MERCURY LEVELS IN YANOMAMI INDIANS HAIR FROM RORAIMA-BRAZIL

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ABSTRACT

The gold mining in brazilian indian areas,although illegal, is very intensive and difficult to control. The consequences to the population are very harmful because of indiscriminated use of Mercury released to air and water in the process of amalgamation and its burning.

Hair of 162 Yanomami indians, from nine villages in Roraima state, were collected in the "Hospital for Indians"during February and March 1990. These samples were analyzed by atomic absorption through.

The results indicate that in some places 40% of population have mercury concentration above 6.0 ppm. The two greatest values were observed in children - a 8 years old boy (7.90 ppm) and a 4 years old girl (8.14 ppm). No correlation between mercury concentration and sex was found. The indians basic foods, wild animals, native fruits and specially fishes are the main pathway of contamination.

INTRODUCTION

The gold mining in Brazilian indian reserves is illegal, however the large amounts of gold and the difficulties in controlling the Amazonian rain forest lured many "gold seekers". The gold mining activities have been developed in an intense and profitable way, without any kind of control, neither of the environmental impacts on the forest nor of the health problems on the local population. This situation, that is reaching a critical point, is demanding a prompt governmental decision in the dismantle of the gold mining activities in the indians reserves.

The gold-extraction process is subdivided in the concentration of gold by amalgamation with mercury and subsequent purification by burning of the amalgam. During the burning, about 1.32 kg of Hg for every kg of gold are released to the environment (ref.1). It is well known that mercury, mainly methyl-mercury, will reach the human through the food chain, mostly by fish ingestion. Once ingested, the mercury can reach the central nervous system producing irreversible injuries, directly related with the amount of mercury accumulated.

Fezes, urine and hair are the main pathways for the mercury excretions. Hair excretion is through the "hair bulb". Among these pathways, hair is the easiest one to collect, transport, stores and analyses. Another advantage is the potential for tracing the period of contamination.

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Almost all the indigenous tribes in the North of Brazil are extremely primitive populations, with very peculiar social organizations. They live in very rustic dwellings and their diet is based on fruits, fish and wild animals. The Yanomami nation is spread out in several villages in the State of Roraima (Brazil) and Venezuela. The gold mining activities reached this reserve in the 80's.

Motivated by all the reasons already cited we decide to analyze mercury concentrations in hair samples from the Yanomami population. All the results were compared with the Maximum Permissible concentration established by the World Health Organization.

MATERIAL AND METHODS

Total mercury was determined in hair samples from 162 Yanomami indians that were hospitalized in the "Hospital for Indians" in Boa Vista, capital of Roraima. Samples were collected during February and March 1990. The indians proceeded from three different areas strongly affected by the gold mining activities, namely, four villages in the Surucucus area (Venezuela border), four villages in the Paapiu area and one village from the Mucajai River (fig.1). For this study, hair from men, women and children were analyzed. All the samples were first washed with destilled water and EDTA (0.01%), and then acid digested with H_2SO_4, oxidized with $KMnO_4$ and $K_2S_2O_8$ and finally reduced with H_4NClO. Samples were analyzed in duplicates, except when sufficient material was not available, and total mercury was determined by atomic absorption cold vapor generations (ref.2).

RESULTS AND DISCUSSION

Table 1 presents the concentration in micrograms of total Hg by gram of hair, no significant differences could be observed between male and female in the different areas and villages. Many samples were above the value of 6.0 ug total Hg/g of hair . The most affected area is the Surucucus, where 40% of the samples from the Maisibiu village were above this value. The two highest mercury concentration belonged to children from two different areas (table 2).

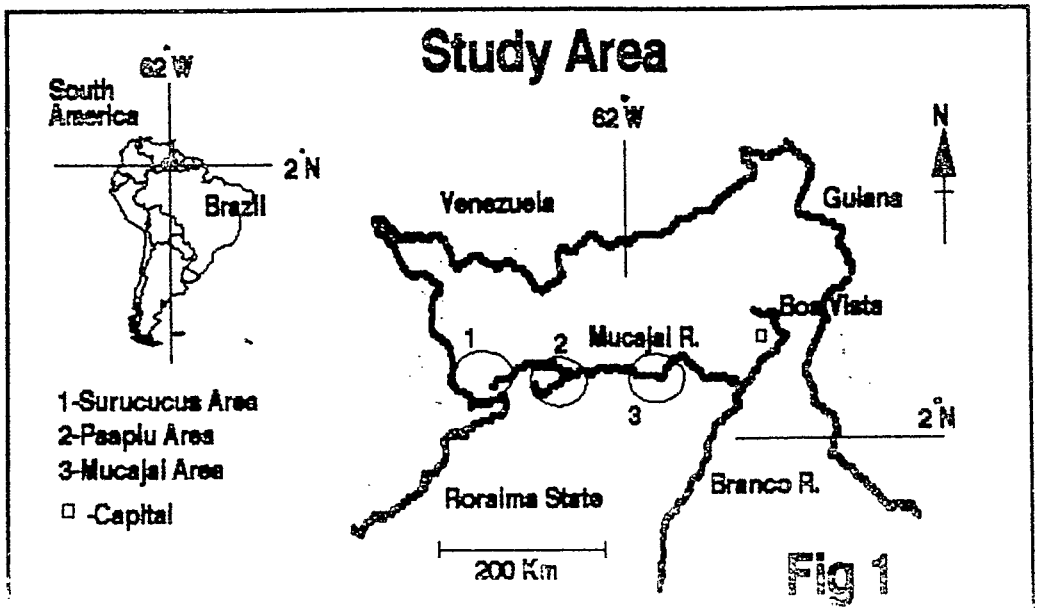

Fig 1

The main pathway of contamination in the Yanomami population is through the food chain because only very few male indians participate in the gold mining activities. Furthermore, the high mercury values found in hair samples confirmed the contamination of the local biota.

Another distinct parameter to assess the risk of contamination by mercury is the quantification of methyl-mercury compounds. In April 1990, some of hair samples were sent to the Faculty of Medicine of the Federal University of Kumamoto, in Japan, for methyl-mercury determination .These results are summarized in Table 3. The methyl-mercury concentration in the analyzed samples was below the Maximum Permissible value for the World Health Organization, 6 ug of methyl-mercury/g of hair (Ref.3). However, the long term of the gold mining activities in this area could increase these levels.

At the present time the survival of the Yanomami population might be jeopardized by the gold mining activities. This situation reflects not only the risks introduced by the mercury itself but also other risks related to diseases and abrupt cultural and social changes.

The Brazilian Government has shown concern regarding this issue and has already started to control the gold mining activities. Also the indian land should be demarcated according with the Brazilian Constitution.

TABLE 1-Mercury concentration in hair from Yanomami indians in different areas (ug total Hg/g hair).

Village	female	male	Average
SURUCUCUS AREA			
Koremutheri	3.37-6.22 n=2	3.39-6.02 n=8	5.01 ± 1.04 n=10
Maisibiu	2.92-5.06 n=4	3.45-7.33 n=6	5.03 ± 1.67 n=10
Kanau	2.47-3.99 n=4	2.21-4.45 n=6	3.40 ± 0.73 n=10
Xahoxi	2.91-8.14 n=5	3.19-3.54 n=5	3.99 ± 1.46 n=10
PAAPIU AREA			
Maharuu	1.64-3.76 n=12	1.40-5.23 n=16	2.64 ±0.86 n=28
Irobrerebe	1.42-1.99 n=3	1.61-5.26 n=5	2.91 ± 1.83 n=8
Wakahusibiu	1.56-6.34 n=13	2.03-7.90 n=14	3.21 ± 1.42 n=27
Heron	1.98-6.89 n=21	2.44-5.83 n=23	3.72 ± 0.97 n=44
MUCAJAI RIVER AREA			
Mucajai	2.14-6.59 n=8	2.99-4.99 n=7	4.13 ± 1.22 n=15
Total Range	1.42-8.14 n=72	1.40-7.90 n=90	3.61 ±1.36 n=162

TABLE 2-Percentage of samples with mercury concentration above 6.0 ppm

VILLAGE	% Distribution
Koremutheri	20
Maisibiu	40
Kanau	0
Xahoxi	10
Maharuu	0
Irobrebere	12
Wakahusibiu	7
Heron	2
Mucajai	7
Total	7.4

Highest values			
ug Hg.g^{-1} hair	Sex	Age	Village
8,14 ± 0.47	m	8	Xahoxi-Surucucus
7.90 ± 0.76	f	4	Wakahusibiu-Paapiu
7.33 ± 0.52	m	36	Maisibiu-Surucucus

TABLE 3-Total Hg and methyl-Hg values in some hair samples of Yanomami indians*

total Hg (ug.g^{-1})	Me-Hg (ug.g^{-1})	%
2.703	1.855	89.5
1.990	1.297	65.2
1.397	0.957	68.5
2.964	2.051	69.2
1.638	1.031	62.9
7.460	4.418	59.2
4.793	3.029	63.2
1.938	1.235	63.7
5.261	2.142	40.7

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