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Determination of Cobalt (Co) level in hair and serum of Gas Station Workers in Van Province

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Abstract: *The study was aimed to determine Cobalt level in hair and serum of gas station staff in Van province. One group of hair and blood samples was taken from permissive petrol station workers (n = 100), whereas another group of hair and blood samples was taken from the control group (n = 100) who did not work in petrol station. The hair samples were washed with triton x100 (1%) and the samples were dried at 60 ºC. Then, the samples were mixed with 1 ml nitric acid and incubated for 7-8 h in a hot water bath at 60 ºC. The digested hair samples were added to 10 mL ultra-pure water and analyzed using an ICP-OES instrument. After the sera were separated, the blood samples were diluted with water (1/5) and analyzed using the ICP-OES instrument.*
Although cobalt level (0.00919 ± 0.017) in hair samples of the petrol station workers was higher than that of the control group (0.00562 ± 0.013), this difference was not statistically significant (p> 0.05). Furthermore, there was no significant difference in the serum cobalt level of the oil station staff (0.21 ± 0.02) compared to the control (0.21 ± 0.02) (p = 0.549).
The cobalt level in hair samples of the petrol station employees is somewhat higher than that of the control, which may be a sign that these workers more expose to this heavy metal, so monitoring the cobalt level may be important.

Keywords: *Cobalt, Hair, Heavy metal, Petrol station*

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I. Introduction

Cobalt, a transition metal, is found in trace amounts in the human diet, mainly found in vegetables, fish and drinking water. Cobalt is an essential micronutrient in the form of vitamin B12 (hydroxocobaltamine), however, inorganic cobalt is not necessary for the human diet and cobalt deficiency has never been identified in the human body [1]. Toxic effects of cobalt are important. Cobalt is acutely toxic at high doses. Prolonged exposure at low levels, such as occupational exposure, can be harmful to health in various organs and tissues [2,3]. Its health effects may include the immune system of the thyroid gland (inhibition of tyrosine iodinase by cobalt), lungs (cobalt asthma, hard metal disease), skin (allergic contact dermatitis) and carcinogenic potential [4].

The change of trace element level may indicate early health problems in people working in dangerous jobs [5]. Therefore, the observation of metal exposure is necessary to prevent the adverse health effects of industrial workers. At the same time, there is insufficient data on the effect of petrochemical complex on trace element level of occupational exposures of persons.

Human hair is widely used to evaluate trace element exposure. The main advantage of using hair as a biological matrix is the irreversible association of trace elements in the hair and the high accumulation of minerals [6]. Furthermore, trace element content of hair may reflect the environmental exposure of certain elements [7]. It has been shown that occupational exposure to heavy metals, especially hair, is a good marker [8]. At the same time, trace element content of hair is highly variable and depends on gender, age, geographical situation, climate and life and diet habits [9].

For this reason, herein, we aimed to investigate content of hair and serum specimens to determine the occupational exposure extent of oil station workers.

II. Materials and Methods

100 people working in oil stations informed about the survey and 100 people living in the city center and working in the office were included in the study. From the participants included in the study, hair samples (approximately 1 g) were taken from the nape of the hairline, cut with steel scissors (dyed hair was not included in the study). The hair samples were kept at -20 ^{o}C until working day.

Heavy metal analysis in hair; Hair samples were cleaned in 10 ml of 1% Triton X-100 solution in an ultrasonic bath for 15 minutes and then washed several times with deionized water several times (Milli-Q, Millipore®) and allowed to dry for 24 h at 60 ° C. 1 ml of concentrated HNO_3 was added to the samples and allowed to stand in a hot water bath for 2 h and then 10 ml of deionized water was added to the samples [10]. The samples were studied by ICP-OES device (ICAP 6900 Thermoscentifik) at Van Yüzüncü Yıl University Science Application Research Center. Blood samples were taken from the glioma biochemistry tubes. The sera were then separated by centrifugation at 300 rpm for 15 min. These sera were stored at -80 °C until analysis. All sera were allowed to stand for thawing in their room on working day. Then, the serum samples were distilled with water in 1/5 ratio to study cobalt concentration at Van Yüzüncü Yıl University Science Application Research Center by an ICP-OES instrument (ICAP 6900 Thermoscientific) [11].

Statistical analysis of differences between groups was assessed by SPSS 22.0 program using t-test in parametric tests.

III. Results

Table 1

	Exposure group	Control Group	P
Cobalt in hair (µgr/gr)	0.00919 ± 0.0017	0.00562 ± 0.0013	0.125
Cobalt in sera (µgr/L)	0.21 ±0.02	0.19 ± 0.05	0.549

Although the cobalt content of hair was higher in the oil station workers than that in the control group, this was not significant. Furthermore, there was no significant difference in serum samples of the oil station workers compared to the control.

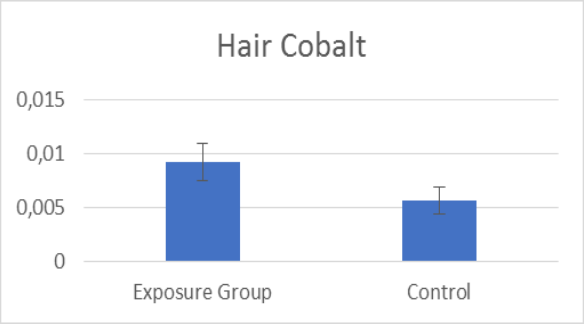

Figure 1: Cobalt level in the hair samples

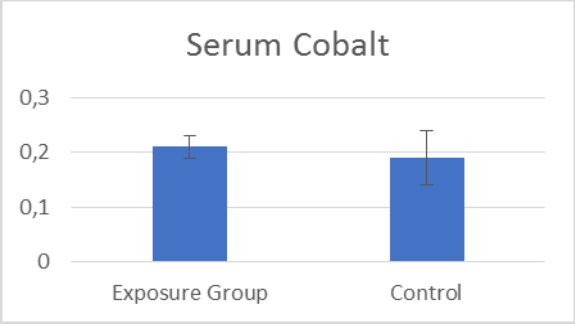

Figure 2: Cobalt level in the seum samples

IV. Discussion

Humans are exposed to various cobalt compounds in their daily life. General population is basically exposed to water contaminated with cobalt compounds, digesting food and inhalation of dust in the air [13]. Occupational exposure to cobalt is a relatively common cause, since cobalt is a variety of industrial applications [3,12] Petrochemical industry products have been shown to affect hair trace element content. Present data show that the petrochemical industry is associated with an increase in heavy metal emissions to the environment. It has been shown that complex petrochemical processes and products, especially fuel oil, petroleum and other petroleum products, contain significant amounts of heavy metals [13,14,15,16]. After a single dose of cobalt (Co2+) was administered to humans, the concentration of cobalt in blood and serum initially increased but declined gradually mainly due to the uptake of tissues such as the liver and kidney [17]. Renal extraction is rapid at first, however decreases after the first day and continues in low phase for several weeks and remains in tissues for many years [2,18]. After absorption, cobalt mainly spreads in serum, whole blood, liver, kidney, heart and spleen. It was observed at low consolidation skeletal, hair, lymphatic circulation, brain and pancreas [19,20,21,22]. 0.008 and 0.007 µgr/gram cobalt were found in the hair specimens of people living in Rome and Vienna, respectively [23]. In the present study, cobalt levels in hair and serum samples of the petrol stations workers were found to be higher than those of controls. Nevertheless, these differences were insignificant. Serum cobalt normal value is less than 0.5 µg/L. [24]. Serum levels in studies performed in healthy populations were found to be 0.19 ± 0.08 pg/L [25], 0.10 ± 0.06 pg/L [26], 0.3 pg/L [27], 0.22 ± 0.1 pg/L [28] and <0.3

pg/L [29]. Therefore, serum cobalt levels in our study groups were in accord with these studies.

In the present study, cobalt levels in hair samples of the petroleum stations workers were found to be higher than cobalt levels found in Wolfsberger et al. (1994), while the control group was found to be lower. Again, cobalt levels in the serum samples of the oil station workers were higher than in control however, this was not significant. The increase in cobalt level in this study may be indicative of cobalt exposure in the workers. For this reason, it is recommended that the biogeosystems of the oil station workers should be carried out regularly and that measures should be taken to prevent or decrease exposure.

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