IOSR Journal of Applied Chemistry (IOSR-JAC)
e-ISSN: 2278-5736.Volume 10, Issue 11 Ver. II (November. 2017), PP 47-50
www.iosrjournals.org

Selenium Concentration in Serum and Hair of Petrol Station Workers in Van Province / Turkey

Ahmet Ufuk KÖMÜROĞLU[1], İhsan ALACABEY[*2], Nur AKMAN ALACABEY[1], Uğur ÖZDEK[1], Ali Rıza KUL[3], Nurhayat ATASOY[3], Ufuk MERCAN YÜCEL[4]

[1]*Van Vocational Higher School of Healthcare Studies, Van Yüzüncü Yıl University, Turkey*
[*2]*Vocational Higher School of Healthcare Studies, Mardin Artuklu University, Turkey*
[3]*Department of Chemistry, Faculty of Science, Van Yüzüncü Yıl University, Turkey*
[4]*Department of Pharmacology, Faculty of Veterinary Medicine, Van Yüzüncü Yil University, Turkey*

Abstract : *Selenium has been found to show protective properties against different toxic effects. Petrol station workers are exposed to many harmful effects. Therefore, we aimed to determine the selenium level in hair and serum specimens of the oil station workers. A total of 100 petrol station workers and 100 office workers were included in the study. Selenium concentration in hair and serum samples of this people was determined using an ICP-OES instrument.Se amount (0.456 ± 0.348) in hair samples of petrol station workers were higher than that of the petrol station staff (0.340 ± 0.191), however this difference was insignificant (p=0.278) Serum selenium concentration in petrol station workers (22.30± 3.37) was significantly lower than that of the control group (24.680 ± 3.08) (p = 0.031), which may be due to inclusion of selenium in detoxification owing to exposure to various chemicals by the workers. Thus, selenium supplementation can be recommended in their diet.*

Keywords: *Selenium, ICP-OES, Heavy Metal, Hair, Serum, Petrol Station Workers*

Date of Submission: 30-11-2017 Date of acceptance: 14-12-2017

I. Introduction

Selenium (Se) is an indispensable part of the glutathione peroxidase enzyme, which plays an important role in the protection of tissues against oxidation. This metal also antagonizes the toxic effects of heavy metals such as cadmium, mercury, and silver, and simultaneously, amount of Se is changed depending on exposal of these heavy metals [1].

The protective function of selenium depends on its inhibition of various elements that can be encountered in foods, the environment and office. These elements include As, Cu, Zn, Cd, Hg, Sn Ni, Co. The selenium interaction with these elements occurs spontaneously in vivo and represents the natural detoxification process. Highly related elements for selenium combine with selenium to form protein complexes and metal selenides. This interaction leads to the physiological inactivation of selenium [2].

Although crude oil is a mixture of organic substances, it is a mixture of organic compounds containing large amounts of metal and metalloids, which may be associated with organic acid and porphyrin groups [3]. Several elements such as Co, Cu, Pb and Se are found naturally in crude oil and can be transported to lighter fractions during distillation processes. Gasoline can include low concentrations of these metals and metalloids [4,5]. Furthermore, contamination in storage or transport and corrosion of tankers or pumps are other sources of metal and metalloids [6].

Pump workers at petrol stations have been shown to be affected by various physiological systems in the body during long-term petroleum vapor exposure [7]. Pump workers working at petroleum stations have been shown to affect the different physiological systems in the body [7]. An epidemiological study in humans exposed to oil vapor has shown an increased incidence of disease [8,9]. Petroleum is not safe even when steam is briefly left in the refueling, which makes the oil station too risky for occupational exposure [10].

In this study, we aimed to investigate the effects of occupational exposure to serum and hair selenium levels in workers working at the oil station.

II. Materials and Methods

Working group

Work was included in the study as a control group of 100 men workers of petrol stations located in Van city center and 100 men workers who were not exposed to petroleum derivatives.

Taking hair samples and analyzing selenium in hair

Hair samples were cut as close as possible to the head skin from the occipital area with surgical stainless steel scissors. Hair samples were washed several times with 1% Triton X-100 solution, then dried several times with deionized distilled water and then dried at 70 °C for 2 h. Approximately 200 mg of hair sample was placed in 15 ml glass tubes and digested with 1 ml HNO_3 for 12 h and then diluted with 10 ml deionized water. The Selenium Concentration from this solution was studied in the ICP-OES device at Van Yüzüncü Yıl University Science Application Research Center [11].

Selenium analysis in serum samples

Blood specimens were removed by vacuum tube and centrifuged at 300 rpm for 10 min to separate the sera, which were stored at -20 °C until analysis. Serum selenium concentration was studied in ICP-OES device at Van Yüzüncü Yıl University Science Application Research Center.

Statistical analysis

The results are given as mean ± standard deviation. Statistical analyzes were performed using the SPSS 23.0 package program. Student t test was applied between the groups.

III. Results and Discussion

Bioprocessing studies provide valuable information about the concentration and prevalence of chemicals in the general population. Measuring the concentrations of chemicals in biological materials such as blood, urine, hair, etc., reflects the exposure that can occur in many ways. Biomass data are used as an increasing tool to assess exposure to environmental chemicals [12]. In the present study, selenium levels were studied in hair and serum specimens of workers filling the oil station. Serum selenium level was significantly higher than that of the control group (Table 2). This height was not significant, although the concentration of selenium hair concentrate was high in the exposure group.

Since selenium is the essential component of many enzymes it has been extensively studied because of its potential for the prevention of chronic diseases [13]. Selenium is considered to be a necessary mineral for antioxidant and immunological function, and the uptake of selenium by the diet is crucial for the protection of human homeostasis and functions. Selenium deficiency may have negative side effects on the immune system and may lead to susceptibility to bacterial and viral infections [14,15] and increase cardiomyopathy risk [16,17]. Selenium is considered to be an important factor that neutralizes heavy metal toxicity [18].

95% of the petroleum vapor components are a mixture of aliphatic and alicyclic compounds and hydrocarbons formed by less than 20% aromatic compounds. The volatile nature of petroleum is rapidly spread to the atmosphere when every filling is done, especially at petrol stations [19].

In a study conducted in Poland, serum selenium level was reported to be 73.3 ± 14.4 μg/L while selenium concentration in hair was reported to be 0.30 ± μg/g [20]. Elinder [21] reported that serum selenium levels were between 60 and 12 μg/L in selenium-bearing populations and 0.1 μg/L in hair. Neve [22] classified serum selenium concentration in three categories: low 50-60 μg/L, 100-120 μg/L high and 60-100 μg/L normal. In our study, the serum level was lower than the normal values reported by Elinder [21] and Neve [22]. Hair selenium level was again higher than the value reported by Elinder [21].

It has been reported that the mean value of serum selenium is 89 μg/L in studies conducted in England [23]. In two different studies, serum selenium concentrations were found to be 68 μg/L [24] and 74.3 μg/L [25]. Studies in Turkey have reported that selenium levels in the control groups are 61.50 ± 31.60 μg/L [26] and 73.35 ± 20.40 μg/L [27]. In the present study serum selenium levels were found to be lower in both the control and exposure groups than the results from the previous studies. Selenium concentrations in the general population differ between countries and regions. These differences are explained by the selenium content and dietary habits of the territory of the region [28]. On the other hand, it has been reported that the sample types and analytical methods used in evaluating selenium in each study are influential on this difference [28]. The reported low serum selenium concentration in petrol station workers may be due to the exposure of these workers to various petroleum-based chemicals and the deterioration of these chemicals by selenium. For this reason, selenium supplementation can be recommended for people working in this line of work.

Fathy et al. [29] reported that their hair selenium concentration was 0.354 μg/L in their study. In another study, hair serum level was found to be 0.16 μg/L [30]. In studies conducted in Turkey, hair selenium levels in control groups were found to be 0.63 ± 0.20 [31] and 0.6 ± 0.1 μg/L [32]. In the present study, hair selenium level was determined by Fathy et al. [29], Tinkov et al. [30] and higher than those of Turkey. The main difference in the results of studies evaluating hair selenium levels may be due to the difference in the method of hair washing and the difference in working method. The absence of reference value in the general population at national level in Turkey causes our results to not be considered as healthy. Our Se values were basically compared with the values of the control groups that were conducted in different studies.

As a result, serum selenium levels in pump workers of petrol stations were significantly lower than that of control group, although hair selenium level was insignificant. One can conclude that the workers in this line of work are in the group of risks to be observed carefully and necessary precautions must be taken to prevent long-term effects. Further studies need to be carried out in this field.

Table 1: Age and length of working in the workgroups

	Age (years)	Length of work (yıl)
Expose Group	33.32 ± 8.72	8.83 ± 8.59
Control	30.20 ± 8.59	

Length of working and ages of the exposure group are shown in Table 1.

Table 2: Selenium levels of hair and serum for expose group and control group

	Workgroup	Control group	P
Selenium in hair (µg/g)	0.455 ± 0.34	0.340 ± 0.19	0.278
Selenium in serum (µg/L)	22.30± 3.37	24.680± 3.08	0.032

Exposure group hair selenium level was higher than that of the control group, however this difference was insignificant (p=0.278) (Table 1). Serum selenium level in the control group was significantly higher than that of the exposure group (p=0.031).

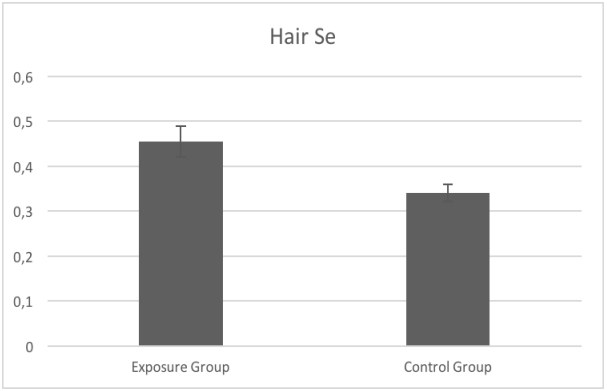

Figure 1: Exposure and control group hair selenium concentration

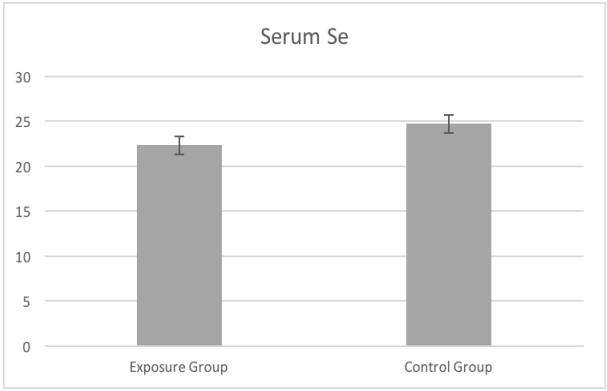

Figure 2: Exposure and control group serum selenium concentration

References

[1]. **Kucharzewski, M., Braziewicz, J., Majewska, U.Góźdź, S.,** (2003). Copper, zinc, and selenium in whole blood and thyroid tissue of people with various thyroid diseases. *Biological Trace Element Research, 93*(1-3), 9-18.

[2]. **Schrauzer, G. N.,** (1992). Selenium. *Biological Trace Element Research*, *33*(1), 51-62.

[3]. **Speight, J. G.**, (2014). *The chemistry and technology of petroleum*: CRC press.

[4]. **Chaves, E. S., Lepri, F. G., Silva, J. S., de Quadros, D. P., Saint'Pierre, T. D.Curtius, A. J.,** (2008). Determination of Co, Cu, Fe, Mn, Ni and V in diesel and biodiesel samples by ETV-ICP-MS. *Journal of Environmental Monitoring, 10*(10), 1211-1216.

[5]. **Santos, D. S., Korn, M. G. A., Guida, M. A., Santos, G. L. d., Lemos, V. A.Teixeira, L. S.,** (2011). Determination of copper, iron, lead and zinc in gasoline by sequential multi-element flame atomic absorption spectrometry after solid phase extraction. *Journal of the Brazilian Chemical Society*, *22*(3), 552-557.

[6]. **Duyck, C., Miekeley, N., da Silveira, C. L. P.Szatmari, P.,** (2002). Trace element determination in crude oil and its fractions by inductively coupled plasma mass spectrometry using ultrasonic nebulization of toluene solutions. *Spectrochimica Acta Part B: Atomic Spectroscopy*, *57*(12), 1979-1990.

[7]. **Begum, S., Rathna, M.,** (2012). Pulmonary function tests in petrol filling workers in Mysore city. *Pak J Physiol*, *8*(1), 12-14.

[8]. **Carletti, R.Romano, D.,** (2002). Assessing health risk from benzene pollution in an urban area. *Environmental monitoring and assessment*, *80*(2), 135-148.

[9]. **Lagorio, S., Forastiere, F., Iavarone, I., Vanacore, N., Fuselli, S.Carere, A.,** (1993). Exposure assessment in a historical cohort of filling station attendants. *International journal of epidemiology, 22*(Supplement_2), S51-S56.

[10]. **Pranjic, N., Mujagic, H., Nurkic, M., Karamehic, J.Pavlovic, S.,** (2002). Assessment of health effects in workers at gasoline station. *Bosn J Basic Med Sci, 2*(1-2), 35-45.

[11]. **Wright, R. O., Amarasiriwardena, C., Woolf, A. D., Jim, R.Bellinger, D. C.**, (2006). Neuropsychological correlates of hair arsenic, manganese, and cadmium levels in school-age children residing near a hazardous waste site. *Neurotoxicology*, *27*(2), 210-216.

[12]. **Sexton, K., Needham, L.Pirkle, J.,** (2004). Human Biomonitoring of Environmental Chemicals Measuring chemicals in human tissues is the" gold standard" for assessing people's exposure to pollution. *Am Sci*, *92*, 38-45.

[13]. **Benstoem, C., Goetzenich, A., Kraemer, S., Borosch, S., Manzanares, W., Hardy, G.Stoppe, C.,** (2015). Selenium and its supplementation in cardiovascular disease—what do we know? *Nutrients, 7*(5), 3094-3118.

[14]. **Lei, C., Niu, X., Ma, X.Wei, J.,** (2011). Is selenium deficiency really the cause of Keshan disease? *Environmental geochemistry and health, 33*(2), 183-188.

[15]. **Virtamo, J., Rapola, J. M., Ripatti, S., Heinonen, O. P., Taylor, P. R., Albanes, D.Huttunen, J. K.**, (1998). Effect of vitamin E and beta carotene on the incidence of primary nonfatal myocardial infarction and fatal coronary heart disease. *Archives of internal medicine, 158*(6), 668-675.

[16]. **Chen, J.-S.,** (2012). An original discovery: selenium deficiency and Keshan disease (an endemic heart disease). *Asia Pacific journal of clinical nutrition, 21*(3), 320-326.

[17]. **Müller, M., Banning, A., Brigelius-Flohé, R.Kipp, A.,** (2010). Nrf2 target genes are induced under marginal selenium-deficiency. *Genes & nutrition, 5*(4), 297-307.

[18]. **Pinheiro, M., Müller, R., Sarkis, J., Vieira, J., Oikawa, T., Gomes, M., Guimaraes, G., Do Nascimento, J.Silveira, L.,** (2005). Mercury and selenium concentrations in hair samples of women in fertile age from Amazon riverside communities. *Science of the Total Environment, 349*(1), 284-288.

[19]. **Bindhya, S., Balachandar, V., Sudha, S., Devi, S. M., Varsha, P., Kandasamy, K., Prakash, V. G.Sasikala, K.**, (2010). Assessment of occupational cytogenetic risk, among petrol station workers. *Bulletin of environmental contamination and toxicology, 85*(2), 121-124.

[20]. **Hać, E., Krechniak, J.Szyszko, M.**, (2002). Selenium levels in human plasma and hair in northern Poland. *Biological Trace Element Research, 85*(3), 277-285.

[21]. **Elinder, C.-G., Friberg, L., Kjellström, T., Nordberg, G., Oberdoerster, G.Organization, W. H.,** (1994). Biological monitoring of metals.

[22]. **Neve, J.,** (1991). Methods in determination of selenium states. *Journal of trace elements and electrolytes in health and disease, 5*(1), 1-17.

[23]. **Stranges, S., Laclaustra, M., Ji, C., Cappuccio, F. P., Navas-Acien, A., Ordovas, J. M., Rayman, M.Guallar, E.,** (2010). Higher selenium status is associated with adverse blood lipid profile in British adults. *The Journal of nutrition, 140*(1), 81-87.

[24]. **Berthold, H. K., Michalke, B., Krone, W., Guallar, E.Gouni-Berthold, I.,** (2012). Influence of serum selenium concentrations on hypertension: the Lipid Analytic Cologne cross-sectional study. *Journal of hypertension, 30*(7), 1328-1335.

[25]. **Stranges, S., Tabák, A. G., Guallar, E., Rayman, M. P., Akbaraly, T. N., Laclaustra, M., Alfthan, G., Mussalo-Rauhamaa, H., Viikari, J. S.Raitakari, O. T.,** (2011). Selenium status and blood lipids: the cardiovascular risk in Young Finns study. *Journal of internal medicine, 270*(5), 469-477.

[26]. **Canoruç, N., Canoruç, F., Aslan, Ç., YILMAZ, Ş., Turgut, C., Dursun, M., Akkuş, Z.Ebru, K.,** (2006). Karaciğer hastalıklarında (siroz veya hepatit) homosistein ve selenyum düzeyleri. *Akademik Gastroenteroloji Dergisi, 5*(1).

[27]. Akarsu, T., (2013). *Tokat ili bölgesi eser elementleri (Selenyum, Çinko, Bakır) referans aralıkları.* Selçuk Üniversitesi Sağlık Bilimleri Enstitüsü.

[28]. **González-Estecha, M., Palazón-Bru, I., Bodas-Pinedo, A., Trasobares, E., Palazón-Bru, A., Fuentes, M., Cuadrado-Cenzual, M. Á.Calvo-Manuel, E.,** (2017). Relationship between serum selenium, sociodemographic variables, other trace elements and lipid profile in an adult Spanish population. *Journal of Trace Elements in Medicine and Biology*.

[29]. **Fathy, G., Diab, H. M., Mostafa, M. S., El-Ashkar, E.Shahin, R. S.,** (2017). Validity of hair selenium analysis as a biomarker of selenium concentration among Egyptian patients with psoriasis vulgaris. *Journal of the Egyptian Women's Dermatologic Society, 14*(1), 61-65.

[30]. **Tinkov, A. A., Skalnaya, M. G., Demidov, V. A., Serebryansky, E. P., Nikonorov, A. A.Skalny, A. V.,** (2014). Hair mercury association with selenium, serum lipid spectrum, and gamma-glutamyl transferase activity in adults. *Biol Trace Elem Res, 161*(3), 255-262. doi:10.1007/s12011-014-0124-3.

[31]. **Karaman, S., MANSUROĞLU, B., Kizilbey, K., Derman, S.Hazar, A. B.,** (2015). Selenium status in blood, urine, and hair samples of newly diagnosed pediatric cancer patients. *Turkish journal of medical sciences, 45*(2), 329-334.

[32]. **Koc, E. R., Ilhan, A., Aytürk, Z., Acar, B., GÜRLER, M., ALTUNTAŞ, A., Karapirli, M.Bodur, A. S.**, (2015). A comparison of hair and serum trace elements in patients with Alzheimer disease and healthy participants. *Turkish journal of medical sciences, 45*(5), 1034-1039.

Ahmet Ufuk KÖMÜROĞLU "Selenium Concentration in Serum and Hair of Petrol Station Workers in Van Province / Turkey." IOSR Journal of Applied Chemistry (IOSR-JAC) 10.11 (2017): 47-50.