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Mercury poisoning: prevalence, knowledge and frequency of gold panning and doing retort among alluvial gold panners in Chiweshe and Tafuna communal lands in Zimbabwe

*MATCHABA-HOVE RB, *SIZIYA S, *RUSAKANIKO S, **KADENHE RM, **DUMBU S, ***CHIRENDA J

Abstract

Objectives: To estimate the prevalence of mercury poisoning, to estimate the knowledge level that mercury can be a poison, and to establish the frequency of gold panning and doing retorts.
Design: Cross sectional study.
Setting: Chiweshe and Tafuna communal lands.
Subjects: Gold panners.
Main Outcome Measure: Mercury levels in blood and urine.
Results: Totals of 23 respondents from Chiweshe and 43 respondents from Tafuna were recruited. Four out of 43 respondents in Tafuna and seven out of 23 respondents in Chiweshe had levels of mercury greater than 0.05 mg/L in blood (p=0.040). Out of 43 respondents in Tafuna, four (9.3%) had levels of mercury of more than 0.01 mg/L in urine. Totals of 18 out of 37 and seven out of 22 respondents from Tafuna and Chiweshe, respectively, did not know that mercury could be a poison. Altogether, 35 (56.5%) out of 62 respondents were full time gold panners. Significantly more respondents in Chiweshe (14/19) than in Tafuna (8/29) did less than four retorts per month (p=0.005). Respondents who did four or more retorts per month were 3.21 (95%CI 1.06 to 9.72) times more likely to have had raised levels of mercury in their blood compared with persons who did less than four retorts per month.
Conclusion: Mercury poisoning among gold panners in Chiweshe and Tafuna communal lands is of public health importance. Panners should be educated on the possibilities of mercury being a poison. A low cost and safe technology to separating mercury from the amalgam should be introduced to the panners.

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Introduction

In Zimbabwe, mercury is considered as a Group II hazardous substance. Although metallic mercury that is not heated does not usually cause a toxic reaction even in large doses,1 mercury poisoning from inhalation exposure to mercury vapour has been noted before.[2,3] Symptoms of acute mercury poisoning by inhalation exposure range from immediate salivation, a metallic taste in the mouth, a sensation of burning in the mouth and throat to dyspnoea, cough, tightness in the chest, nausea and vomiting, colicky abdominal pain, and bloody diarrhoea. These may resolve quickly or may progress to serious pulmonary involvement with necrotic bronchiolitis, pneumonitis, and pulmonary odema, often complicated by pneumothorax in fatal cases.[3,4] Frequently these signs and symptoms are confused with influenza or other infectious respiratory disease.

The panning of gold occurs on an increasingly wide scale in Zimbabwe. Methods of gold panning now commonly used by panners include the use of mercury to separate gold from the ore. The addition of the liquid mercury leads to the formation of a gold-mercury amalgam, which separates out and settles at the bottom due to gravity. Mercury is finally separated from the gold-mercury amalgam by heating the amalgam to remove mercury. A panner is exposed to mercury vapour during the heating process

*Department of Community Medicine
Univeristy of Zimbabwe
Harare
Zimbabwe
**Small Scale Miner's Association of Zimbabwe
Harare
Zimbabwe
***Ministry of Health and Child Welfare
Harare
Zimbabwe

Correspondance to:
Dr S Siziya
University of Zambia
School of Medicine
Department of Community Medicine
P O Box 50110
Lusaka, Zambia.

when mercury separates from the amalgam as a vapour. This process of separating mercury from the amalgam by heating is called retort.

Most studies on mercury poisoning have been on workers employed in mercury factories, farms, bleaching ointment, dentistry and fish consumption. Only a few areas have been surveyed in the world concerning gold mining as a source of mercury poisoning in the population. The notable ones being on gold mining in the Brazilian Amazon[5-7] and in the Philippines.[8]

The prevalence of mercury poisoning in the Chiweshe and Tafuna communal lands is not known. Therefore, a study was conducted with the following objectives:

- to estimate the prevalence of mercury poisoning.
- to estimate the knowledge level that mercury can be a poison.
- to establish the frequency of gold panning and doing retort among gold panners in the Chiweshe communal lands

Materials and Methods

Sample Size and Sampling.

The study population was made up of persons who had illegally settled in the study area. It was not possible to estimate the population of gold panners because persons found in the area could not provide information in fear of victimisation. Consequently, we could not use a random sampling technique to select our study subjects.

Questionnaire.

A questionnaire was used to collect information relating to mercury, length of panning, gold extraction and sociodemographic characteristics of panners from the Chiweshe and Tafuna communal lands.

Blood and Urine Analysis.

Blood and urine specimens were collected on the spot from consenting individuals from the panning communities. The concentration of inorganic mercury in blood is an indicator of recent or current exposure. Meanwhile, the concentration of inorganic mercury in urine shows long term exposure. To detect trace amounts of mercury in the blood and urine specimen, an atomic absorption spectrometric technique that uses cold vapour was used.[9] In this method, both inorganic and organic forms of mercury in body fluids are reduced to elemental mercury. This analytical method is able to detect a concentration greater than 0.001 mg/L that is 1.0 ppb and has a linearity range of 0.001 to 0.100 mg/L.

Using mercury level measurements determined in a USA population, mercury concentrations in blood of adults of less than 0.05 mg/L were regarded as normal mercury levels.[9] Blood mercury estimating is of great value in monitoring persons exposed to alkyl mercury compounds.[10] Meanwhile, mercury concentrations in urine of adults of less than 0.01 mg/L were considered normal. The concentration of mercury in urine is directly proportional to the severity of the exposure to mercury. Urine specimens were only collected from Tafuna because of logistic problems.

Statistical Analysis.

Data was entered, edited and analysed using a computer software EPI INFO version 5. Data was edited using range and consistency checks. The Kruskal-Wallis (H) and the Chi-squared tests were used to analyse continuous and qualitative data, respectively. For expected frequencies less than five, the Fisher's exact test was used. A result with a p value of less than 0.05 was considered statistically significant. Mercury levels in blood were categorised into normal and raised. A stepwise logistic regression analysis was conducted to figure out independent predictors of raised levels of mercury in the blood.

Results

Socio-demographic.

There were 23 respondents from Chiweshe and 43 from Tafuna. Table I shows the distribution of socio-demographic factors between residents of Tafuna and Chiweshe. Respondents in Chiweshe were on average older than the respondents in Tafuna (p=0.048).

Table I: Sample description.

Age(years)	Tafuna	Chiweshe	p-value.
Median (Q_1 Q_3)	25 (19,33)	30 (24,43)	0.048
Sex			
Male	27	19	0.165
Female	16		
Marital status			
Married	23	18	0.087
Not Married	20	5	
Education (years)			
0-7	25	8	0.121
8+	18	15	

Totals of 22 out of 41 respondents in Tafuna and 13 out of 21 respondents in Chiweshe were full time gold panners (p=0.726). Overall, 35 (56.5%) out of 62 respondents were full time gold panners.

More respondents in Tafuna had done less than four retorts per month than respondents in Chiweshe p=0.005) as shown in Table II. More respondents in Chiweshe (14/10) than in Tafuna (8/32) had less than 24 months of doing retort (p=0.002).

Mercury Poisoning.

Out of 37 respondents from Tafuna, 18 did not know that mercury can be a poison. Meanwhile, seven out of 22 respondents from Chiweshe did not know that mercury can be a poison.

Four of the 43 respondents in Tafuna and seven of the 23 respondents in Chiweshe had levels of mercury greater than 0.05 mg/L in blood (p=0.040).

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