutination — The fast indirect hemagglutination technique "Hemave for Chagas" of Polichaco (Argentina), was carried out by the personel in charge in 3 of the 7 blood banks.

RESULTS

Samples of blood donors (1,298) were obtained in the following distribution: 432 from La Paz, 83 from Oruro, 286 from Cochabamba, 72 from Potosi, 105 from Sucre, 114 from Tarija and 206 from Santa Cruz. The majority of donors were males (1,091) while only 194 were female and in 13 cases the sex was not precised, both groups were an average 29 years old.

All 1,298 sera were analyzed by IFI and ELISA techniques and only when there was a reaction in both techniques, the sample was considered positive.

Table I shows the positive percentage of the

samples according to blood banks of the respective departments and the altitude of the collection site. With the exception of Potosi, a negative relation between altitude and percentage of *T. cruzi* infection was observed.

According to biogeographical areas (Fig.) the positivity percentages appear low (with exception of Potosi) in the altiplano, medium in the valleys and high in tropical areas.

In the blood banks of Cochabamba, Santa Cruz, and Tarija the fast indirect hemagglutination test was used besides the classical techniques of IFI and ELISA in order to establish its concordance with these two classical techniques (Table II). Concordance between the classical techniques and the fast indirect hemagglutination technique was found to be between 76 and 86%.

Table III shows the positive percentage found in the 1,298 samples according to the donor's place of birth. This data confirms the inverse relation between altitude and the positive results of the samples demonstrated thru examination of the sample in consequence of the place of collection.

DISCUSSION

As expected, the results of the present study demonstrate that the departments of Santa Cruz, Tarija, Cochabamba and Sucre, which are located at low altitudes, have the highest prevalence of infection.

But high altitude localities do not show negative results: 4.9% in La Paz and 6.0% in Oruro, showing the importance of chagasic endemicity in the whole Bolivian country.

A surprising score was obtained in Potosi (24%) a city located at 3,945 meters of altitude. This high percentage is probably due to the fact that valleys where Chagas' disease is endemic, are close to the city. There exists two possibilities to justify these results. First that people contaminated with *T. cruzi* migrate from the valleys to the city and transmit the disease through blood transfusions. Second that migrating people from the valleys to the city bring infected triatomes with their belongings creating a new circle of contamination, since triatomes adapt very well to their new environment (Ochoa, 1988).

TABLE I

Prevalence of *Trypanosoma cruzi* infection in blood banks of 7 Departments of Bolivia from, June 1988 to April 1989

Department and name of the blood bank	Number of samples	Positive samples ELISA and IFI	% of positivity	Altitude
Santa Cruz San Juan de Dios	206	105	51%	414 m
Tarija San Juan de Dios	114	51	45%	1,875 m
Cochabamba Hospital Viedma	286	81	28%	2,548 m
Sucre a C. N. S. S. and b Gastroenterológico	105	41	39%	2,890 m
La Paz Hospital de Clínicas	432	21	4.9%	3,632 m
Oruro a C. N. S. S.	83	5	6.0%	3,701 m
Potosi a C. N. S. S.	72	17	24%	3,945 m
Total	1,298	321	25%	

a C. N. S. S. = Caja Nacional de Seguridad Social (Social Security).

b Gastroenterológico = Instituto de Gastroenterología (Gastroenterology Institute).

TABLE II

Concordance between the classical ELISA and IFI techniques and the Hemagglutination Test

Department	Positive samples ELISA and IFI	Positive samples HAI	Concordance between classical techniques and HAI
Cochabamba	58	44	76%
Santa Cruz	105	84	80%
Tarija	51	44	86%

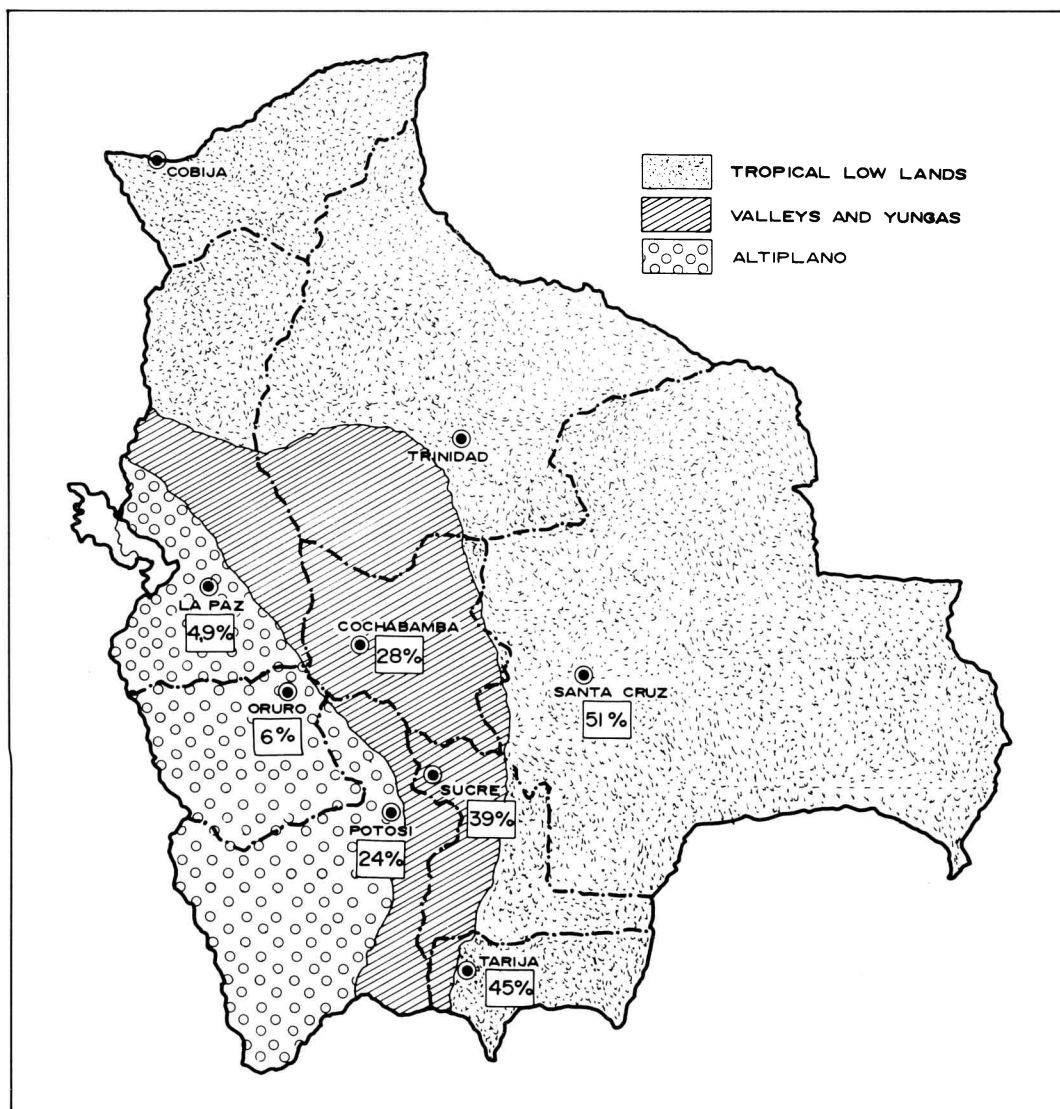
When compared, our results generally appear to be in concordance with previous investigations reported in Bolivia. Studies on prevalence of *T. cruzi* infection in blood banks, were carried out in Santa Cruz by Valdivia & Valdivia (1978) who found a 45.2% positive samples, and Zuna et al. (1985) who report 62.1% and 79% positive samples in donors and receptors respectively. The same investigators report also a 47.6% positivity in Santa Cruz in patients with previous negative serology, after receiving

infected blood. Duchen (1986) in Sucre reported a 41.6% positive factor.

In Cochabamba, Abecia et al. (1988) reported only a 3.29% of positive factor in 1,700 samples. However, their study was carried out in subjects of medium to high socio-economic level. This finding differs completely from our results obtained in blood banks of general hospitals where people of low socio-economical status are treated.

TABLE III
Percentage of positivity according to the birth place of the donors

Birth place	No. of samples	Positive samples	Positivity percentage
Santa Cruz	159	91	57%
Tarija	93	40	43%
Cochabamba	163	54	33%
Sucre	81	38	47%
La Paz	385	23	5.9%
Oruro	110	9	8.2%
Potosi	113	26	23%
Beni	8	0	0
Foreigners	10	1	10%
Personal data not recorded	176	39	22%



Localization of the 7 blood banks studied and their positive percentages, in relation to the main biogeographical areas of Bolivia.

On the other hand, a difference should be established between donors and people who sell their blood. Unfortunately the latter represent the majority of individuals who consider themselves donors and who contact the state blood banks. It is possible that the private blood banks have safe donors in which probably the positive factor is very low. Unfortunately only a few blood transfusion facilities in Bolivia use preventive measures to avoid transmission of the disease through blood transfusion, meaning that the blood is not treated with gentian violet and there is no serological screening of the donors.

CONCLUSION

Chagas' disease is endemic in Bolivia and the present investigation shows that a high percentage of blood donors have anti-*T. cruzi* antibodies. It also pointed out the existence of an inverse relationship between altitude levels of the location and the prevalence of *T. cruzi* infection.

This study stresses the high risk of transfusional contamination existing in Bolivia.

The subsequent recommendation would be the following: serological control of blood donors and in endemic areas where donors are potentially positive and where transfusions are essentials, storage of the blood with gentian violet, during 24 h at 4°C before it is used (Nussenzweig et al., 1953).

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