High Mortalities Due to Cancers and Psychiatric Disorders in Maşjid-I-Sulaiman (South-West of Iran), a Polluted Area with Natural Sour Gas

Mostafa Saadat
Department of Biology, College of Sciences, Shiraz University, Shiraz 71454, Iran

Abstract: Masjid-I-Sulaiman (MIS) (Khuzestan province, South-West of Iran) is contaminated with subsurface of natural sour gas leakage. In the present report the possible effect of environmentally contamination with natural sour gas on mortality due to cancers and psychiatric disorders was investigated. Data concerning mortality in MIS and Khuzestan province are compiled using reports from the Statistical Center of Khuzestan province from 20th March 2000 to 19th March 2002. The mortality in the Izeh and Shoshtar, the nearest city to MIS and the Khuzestan province (excluding MIS) were used as controls. To test the null hypothesis that the mortalities due to cancers and psychiatric disorders in MIS are equal to the control populations, the Chi-square test was used. Statistical analysis of data demonstrated that there were significant differences between MIS and Khuzestan province for cancers ($\chi^2 = 20.58$, df = 1, $p<0.00001$) and psychiatric disorders ($\chi^2 = 43.79$, df = 1, $p<0.00001$) related mortalities. There were significant differences between MIS and Izeh for cancers ($\chi^2 = 7.24$, df = 1, $p = 0.0071$) and psychiatric disorders ($\chi^2 = 17.88$, df = 1, $p = 0.00002$) related mortalities. Also there were significant differences between MIS and Shoshtar for cancers ($\chi^2 = 9.23$, df = 1, $p = 0.0023$) and psychiatric disorders ($\chi^2 = 9.80$, df = 1, $p = 0.0017$) related mortalities. There was no difference between either Izeh or Shoshtar and Khuzestan province for mortalities due to cancers and psychiatric disorders. Taken together, it is suggested that high level of sulfur compounds in MIS has some role(s) in the high mortality rates due to cancers and psychiatric disorders in MIS.

Keywords: Mortality, cancer, psychiatric disorders, sour gas leakage, Masjid-I-Sulaiman, Iran

Introduction

Masjid-I-Sulaiman (MIS) is located in Khuzestan province, south-west of Iran. Petroleum-whether gas, oil, or liquid asphalt- that exudes in the form of springs and seepages may reach the surface. Active seepages of oil and gas overlie the MIS oil field (Lee, 1953). Unfortunately, some parts of the MIS are contaminated by sub-surface leakage of natural gas, which contains the hydrogen sulfide. It should be mentioned that the gas dissolved in the oil of the MIS oil field contains 40% hydrogen sulfide (Levitsen, 1967).

Recently we showed that the offspring sex ratio at birth of families living in contaminated areas of MIS had significantly difference compared with the general population of MIS (Saadat et al., 2002, 2003). The influence of the subsurface leakage of sour gas on the systolic and diastolic blood pressure (Saadat et al., 2004a) and hematological indices (Saadat and Bahaoddini, 2004) of individuals living in contaminated areas of MIS was reported. High incidence of suicide attempts, completed suicide and suicide by self-burning in MIS was reported (Saadat et al., 2004b). Very recently it was showed that MIS citizens are more at risk to be depressed and hopeless compared to control group (Saadat, 2006).
There are several reports about effects of petroleum compounds on mortality rates and causes of mortality (Divine et al., 1996; Mavaluso et al., 1996; Tsai et al., 2001). However, there is no data about the possible effects of environmental contamination with sulfur compounds on causes of mortality. In the present study we are going to compare the mortality due to cancers and psychiatric disorders between MIS and control populations.

Materials and Methods

Data concerning mortality in MIS and Khozestan province are compiled using reports from the Statistical Center of Khozestan province from 20th March 2000 to 19th March 2002, equal to Iranian calendar 1379 to 1380 Hijrae Shamsi (HS). The mortality in the Izeh and Shoshtar, the nearest city to MIS and the Khozestan province (excluding MIS) were used as controls. It should be noted that citizens of MIS and Izeh belong to the same ethnic group (named Bakhtiari). It should be noted that there is no significant difference between MIS, Izeh, Shoshtar and the Khozestan province (excluding MIS) regarding the age distribution of citizens.

To test the null hypothesis that the mortalities due to cancers and psychiatric disorders in MIS are equal to the control populations, the Chi-square test was used. A probability of p < 0.05 considered statistically significant.

Results and Discussion

Table 1 show the total mortality and mortality cause by cancers and psychiatry disorders in MIS, Izeh, Shoshtar and Khozestan province during two years.

Statistical analysis of data demonstrated that there were significant differences between MIS and Khozestan province for cancers ($\chi^2 = 20.58, df = 1, p < 0.00001$) and psychiatric disorders ($\chi^2 = 43.79, df = 1, p < 0.00001$) related mortalities. There were significant differences for mortalities between MIS and Izeh due to cancers ($\chi^2 = 7.24, df = 1, p = 0.0071$) and psychiatric disorders ($\chi^2 = 17.88, df = 1, p = 0.00002$). Also there were significant differences for mortalities between MIS and Shoshtar due to cancers ($\chi^2 = 9.23, df = 1, p = 0.0023$) and psychiatric disorders ($\chi^2 = 9.80, df = 1, p = 0.0017$).

It should be mentioned that there was no difference between Shoshtar and Khozestan province for mortalities due to cancers ($\chi^2 = 0.0, df = 1, p = 0.980$) and psychiatric disorders ($\chi^2 = 0.69, df = 1, p = 0.408$). Also there was no difference between Izeh and Khozestan province for mortalities due to cancers ($\chi^2 = 0.05, df = 1, p = 0.818$). However there is a borderline significant difference between Izeh and Khozestan province for mortality due to psychiatric disorders ($\chi^2 = 4.58, df = 1, p = 0.032$). In Izeh mortality due to psychiatric disorders is less than Khozestan province. Considering that citizen of MIS and Izeh are belonging to same ethnicity group (named Bakhtiari), it should be stressed that ethnicity can not explained the high level of mortality due to psychiatric disorders in MIS.

No studies into the mutagenic or carcinogenic potential of H2S were reported. However, a study in which rats were orally administrated with sodium sulfide for 78 weeks did not present any evidence of carcinogenicity (Costigan, 2003). The epidemiological studies have linked SO2 exposure and lung

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<th>Table 1: Mortality due to cancers, psychiatry disorders and other causes in MIS, Izeh, Shoshtar and Khozestan province</th>
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<td>Mortality due to Population</td>
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cancer (Meng and Zhang, 1992). Several studies have shown that the frequencies of micronuclei, chromosomal aberrations and sister chromatide exchanges in peripheral blood lymphocytes of factory workers chronically exposed to SO2 were higher than the controls (Meng and Zhang, 1990; Yadav and Kaushik, 1996). It was reported that the hydrated forms of SO2 (bisulfite and sulfite) induced micronuclei, chromosomal aberrations and sister chromatide exchanges formation in cultured human lymphocytes in vitro (Meng and Zhang, 1992; Renzegullari et al., 2001). Based on these reports it might be concluded that exposed chronically to natural sour gas which contain several compounds such as H2S, SO2 and SO3 increases the mortality due to cancers.

The endogenous levels of H2S have been measured in the human brain, suggesting that H2S may have a physiological function (Savage and Gould, 1990; Abe and Kimura, 1996). It is showed that increase or decrease of brain hydrogen sulfide is associated with Down’s syndrome and Alzheimer’s disease, respectively (Eto et al., 2002; Kamoun et al., 2003). Therefore, alteration(s) in H2S level is coupled with brain dysfunction. Our recent reports indicated that in MIS the incidence of suicide attempts, completed suicide and suicide by self-burning is remarkably high (Saadat et al., 2004b) and MIS citizens are more at risk to be depressed and hopeless compared to control group (Saadat et al., 2006). Present results indicated that mortality due to psychiatric disorders in MIS increased significantly. Taken together, it is suggested that high level of sulfur compounds in MIS has some role in the high mortality due to psychiatric disorders in MIS.

In this situation, health-care providers need to be aware of the possible role(s) of natural sour gas leakage on causes of mortality of MIS citizens. Other study describing the age and sex specific mortality rates due to cancers and psychiatry disorders are necessary.

Acknowledgements

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References


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