Sabuncuoglu Serefeddin Health Science (SSHS)

ISSN: 2667-6338, 2020/Vol.2:2

LEAD - CADMIUM LEVEL IN CORD BLOOD AND DETERMINING THE FACTORS AFFECTING

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Research Article

Received: 10/08/2020, Accepted: 30/08/2020

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Abstract

It has been stated that heavy metals such as lead and cadmium, which have accumulated in the mother's body for years, can pass to the fetus through the placenta, cord and pose a risk for fetus and newborn health.

Our research was carried out in descriptive and analytical type based on both blood and questionnaire applications from 100 volunteer pregnant women by obtaining and designing ethical committee permission to determine the levels of lead (Pb) and cadmium (Cd) in the cord blood and the factors affecting it.

The cord blood lead value of pregnant women was found to be between 0,92 ± 0,22 and cadmium average was 0,29 ± 0,07 and it was found to be among the safe reference values.

In addition, a significant relationship was found between daily smoking of pregnant women and cord blood Pb value, and between the year in Karabük province and cord blood Pb ($p < 0,001$).

As a result, since Karabük is one of the leading provinces of the Iron and Steel industry, it has been determined that cord blood Pb and Cd heavy metals change depending on the pregnancies smoking, exposure to cigarette smoke and the year of living here. In the future, long-term heavy metal exposure on pregnant women and babies is required and an inventory should be kept.

Key words: Cord Blood, Heavy metal, Pregnant, Bullet, Cadmium.

Özet

Annenin vücudunda yıllarca biriken kurşun ve kadmiyum gibi ağır metallerin plasenta, kordon yoluyla fetüse geçebileceği ve fetus ve yenidoğan sağlığı için risk oluşturabileceği belirtilmiştir.

Araştırmamız, kordon kanındaki kurşun (Pb) ve kadmiyum (Cd) seviyelerini ve faktörleri belirlemek için etik kurul izni alarak ve tasarlayarak 100 gönüllü gebeden hem kan hem de anket uygulamalarına dayalı tanımlayıcı ve analitik tipte yürütülmüştür.

Gebe kadınların kordon kanı kurşun değeri 0,92 ± 0,22 arasında, kadmiyum ortalaması 0,29 ± 0,07 ve güvenli başvuru değerleri arasında bulundu.

Ayrıca, gebe kadınların günlük sigara içimi ile kordon kanı Pb değeri arasında ve Karabük ilinde yıl ile kord kanı Pb arasında anlamlı bir ilişki bulunmuştur ($p < 0.001$).

Sonuç olarak, Karabük, Demir ve Çelik endüstrisinin önde gelen illerinden biri olduğu için, kordon kanı Pb ve Cd ağır metallerinin sigara içme, sigara dumanına maruz kalma ve burada yaşama yıllarına bağlı olarak değiştiği belirlenmiştir. Gelecekte, hamile kadınlar ve bebekler üzerinde uzun süreli ağır metal maruziyeti ile ilgili envanter tutulmalıdır.

Anahtar kelimeler: Kordon Kanı, Ağır metal, Gebe, Kurşun, Kadmiyum

1. Introduction

Due to the environment-human relationship in the 21st century, the natural flora of the environment has shifted to pollution and as a result, a pollution has emerged above the self-cleaning power of nature. Because of the nature of the products and materials produced by industry organizations, heavy metals such as Lead (Pb), cadmium (Cd), nickel (Ni), mercury (Hg), copper (Cu), iron (Fe) and arsenic (As) have been released into the nature (Çetinkaya, 2018). In nature, elements with a density of 5 gr/cm^3 and greater are specified as heavy metals (Boğa, 2007). Lead and cadmium are also toxic heavy metals (ATSDR, 2007), which are among the top 10 hazardous substances announced by the Agency for Toxic Substances and Disease Registry in 2007 (ATSDR, 2007).

Lead and cadmium are taken into the human body with air, water, soil and nutrients. Lead in the air is the most important way to enter the body, and the presence of cadmium in respiratory air at the level of 0.1-0.5 µg Cd / m^3 is significantly dangerous for the lungs. Cadmium, which is the most easily soluble element in water, is easily taken by living sea organisms and plants from the soil. Plants accumulate lead and cadmium in various densities. The accumulating amount of this lead and cadmium continues in each step of the food chain increasingly and reaches the toxic

level that will adversely affect human health. (Yapıcı et al., 2002, Kahvecioğlu et al., 2003, Dündar and Aslan, 2005, Ayhan et al., 2007, Taurus, 2007, Alkaya et al., 2015).

It has been suggested that excessive calcium intake can cause releasing lead to the circulatory system and nephrotoxicity, neurotoxicity and hypertension can occur after this process (Alkaya et al., 2015). Lead has been reported to exceed the blood-brain barrier and is stored most in the bone tissue, liver and kidneys (Ateş, 2008). While 94% is stored in bones and teeth in adults, this rate is 74% in children. It has been suggested that the level of lead in the bones of babies and children is low, and the lead level in the bones increases with the progression of years (Tuna, 2011). While some lead remains in the bone for years, some has been determined to pass from bones to blood and other organs as a result of pregnancy, menopause, lactation periods, hypertroidism, calcium deficiency, iron deficiency, phosphorus deficiency or bone fracture (Çırak, 2016, Çetinkaya, 2018, Açıkgöz, 2019).

Cadmium has been suggested to prevent organ function by replacing zinc (Kahvecioğlu et al., 2003). It has been suggested that exposure to cadmium causes cardiovascular system, gastrointestinal system, skeletal system, reproductive system, endocrine system, neurological, hematological system, and organ diseases such as liver and kidney (Eravcı, 2016, Açıkgöz, 2019). These metals, which accumulate in the mother's body for years, pose a risk for fetus and newborn health (Özçetin et al., 2013, Akaydın, 2014).

It was determined that the encounter between the heavy metals in the mother's body and the baby started in the intrauterine period and the lead passes to the fetus through the placenta (Örün and Yalçın, 2011). It is stated that while fetal blood contains more amount of lead than mother blood, cadmium is held more in the placenta and cadmium can pass to the fetus after the cadmium is damaged due to the increase of cadmium in the blood (Baranowska, 1995; Öztan et al., 2009).

In infants and children exposed to lead or cadmium, learning difficulties, mental disorders, hyperactivity, high blood pressure, and peripheral nerve damage have been reported (Çağlarırmak & Hepçimen, 2010; Örün & Yalçın, 2011). In addition, it has been stated that lead causes anemia by decreasing the synthesis of hemoglobin (Çağlarırmak & Hepçimen, 2010; Yalçın, 2009).

Özden et al. (2007) found high levels of hair lead and cadmium in relation to herbal tea consumption, cigarette smoke contact, living near the highway and at home with heating. Mortada et al. (2004) reported that the hair and blood Pb levels were higher in the smokers between the

ages of 25-35 than non-smokers. García-Esquinas et al. (2013) stated that the umbilical cord blood lead levels show seasonal variability and that there is a lower level of lead in winter.

In Turkey, clinical and experimental studies for determining lead-cadmium level and affecting factors in pregnancy are limited in number and their findings are insufficient. In addition, due to the environmental pollution emerging in Karabük province, which is one of the important iron and steel industry of our country, we analyzed pregnant women (n = 100) who applied Karabük Training and Research Hospital in order to determine the level of Lead - Cadmium in the cord blood of fetuses. For this reason, by determining the level of lead and cadmium from toxic heavy metals in cord blood, interpreting the risks to the mother and baby and their possible health effects and making suggestions to take necessary measures to eliminate these risks will also raise awareness on the subject.

2. Material and Methods

Our research was carried out between 01.09.2018- 01.09.2019 at Karabük University Training and Research Hospital with the project supported by the permission of the non-interventional ethics committee of Karabük University (decision dated 04.07.2018 and numbered 4/7) and the SRP (scientific research project) coordinator.

The Universe and the Sample of the Research; The universe was made in all pregnant women who applied to Karabük Training and Research Hospital between 01.09.2018 and 01.09.2019 for birth. The sample is; It consists of 100 pregnant women who do not have communication problems and mental disabilities, can understand and speak Turkish, have lived in Karabük province for the last 1 year and accepted to participate in the research.

Data Collection and Analysis; Immediately after delivery of the blood sample, the cord was clamped and 2-3ml of blood for both lead and cadmium were taken through a sterile syringe. Blood samples taken for cadmium were transferred slowly to the hematogram tube with EDTA and to heparinized tubes for lead. The name and surname of the newborn (baby surname) and sampling number were written on the tube, the same number was written on the questionnaire filled by the mother. After the collected bloods are kept at room temperature for 20-25 minutes, blood samples in EDTA tubes taken for cadmium are kept in the cooler between -20 ° C and blood samples in heparinized tubes taken for lead are analyzed in a cooler between -4 / + 4 ° C (14).

Lead and cadmium in blood samples were analyzed in the Private Baran Medical toxicology laboratory. Measurements of collected blood samples were studied with Graphite Atomic

Absorption Spectroscopy (Perkin Elmer AAnalyst 600 Zeeman model electrochrothermal atomic absorption spectroscopy). Due to the number of units of socio-demographic variables, Shapiro Wilk's was used, and their status from normal distribution was evaluated. While interpreting the results, 0,5 was used as the level of significance; It was stated that there was a significant relationship if $p < 0.05$, and there was no significant relationship if $p > 0.05$.

3. Results

In order to determine the cord blood lead - cadmium level and the factors affecting it, findings were obtained in 4 stages depending on the blood samples taken from Karabük Training and Research Hospital between the dates of 01.09.2018- 01.09.2019 and the questionnaires conducted.

1. Comparison of Socio-Demographic Characteristics and Lead Values of Pregnant Women
2. Comparison of Variables Related to the Medical History of Pregnant Women with Lead Values
3.Comparison of Socio-Demographic Characteristics and Cadmium Values of Pregnant Women
4. Comparison of Variables Related to the Medical History of Pregnant Women with Cadmium Values.

3.1 Comparison of Socio-Demographic Characteristics and Lead Values of Pregnant Women:

In our study, the mean cord blood lead level was found to be 0.92 ± 0.22 µg / dl. When the blood lead levels of pregnant women are examined according to their educational status, only literate 0,76 ± 0,18 µg / dl, primary school 0,94 ± 0,21 µg / dl, middle school 0,91 ± 0,21 µg / dl, high school 0,94 ± 0,27 µg / dl, 0,92 ± 0,17 µg / dl for undergraduate and above graduates. When cord blood lead levels are evaluated in terms of working status of pregnant women, housewife 0,91 ± 0,21 µg / dl, civil servant 0,95 ± 0,25 µg / dl, worker 1,04 ± 0,34 µg / dl, 0 in self-employment, 95 ± 0.26 µg / dl and 0.94 ± 0.10 µg / dl in other private sector employees. When the educational status of pregnant spouses is examined in terms of blood lead level, only 0,99 ± 0,45 µg / dl of pregnant women who can read and write, primary school 0,90 ± 0,18 µg / dl, middle school 0,91 ± 0,22 µg / dl, The average cord blood of 0,94 ± 0,21 µg / dl for high school graduates and 0,89 ± 0,20 µg / dl for undergraduate and higher graduates was determined as lead. In general, when the lead levels and the variables that make up the socio-demographic characteristics of the pregnant women were compared, no statistically significant differences were found between the groups ($p > 0.05$) (Table 1).

Table 1. Comparison of Lead Values with Socio-Demographic Characteristics of Pregnant Women

		Lead Level			
		N	**Arit mean ± SS**	**Min-Max**	**Statical Analysis**
Lead Level		100	0,92 ± 0,22	0,57 – 1,80	
Age		100	28,40 ± 5,39	18 - 40	
Socio-demog features		**N**	**r***	**P**	
Age		100	0,131	0,195	
Ed status	Literate	6	0,76 ± 0,18	29,00	
	Primary school	19	0,94 ± 0,21	52,61	H**=4,041; p=0,400
	Middle school	19	0,91 ± 0,21	49,18	
	High school	31	0,94 ± 0,27	50,55	H**=4,041; p=0,400
	Undergraduate and above	25	0,92 ± 0,17	55,00	H=2,042; p=0,728
Profession	Hausewife	79	0,91 ± 0,21	48,57	
	Officer	7	0,95 ± 0,25	53,72	
	Worker	9	1,04 ± 0,34	62,07	H=2,042; p=0,728
	Free	2	0,95 ± 0,26	56,00	
	Other	3	0,94 ± 0,10	61,00	
Your partner status	Literate	5	0,99 ± 0,45	47,70	
	Primary school	18	0,90 ± 0,18	49,44	H=0,517; p=0,972
	Middle school	11	0,91 ± 0,22	49,05	
	High school	46	0,94 ± 0,21	52,68	
	Undergraduate and above	20	0,89 ± 0,20	47,93	H=0,517; p=0,972 H=3,047; p=0,550
Your partner profession	Worker	50	0,92 ± 0,21	49,25	
	Officer	11	0,89 ± 0,24	45,00	H=3,047; p=0,550 H=4,479; p=0,214
	Free	23	0,95 ± 0,24	55,09	
	Other	14	0,95 ± 0,21	55,43	

3.2 Comparison of Variables Related to the Medical History of Pregnant Women with Lead Values:

When cord blood lead levels were compared in terms of number of pregnancies, number of births, low-abortion number, number of living children, week of gestation, 37% was the first pregnancy and the lead level was found to be 0.91 ± 0.23 µg / dl in those with first pregnancy. Number of pregnancies (r = 0.105, p = 0.300), number of births (r = 0.103, p = 0.309), low-abortion number (r = 0.016, p = 0.874), number of living children (r = 0.143, p = 0.257) and the difference between gestational week (r = 0.041, p = 0.668) and cord blood lead level was not statistically significant (p> 0.05).

When the effect of previous births of pregnant women on cord blood lead level was examined, it was determined that 37% of them did not give birth or had low-abortion, 40% of previous pregnancies resulted in normal delivery, 20% of cesarean and 3% of abortion. . Although

cord blood lead level was 52.25% higher in those who had previous cesarean delivery, no statistically significant relationship was found between the groups (p> 0.05).

When the relationship between the presence of chronic disease of pregnant woman (HT, thyroid) and cord blood lead level is examined, cord blood lead level is 0.86 ± 0.07 µg / dl in patients with chronic disease and 0.93 ± 0.23 µg / dl in patients without chronic disease. Although no statistically significant difference was found (p> 0.05).

When the effect of smoking of pregnant women on cord blood lead level was evaluated, 10% of pregnant women used cigarettes in the research while 90% did not smoke. The mean cord blood lead level in pregnant women who smoke is 1.29 ± 0.30 µg / dl, and 0.88 ± 0.16 µg / dl in non-smokers. Cord blood lead level was significantly higher in smokers (p <0.001). Again, as the amount of cigarettes smoked per day increases, cord blood lead amount increases, and a statistically significant difference was found (r = 0.542, p <0.001).

In generally, although no significant correlation / correlation was observed between lead levels and "your pregnancies", "your birth number", "your low-abortion number", "your number of living children" and "your gestational week" variables, "how many cigarettes per day" and "how many There has been a significant relationship / correlation between the variables "You have been living in black pepper for years" (r = 0.542, p <0.001 and r = 0.461, p <0.001, respectively). In addition, although lead levels were significantly higher in smokers (p <0.001) and those exposed to cigarette smoke (p = 0.014), there was no statistically significant difference (p> 0.05) (Table 2).

3.3 Comparison of Socio-Demographic Characteristics and Cadmium Values of Pregnant Women:

When blood cadmium levels are analyzed according to the educational status of pregnant women, cadmium level is 0.31 ± 0.044 µg / dl for primary literate people, primary education 0.27 ± 0.077 µg / dl, secondary school 0.27 ± 0.070 µg / dl, high school 0.29 ± 0.077 µg / dl, 0.30 ± 0.086 µg / dl in undergraduate and above graduates. It was found that although the pregnant women participating in our study had a higher amount of cord blood cadmium than others with a rate of 58.75% only in those who could read and write (p> 0.05).

Table 2. Comparison of variables related to medical history pregnant women with lead values.

		Lead Level		
	N	**r***	**P**	**Static Anal**

What is your pregnancy?		100	0,105	0,300	
Your birth number		100	0,103	0,309	
Your lov-abortion number		100	0,016	0,874	
The number of living children		100	0,114	0,257	
Your pregnancy week		100	0,041	0,686	
How many cigarattes do you smoke per day?		100	0,542	<0,001ˢ	
		N	**Arit M ± SS**	**Sıra Ort.**	
Have you had problems with your previous pregnancies and birth?	Yes	15	0,96 ± 0,23	56,40	z**=-0,855; p=0,393
	No	85	0,91 ± 0,22	49,46	
Your previous birth	My first pragnancy	37	0,91 ± 0,23	48,57	H***:0,413 p: 0,938
	Normal birth	40	0,93 ± 0,23	51,80	
	ceserean	20	0,91 ± 0,17	52,25	
	Lov	3	0,95 ± 0,43	45,33	
Do you have any chronic diseases?	Yes	9	0,86 ± 0,07	43,94	z=-0,711; p=0,477
	No	91	0,93 ± 0,23	51,15	
Did you exprience HT in your current pregnancy?	Yes	10	0,94 ± 0,09	60,10	z=-1,104; p=0,270
	No	90	0,92 ± 0,23	49,43	
Have you ever had diabetes in your pregnancy?	Yes	8	0,83 ± 0,07	37,63	z=-1,310; p=0,190
	No	92	0,93 ± 0,23	51,62	
Dou you smoke?	Yes	10	1,29 ± 0,30	86,65	z=-4,156; p<0,001 ˢ
	No	90	0,88 ± 0,16	46,48	
Heve you been exposed to cigarette smoke during pregnancy?	Yes	60	0,97 ± 0,25	56,29	z=-2,447; p=0,014 ˢ

When the relationship between the educational status of the wives of the pregnant women and the cord blood cadmium level was examined, the cord blood cadmium level in the pregnants of the mothers who could only read and write was 0.31 ± 0.04 µg / dl, 0.27 ± 0.06 µg / dl in the primary school graduates, middle school graduates 0.29 ± 0.07 µg / dl for those with high school, 0.29 ± 0.07 µg / dl for high school graduates, 0.29 ± 0.10 µg / dl for undergraduate and higher graduates. Cord blood cadmium level was found to be the highest in pregnant women of literate spouses with a rate of 60.30%, and in primary school graduates with a lowest rate of 44.64%. As the education level increased, cord blood cadmium level did not decrease. In the study, no statistically significant relationship was found between the level of co-education and cord blood cadmium level (p> 0.05) (Table 3).

Table 3. Comparison socio-demographic characteristic and cadmium values of pregnant women

Cadmium Level

		n		Arit. M. ± SS	Min-Maks	Statistical Analysis
Cadmium Level		100		0,29 ± 0,07	0,15 – 0,50	
Age		100		28,39± 5,40	18 - 40	
Socio-demographic characteristics		**n**		**r***	**P**	
Edication status	Literate	6	6	0,31 ± 0,044	58,75	H**=1,713;p=0,788
	Primary school	19	19	0,27 ± 0,077	46,50	
	Middle school	19	19	0,27 ± 0,070	45,58	
	High school	31	31	0,29 ± 0,077	52,29	
	Undergraduate and above	25	25	0,30 ± 0,086	53,08	
Profession	Midwife	79	79	0,29 ± 0,07	50,43	H=3,276; p=0,513
	officer	7	7	0,30 ± 0,11	50,29	
	Worker	9	9	0,29 ± 0,08	50,39	
	Free	2	2	0,36 ± 0,03	80,75	
	Other	3	3	0,25 ± 0,07	33,00	
Education your husband	Litrate/not litrate	5	5	0,31 ± 0,04	60,30	H=1,464; p=0,833
	Primary school	18	18	0,27 ± 0,06	44,64	
	Middle school	11	11	0,29 ± 0,07	53,18	
	High school	46	46	0,29 ± 0,07	51,42	
	Undergraduate and above	20	20	0,29 ± 0,10	49,73	

3.4 Comparison of Variables Related to the Medical History of Pregnant Women with Cadmium Values:

When cord blood cadmium levels are compared in terms of number of pregnancies, number of births, low-abortion number, number of children living and gestational week, 37% of them have first pregnancy and those with first pregnancy have an average cadmium level of 0.29 ± 0.08 µg / dl, respectively. Number of pregnancies (r = -0.034, p = 0.739), number of births (r = 0.050, p = 0.622), number of low-abortion (r = -0.154, p = 0.125), number of living children (r = 0.035, p = 0.731) and gestational week (r = 0.056, p = 0.581) and the difference between cord blood cadmium level was not statistically significant (p> 0.05).

Table 4. Comparison of Variables Related to the Medical History of Pregnant Women with Cadmium Values

		Cadmium Level				
		N		**r***	**P**	**Statistical analysis**
How many pregnancies did you have?		100		-0,034	0,739	
How many birth did you have?		100		0,050	0,622	
How many lov-abortion did you have?		100		-0,154	0,125	
How many of your children live?		100		0,035	0,731	
How many week of your pregnancy are you?		100		0,056	0,581	
How many cigarettes do you smoke per day?		100		0,011	0,916	
		N	**(%)**	**Arit. M. ± SS**	**Rank avarage**	
Have you had problems with your previous pregnancies and births?	Yes	15	15	0,27 ± 0,07	45,87	z**=-0,672; p=0,502
	No	85	85	0,29 ± 0,08	51,32	
Your previous birts	My first pregnancy	37	37	0,29 ± 0,08	51,12	H:0,579 p: 0,901
	Normal birth	40	40	0,28 ± 0,08	49,61	
	Ceserian	20	20	0,29 ± 0,07	52,73	
	Abortion	3	3	0,26 ± 0,08	39,83	
Do you have chronic disease?	Yes	9	9	0,29 ± 0,07	51,50	z=-0,109; p=0,914
	No	91	91	0,29 ± 0,08	50,40	
Did you experience HT in your current pregnancy?	Yes	10	10	0,28 ± 0,07	50,00	z=-0,058; p=0,954
	No	90	90	0,29 ± 0,08	50,56	
Have you been exposed to cigarette smoke during pregnancy?	Yes	60	60	0,28 ± 0,08	50,71	z=-0,088; p=0,930
	No	40	40	0,28 ± 0,08	50,19	

When the relationship between the presence of chronic disease of pregnant woman (HT, thyroid) and cord blood cadmium level is examined, cord blood cadmium level is 0.29 ± 0.07 µg / dl in patients with chronic disease and 0.29 ± 0.08 µg / dl in patients without chronic disease. but statistically significant difference was not found (p> 0.05).

When the relationship between pregnant women with hypertension in their current pregnancy and cord blood cadmium level is examined, it is statistically significant, although cadmium level is 0.28 ± 0.07 µg / dl in those with hypertension and 0.29 ± 0.08 µg / dl in those without hypertension, there was no statistically significant difference.

When the effect of smoking of pregnant women on cord blood cadmium level was evaluated, cord blood cadmium level was determined as 0.30 ± 0.07 µg / dl in non-smoker pregnants and 0.29 ± 0.08 µg / dl in non-smokers. In our study, the relationship between smoking

and the number of cigarettes smoked per day and cord blood cadmium level was not found statistically significant ($r = 0.011$, $p = 0.916$), ($p > 0.05$).

In general, there is a relationship / correlation and cadmium levels between cadmium levels and "your pregnancies", "your birth number", "your low-abortion number", "your number of living children", "your pregnancy week", "how many cigarettes per day" variables. No statistically significant difference was found between the variables related to the medical history of pregnant women ($p > 0.05$) (Table 4).

4. Discussion and Conclusion

It has been determined that people are exposed to Pb and Cd, which are toxic even at very small doses due to the increasing environmental pollution (Raghunath et al. 2000, Açıkgöz 2019). Children, youth, and pregnant women constitute the most sensitive population in the society in terms of heavy metal toxicity (Küçük Böttjer 2008) and especially prenatal life is the most sensitive period for human development (Açıkgöz 2019).

Pb, which accumulates in the mother's body before or during pregnancy, can cross the placental barrier and pass to the fetus through cord blood (Açıkgöz 2019). Maternal blood lead level and fetal lead level are in parallel. Also, cord blood lead level is a good indicator of maternal blood lead amount. Many studies have found that there is a statistically significant relationship between the mother's blood lead quantity and the cord blood lead quantity (Kaya 2014).

In our study, it was found that cord blood lead level was on average 0.92 ± 0.22 µg / dl (Table 1). The blood lead level determined by the American Center for Disease Control and Protection (CDC) is 5 µg / dl for pregnant women and children, and in our study, the lead level in cord blood was found to be less than 5 µg / dl, which is toxic.

Raghunath et al. (2000) conducted a study to investigate the amount of heavy metal in maternal blood and cord blood. Authors found that maternal blood lead amount was 6.4 µg/dl and cord blood lead amount was 5.1 µg/dl. In a study conducted on mothers and babies in the center of Eskişehir, maternal blood lead level was found as 2.7 ± 1.6 µg/dl, while cord blood lead level was 2.2 ± 1.2 µg/dl on average (Özmert et al. 2003). In the study conducted by Güngör in 2011, where cadmium, mercury, lead and the factors affecting them were examined. Authors found that as the lead amount in the maternal increased by 1 µg / dl, the lead amount in the baby increased by 0.716 µg / dl. In the study conducted by Fatmi et al. In 2017, it was stated that the cord blood lead amount was the highest 43.0 µg/dl, the lowest was 5.54 µg/dl and the lead

amount in the cord blood was close to the maternal blood lead amount. Studies show that maternal lead can easily pass through the placenta and pass to the fetus via cord and some factors can effects the amount of blood lead like socio-economic level. For cadmium, although the placenta acts as a partial barrier to protect the fetus from cadmium exposure, it has been determined that it can overcome some of the cadmium placenta as a result of accumulation (Caserta et al. 2013).

In our study, cord blood cadmium level was determined to be 0.29 ± 0.07 (Table 4). The reference range specified for the blood cadmium level was determined to be 0-5 µg / L (Öktem et al. 2018). In our study, cadmium level in cord blood was found in the reference range specified. Al-Saleh et al. (2011) conducted a study to evaluate the status of heavy metal exposure by measuring lead, cadmium, mercury in placental tissue, umbilical cord and maternal blood samples of 1578 women between 2005 and 2006, 9% of cord and maternal blood samples It is stated to have a cadmium level above 5 µg / L. In the study conducted by Raghunath et al. In 2000, they found the cord blood cadmium level to be 0.06 µg / dl. These differences in study results are due to the variability of heavy metal depending on the dose, the route of exposure and factors such as age, gender, genetics, socio-economic status, nutritional and hygiene conditions of exposed pregnant women (Tables 2 and 3).

In a study conducted with 195 pregnant women in the USA, blood lead was found higher in pregnant women with low education level (Hertz Picciotto et al. 2000). Arbuckle et al. (2016) reported that in found that as the education level of pregnant women increased, the amount of blood lead decreased statistically significantly.

It has been reported that the most important source of cadmium exposure is smoking (Rakıcıoğlu 1991). One cigarette contains 0.5-1.5 µg cadmium and cigarette smoke has a dry weight of 0.19-3 mcg / g cadmium (Jarup 2003). However, it has been determined that there is a source of cadmium exposure in passive smoking and passive smokers are exposed to an average of 4mg more cadmium per day compared to smokers (Rakıcıoğlu 1991, Al-Saleh et al. 2011).

When we examine the cord blood lead and cadmium levels with the smoking of pregnant women, 10% of pregnant women participating in our study smoke during pregnancy, 90% do not smoke and 60% are exposed to cigarette smoke. Cord lead levels of pregnant women were significantly higher in smokers ($p < 0.001$) and those exposed to cigarette smoke ($p = 0.014$), while there was no statistically significant difference in cord blood cadmium levels and smokers and smokers ($p > 0.05$). (Table 2).

In our study, when we examined the relationship between the number of pregnant women in Karabük and the cord blood lead and cadmium, there was no statistically significant relationship between the years of pregnant women living in Karabük and the cord blood cadmium level ($p > 0.05$). However, there was a significant correlation between blood lead level and the year of pregnant women living in Karabük ($r = 0.461$, $p < 0.001$).

Although Karabük, which is one of the most important centers of iron-steel industry of Turkey, adds very large contribution to the economy, it is not cause serious heavy metal. However, according to our results we believe it would be appropriate to pay attention to the following recommendations in the future.

- Analysis in cord blood determines short-term lead and cadmium exposure. To clarify the relationship between age and lead and cadmium levels, long-term exposure using hair, bone and nail researches should be carried out.
- According to the results of this study, active or passive smoking of cigarettes is an important factor in terms of cord blood lead level in pregnant women and babies. Therefore, it is important for midwives to inform women about the negative effects of smoking during pregnancy and encourage women to quit smoking from the moment women think about pregnancy. It is important to inform the midwives that pregnant women should not be exposed to cigarette smoke even if they do not smoke, and that adverse effects should occur if they are exposed to cigarette smoke.
- As a result of this research, it shows that cord blood lead level is an important factor for pregnant women and babies living in Karabük. The high number of iron and steel factories in Karabük affect women negatively depending on the year experienced. Care should be taken to filter factories in Karabük and make their wastes under control. Unless careful, it poses a danger to pregnant women and babies

Conflicts of interest

The authors declare that there are no potential conflicts of interest relevant to this article.

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