ORIGINAL ARTICLE

Comparison Study of ALPHA 1-Antitrypsin, And Some Elements in Iraqi Cord Blood new Born with their Mothers

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ABSTRACT

Umbilical cord blood (UCB) consider as a waste product after obstetrical but when the medicine development, it was found that UCB abundant of life saving hematopoietic stem cell and contents of soluble growth factors which is necessary for proliferation.

Alpha- antitrypsin (α1-AT) is mainly synthesized in the hepatocytes by the liver then secreted to the circulation Its function is Remove the acute inflammation through supperion cytokine production and inhibits different enzymes such as neutrophil elastase (NE) in the lungs, proteinase 3, trypsin, and cathepsin G.

Lead (Pb) is one of the most toxic of the heavy metals. The children especially newborns are the most affected by Pb because of they grow up rapidly resulting impaired brain and nervous system development.

Cadmium (Cd) is the metal of the 20th and its effect resulted when Cd binds to proteins rich in cystein like metallothionein which causing hepatotoxicity in the liver and through circulating accumulates in the kidney tissue via and causing nephrotoxicity. Selenium (Se) as a trace element is an essential and important for human health. The vital function of Se including thyroid hormone metabolism and anti-inflammatory, immunity, activates natural killer cells, increases activated T cells proliferation, tumor cytotoxicity and antioxidant defense.

The research conducted to study of 92 specimen of mothers with their new born infants in (46 normal and 46 cesarean delivery) and examined the levels of α1-AT bu enzyme liked immune assay method. Also some heavy metals i.e. Pb, Cd in addition to the Se element were determined by atomic absorption spectroscopy. The correlation between α1-AT with Pb, Cd and Se was instigated.

Conclusions: The levels of α1-AT in the UCB was higher than their maternal sera after normal delivery this mean the new infant need to observation and monitoring of α1-AT level after the birth till seventh days, while α1-AT level in the UCB was lower level than their mothers sera in cesarean delivery.

Keywords: α1-AT, Pb, Cd, Se, cord blood and new born

INTRODUCTION

Umbilical cord blood (UCB) consider as a waste product and disposal away with the placenta after obstetrical but after medicine development, it was found that UCB abundant of life saving hematopoietic stem cell(1) and contents of soluble growth factors which is necessary for proliferation, and differentiation of Human Mesenchymal Stromal Cells (HMSCs) and human umbilical cord plasma serum (HUCBP)(2). Two ways can be used to collect the blood from the umbilical cord in new born infants, by bag or a syringe method and this blood can used for transplantation or restore immunological dysfunctions as an instead of bone marrow(3).

Alpha-1 antitrypsin (α-1AT) is a glycopolypeptide single chain, its molecular weight of 52 kDa and composes of 394 amino acid residues. It is also known as SERPINA1 (serine protease inhibitor, group A, member 1) and α1 proteinase inhibitor (α 1-Pi)(4). Alpha- antitrypsin is mainly synthesized in the hepatocytes by the liver then secreted to the circulation furthermore produced by different cells such as macrophages, monocytes, neutrophils, intestinal, pulmonary alveolar and corneal epithelium(4, 5). Its function is Remove the acute inflammation through supperion cytokine production(4), inhibits different enzymes such as neutrophil elastase (NE) in the lungs, proteinase 3, trypsin, thrombin, chymotrypsin, and cathepsin G (6), inhibits synthesis and release of inflammatory mediators such as interleukin (IL) IL-1β, IL-6, IL-8 and Il-32 in addition to tumour necrosis factor-α (TNF-α) (1), while increases release of anti-inflammatory cytokines like IL-10 (7).

Lead (Pb) is the most toxic of the heavy metals, despite it has many useful uses such as cosmetics, batteries production, screens x-rays, roofing sheets, radioactive emissions, metal products (ammunitions, pipes and solder) but has no important biological function in human(8). Absorption of Pb increases by deficiencies of calcium and Zinc(9), children especially newborns are the most affected by Pb because of they grow up rapidly resulting impaired brain and nervous system development(8, 10). The outcome of Pb exposure on pregnancy including spontaneous abortion, gestational hypertension, preterm delivery, low birth weight(11), congenital anomalies, decreased length and head circumference.(12, 13).

Cadmium (Cd) is the metal of the 20th century because of increasing technological use. Many applications used Cd such as pigments, batteries, plastic, metal coating and electroplating (14). The effect of Cd resulted when it binds to proteins rich in cystein like metallothionein. The complex of cystein-metallothionein causes hepatotoxicity in the liver and through circulating accumulates in the kidney tissue via and causing nephrotoxicity. Also Cd capable to bind with histidine, aspartate ligands and glutamate this can lead to the iron deficiency(14).

Selenium (Se) as a trace element, is an essential and important for human health and other organisms(15-17). The source of Se comes from diet which in turn from soil selenium or external supplementation(15). The vital and biological function of Se including thyroid hormone metabolism and improves the function of thyrocytes, anti-inflammatory priorities, immunity, activates natural killer cells, increases activated T cells proliferation, tumor cytotoxicity, antioxidant defense, maintains redox balance in the cells and fertility (18). In addition it contributes in selenoproteins synthesis, such as glutathione peroxidases (GPx) (including GPI, II, III, IV, and VI); thioredoxin reductases (TXN) (I, II, and III), which possess antioxidant against reactive oxygen species (ROS)(19).

This study aimed to find relation α1-AT and Pb, Cd and Se in UCB for Iraqi new born compare with their mothers between normal and cesarean delivery.

MATERIALS AND METHODS

The sampling was conducted from 46 pregnant women (divided to 23 normal delivery and 23 Cesarean delivery) while cord blood consist their babies 46 umbilical cord blood newborn (divided to 23 post normal delivery and 23 post Cesarean delivery). All they were existing at Al-Elwyah teaching hospital during the period from December 2020 tile April 2021, their age ranged from (16-50) years. Blood samples (5ml) were collected by vein puncture from the pregnant women and left for 45 min. at room temperature for clotting, then centrifuged (at 2000 rpm for 10 min) to get the serum, which stored at -20 ºC until assay. While the samples of

cord blood new born babies were collected immediately after normal and Cesarean delivery which proceed in the same way for their mothers to get cord blood serum.

Enzyme-linked immunosorbent assay (ELISA) technique was used to measured α1-AT by using α1-AT CUSABIO kit, catalog number CSB-E11719h. The detection range 78-5000 nIU/ml. Atomic absorption flame emission spectrophotometry technique was used to evaluate the concentration of Pb, Cd and Se at the weave length (217, 228, 196 nm) respectively (device model NOV AA 350/2012, Germany) .

Statistical Analysis: The Statistical Analysis System- SAS (2012) program was used to detect the effect of difference factors in study parameters(20). T-test was used as a significant or non significant correlation compare between the groups under study. When P value < 0.05 refer to a significant correlation, whereas P ≥ 0.05 is a non-significant.

RESULTS AND DISCUSSION

The results obtained from this study were listed in the table (1). The data showed significant increase in the level of α1-AT and Cd whereas high significant decrease in Pb and Se levls between mothers and their babies after normal delivery.

Table 1: Comparison data between mothers and their babies after normal delivery

Parameters	Mean ± SD		P value
	Mother No. = 23	Cord blood new born No.= 23	
α1-AT (nIU/ml)	261.33±11.2	354.38±24.45	S
Pb (ppm)	63.65±12.21	38.84±1.88	h.S*
Cd (ppm)	18.02±0.97	11.04±0.46	S
Se (ppm)	116.21±8.86	85.75±12.11	h.S*

h.S* refer to high significant

Table 2 illustrated high significant decrease in the levels of α1-AT(231.14±116.21), (166.83±8.91) Pb (56.96±6.67), (38.43±2.18), and Se (121.90±9.20), (82.57±8.78) respectively, while there were non significant differences in Bilirubin (0.61±0.18), (0.61±0.18) and there was significant decrease in Cd levels (17.72±0.65), (10.83±0.62) among mothers and their babies after Cesarean delivery.

Table 2: Comparison data between mothers and their babies after Cesarean delivery

Parameters	Mean ± SD		P value
	Mother No. = 23	Cord blood new born No.= 23	
α1-AT (nIU/ml)	231.14±116.21	166.83±8.91	h.S
Pb (ppm)	56.96±6.67	38.43±2.18	h.S
Cd (ppm)	17.72±0.65	10.83±0.62	S
Se (ppm)	121.90±9.20	82.57±8.78	h.S

The data in the table 2, revealed that a high significant decrease in α1-AT, Pb and Se levels (166.83±8.91), (38.43±2.18) and (82.57±8.78) respectively in new born cord blood when compared the same levels with their mothers in Cesarean delivery. There was significant decrease in Cd levels (10.83±0.62) in new born cord blood as compared with their mothers.

In human, the one of the most existent proteins is α-1AT, which mainly produced from liver and other tissues such as amniotic epithelial cells. This protein capable to neutralize neutrophile elastase which is required to migrate neutrophil in tissue remodeling, and prevent the proteolytic tissue damage besides to an anti inflammation(21). It was found that α-1AT level significantly increased through the third trimester of pregnancy(22,23).

The pregnant and their fetus are a higher groups exposed to influence Pb. The Pb moves from maternal to the embryo by passive diffusion and effected to spontaneous abortion, preterm delivery, low birth weight, congenital anomalies, decreased head circumference(12). The high level of Pb metal were in maternal pregnant as compared with their newborn cord blood in both normal and caesarean delivery. This observation attributed to maternal highly direct exposure to the pollutants such as industrial wastes, untreated sewage water, petroleum gases even the remnants of the second Gulf war which is considered as the main sources of pollution in Iraq, this was in agreement with another study (24).

Table 3: The correlation of α-1AT with Pb, Cd and Se in cord blood in normal delivery

Parameters	α-1AT	
	r	P
Pb	-0.0168	0.000
Cd	0.534	0.000
Se	-0.099	0.000

Extract data from the table 3 referred to positive correlation between α-1AT and Cd as in figure 1 and negative correlation between α-1AT and Pb, Se as in figures 2 and 3 respectively in UCB and their mothers sera in normal delivery.
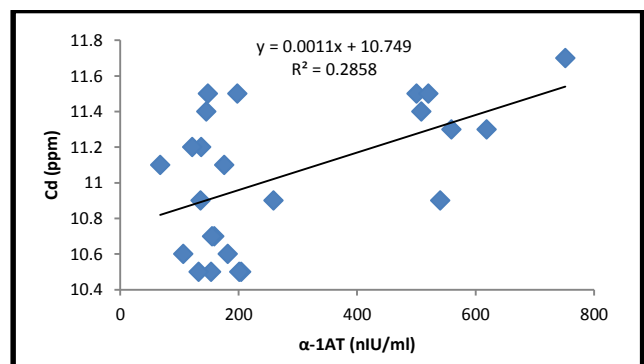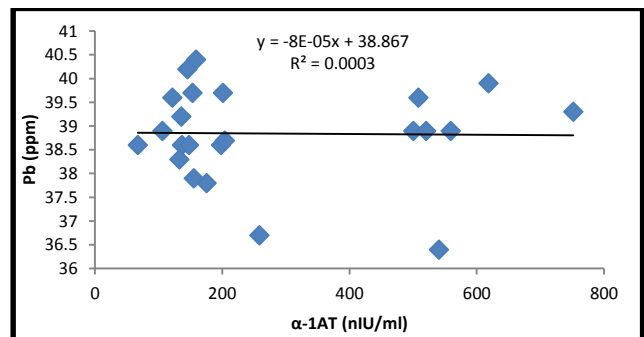

Figure 1: Correlation α-1AT with Cd in normal delivery

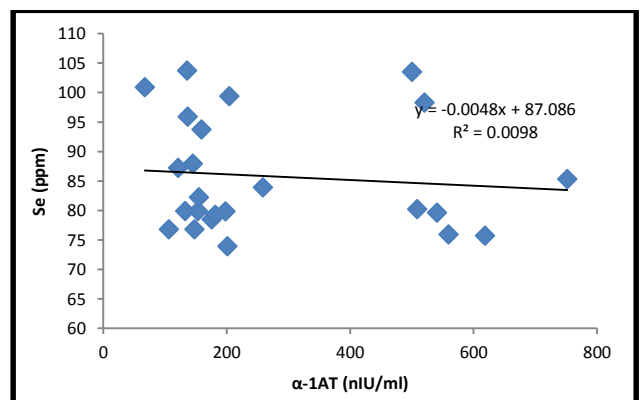
Figure 2: Correlation α-1AT with Pb in normal delivery

Figure 3: Correlation α-1AT with Se in normal delivery

Previous studies revealed that Cd raises in the placental tissues and this regarding to the maternal not to cord blood levels(25). The presence of metallothionein (MT, small protein synthetized in maternal tissues and the placenta) conserves Cd and toxic in the placenta and prevents the passage to the fetal as a protective mechanism(26).

This study also investigated the correlation between α-1AT and Pb, Cd and Se in UCB and their mother after normal and cesarean delivery, the data showed in the tables 3 and 4 as in below.

The correlations between α-1AT and Pb, Cd and Se in UCB and after cesarean delivery were also investigated, as in the table 4.

Table 4: The correlation of α-1AT with Pb, Cd and Se in cord blood in Cesarean delivery

Parameters	α-1AT	
	r	P
Pb	-0.157	0.000
Cd	-0.400	0.000
Se	-0.176	0.000

The data revealed that there were negative correlations between 1-AT with Pb, Cd, and Se in UCB as compared with their mothers sera after cesarean delivery as in figures 4-6 .
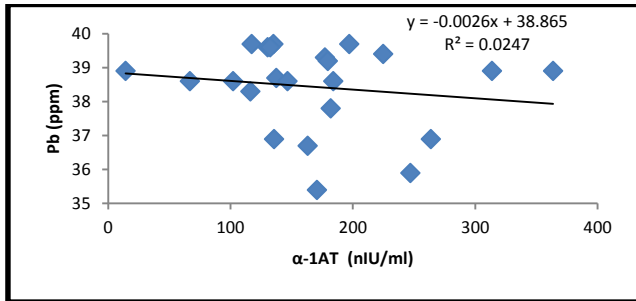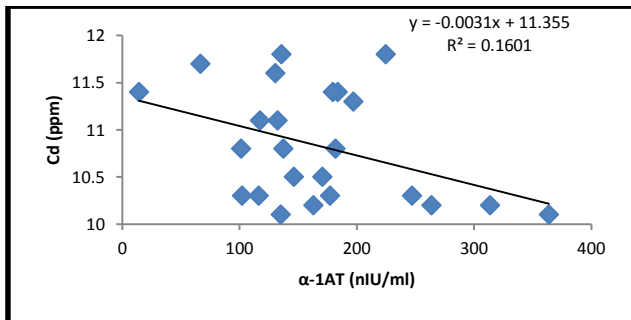

Figure 4: Correlation α-1AT with Cd in Cesarean delivery
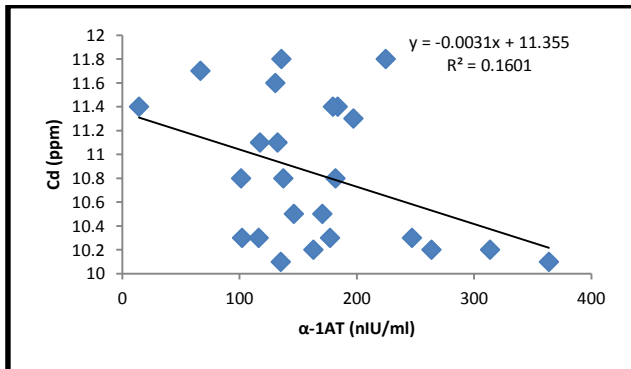

Figure 5: Correlation α-1AT with Pb in Cesarean delivery

Figure 6: Correlation α-1AT with Se in Cesarean delivery

CONCLUSION

The levels of α1-AT in the UCB was higher than their maternal sera after normal delivery this mean the new infant need to observation and monitoring of α1-AT level after the birth till seventh days, while α1-AT level in the UCB was lower level than their mothers sera in cesarean delivery.

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