

THE PROBLEM OF ARSENIC IN THE WORLD AND IN TURKEY (THE SPECIAL CASE OF KÜTAHYA)

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Arsenic found in drinking water is defined as a carcinogenic substance by the World Health Organisation (WHO). On the basis of conducted studies, the World Health Organisation reduced the amount of arsenic in drinking water from 50 µ/litres to 10 µ/litre in 1993 and determined the water as toxic if the level of concentration of arsenic in water is over 10 µ/l (1). Even though the recommended level of arsenic in water was reduced from 50 µ to 10 µ per litre, when the standards of chemical substances used in industry is practiced, the figures which have been determined must further be reduced. Arsenic is at the top of all lists in the world as being the most toxic known substance contained in drinking water.

Chronic arsenic poisoning has been identified in the vicinity of the province of Kütahya (2, 3). Doğan (et al., 2005) have compared the amount of arsenic found in water and its dermatological effects in their publications and have also investigated the impact of the importance of dose as a factor and disease types and their frequencies. The source of arsenic in the region is largely due to geogenic.

ARSENIC IN THE WORLD AND KÜTAHYA

The arsenic concentration in many countries is at a toxic level. The countries which experience the problem of As in underground water are namely Argentina, Bangladesh, Chile, China, Hungary, India, Mexico, Taiwan, Vietnam and especially the south-western states of the USA. The table below (Table 1) shows examples of some countries which are known to have high concentrations (µg /l) of arsenic in their drinking water (4-15).

Table 1

| | | |
|--------------------------|------------|--|
| ● Chile | 190-21,800 | Caceres et al. (1992) |
| ● Argentina | <1-7,500 | Nicolettiet al. (1989), Sancha and Castro (2001), Smedley et al., (2002) |
| ● Ghana | <2-7,900 | Smedley et al. (1996) |
| ● Ontario, Canada | 35-100 | Azcue and Nriagu (1995) |
| ● Bangladesh | 10-5,000 | Das et al. (1995) |
| ● Taiwan | 10-1,820 | Kuo (1968) |
| ● Ural Mountains | 400,000 | Gelova (1977) |
| ● California, USA | <243,000 | White et al. (1963) |
| ● Fairbanks, Alaska, USA | <10,000 | Wilson and Hawkins (1978), Welch et al. (1988), |

Samples from 40 different sources of drinking water have been taken in the province of Kütahya by Doğan and Doğan (at print). The amount of arsenic found varies between 0-10.7 mg/l. It was seen that the amount of 10.7 mg/l arsenic found in one of the water samples is among the highest value of arsenic found when compared with other findings in the literature.

The Bangladesh example, where arsenic in the drinking water has affected the most widespread and the highest population is well known. Epidemiological studies conducted in other countries with high concentrations of arsenic in drink water and especially in Bangladesh have been pioneers in identifying the limits of arsenic.

THE PROBLEM OF ARSENIC IN THE WORLD

The effects of arsenic change according to populations, even to individuals and geographical regions. There is no simple or known explanation as to why it causes different diseases in different individuals. Therefore, the data relating to arsenic intoxication varies according to different populations and this means that it is difficult to conduct concluding studies.

Arsenic intoxication has been observed in communities which have consumed arsenic-rich water over a long period of time (15-21). Dermatological diseases caused by arsenic lead to many different types of cancer. Many researchers have found relationships between arsenic and diseases such as skin, lung, urinary bladder, oesophagus and thyroid cancer.

Arsenic contamination which occurs due to the effect of the environment generally causes skin lesions. It has been found that high

concentrations of arsenic is present in the drinking water in the endemic regions where skin lesions are seen. Epidermal keratinocyte changes and proliferation has been observed in persons who have been exposed to high doses of arsenic over long periods of time. These reported in-vitro findings show that there is a relationship between the keratosis pathogenesis and arsenic. The oncogenesis of arsenic related cancers are still being debated. A few molecular explanations on arsenic oncogenesis have been suggested. Some epidemiological studies conducted in various countries showed that there is a positive correlation between skin lesions and arsenic (15-20). However, different skin lesions do show some differences between racial groups (18, 21). In some studies, the concentration factor was also considered.

THE PROBLEM OF ARSENIC IN KÜTAHYA

Doğan (et al., 2005) and Doğan & Doğan (at print) compared the relationships between the concentration of arsenic, and the origin and skin lesions in their studies. In the first study, the concentration of arsenic from the drinking water of two villages in Emet, Kütahya and various skin diseases were identified. The relationship between chronic arsenic intoxication and adverse health effects is given in Table 2. The diseases observed in the area and the signs of arsenic poisoning in the region are as follows: “Palmo-plantar keratosis”, “basal cell carcinoma”, “plantar keratoderma”, “plantar hyperkeratosis”, “pigmented nodular lesions”, “mycosis fungicides”, “keratic papules”, “Bowenoid lesions”, “hyperhidrosis”, “verru plantaris” and “verru plantaris et Palmaris”. “Bowenoid lesions”, hyper-pigmentation” and “keratosis” are among the pre-symptoms for carcinomas that are caused by chronic arsenic intoxication. Forty different drinking water samples were taken from water at Emet and the surrounding areas. The concentration of arsenic showed a large range from 0-10.7 mg/l. Cases of arsenic poisoning of a percentage of 30.9% was observed in the village where the level of arsenic was high. Table 2 provides the dermatological data found in Doğan (et al., 2005).

Table 2. Dermatological findings from two separate villages in the vicinity of Emet (Kütahya) in which arsenic intoxication is seen (Doğan et al., 2005)

| Symptoms and Findings | Village1 N (M/F) | Village2 N (M/F) | Total N (M/F) |
|---|-----------------------------|-----------------------------|--------------------------|
| Palmo plantar keratosis | 17 (9/8) | 1 (1/0) | 18 (10/8) |
| Basal cell carcinoma | 2 (1/1) | 0 | 2 (1/1) |
| Verru plantaris | 3 (3/0) | 0 | 3 (3/0) |
| Verru plantaris et palmaris | 1 (0/1) | 0 | 1 (0/1) |
| Plantar keratoderma | 1 (0/1) | 0 | 1 (0/1) |
| Plantar hyperkeratosis | 1 (0/1) | 0 | 1 (0/1) |
| Pigmented nodular lesions | 0 | 1 (0/1) | 1 (0/1) |
| Mycosis fungicides | 1 (1/0) | 0 | 1 (1/0) |
| Hyperhidrosis | 0 | 1 (0/1) | 1 (0/1) |
| Keratic papules | 3 (0/3) | 0 | 3 (0/3) |
| Bowenoid lesions | 1 (0/1) | 0 | 1 (0/1) |
| Total of findings related to arsenic | 30 (14/16) | 3 (1/2) | 33 (15/18) |

When Table 2 is examined, the relationship between the skin lesions related to chronic arsenic intoxication and the amount of arsenic in water can be established. In Village1, where the concentration of arsenic in water has reached 8.9-9.3 mg/l, 30 cases of poisoning due to arsenic were observed. Only three cases were observed in Village2 where the amount of arsenic in the water was between 0.3-0.5. Changes in skin due to arsenic were found in 30.9% of the subjects in Village1 and in 5.4% of the subjects in Village2. The relationship is supported by the observation that 17 persons (17.5% of subjects) were found to have Palmoplantar keratosis in Village1, whereas this condition was found in only 1 person (1.8% of the subjects) from Village2.

Chronic skin lesions such as keratosis and hyper-pigmentation seen in persons exposed to high levels of arsenic are important indicators of arsenic intoxication for early diagnosis (18-20).

CONCLUSION

The preliminary findings for those cases which have had long-term exposure to arsenic are changes in pigmentation and hyperkeratosis (24-25). The changes that may cause cancer can take years, even 10 years long. For example, in a study conducted in Japan it was found that 10

years of exposure to arsenic poisoning led to Bowen disease, 20 years of exposure led to squamous cell carcinoma and 30 years of exposure led to lung cancer. The latency period for skin cancer is between 3-40 years with an average of 18 years (24-25).

In other countries, the relationship between skin cancer, palmar and plantar keratosis in individuals who had been exposed to arsenic in large amounts was found and published (16-17, 24-26). However, as it has been mentioned above, the carcinogenic mechanism of arsenic has yet to be fully understood and the oncogenesis of the cancers it causes is still in need of explanation. Studies show that the cases of people with skin cancer and internal cancers may increase in individuals that have been exposed to drinking water containing arsenic in Emet and its vicinity in future years. Urgent measures must be taken to prevent an increase in the cases of cancer in the region.

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