

## Trace Elements in Health and Disease

### P-10-316-1

#### The effect of antidiuretic hormone on bile lipid fractions secretion in dogs

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We studied the effect of one of the synthetic antidiuretic hormone analogous 1-Desamino-8D-argenin vasopressin (dDAVP, desmopressin) on bile volume and its lipid component contents in vivo in dogs. We used dogs with cholecystoduodenal fistula tubes in chronic experiment. Desmopressin (0.1 ng/kg body weight) bolus intramuscularly injected and collected secreted bile each 30 minute during 3 hours of experiment. The content of bile lipid fractions, in each half-hour sample was determined using thin layer chromatography method and compared with control group (i.e. intramuscularly injected 1 ml 0.9% sodium chloride solution). The results of our experiment showed that the bile volume velocity during 3 hours by 62.2% ( $P < 0.001$ ) was more than control data. Under the effect of desmopressin the phospholipids content in whole time of experiment rose by 80.6% ( $P < 0.01$ ). The changes of free cholesterol content in whole time of experiment by 57.1% ( $P < 0.05$ ), and the content of its esters by 93.4% ( $P < 0.001$ ), were more than the results in control dogs, that leads to increase the cholesterol etherification coefficient. The content of free fatty acids in overall time of experiment increased by 31.8% ( $P < 0.05$ ). We conclude that, the synthetic peptide regulates lipids metabolism, especially the process of etherification of cholesterol in hepatocytes. The last improve antilithogenic bile properties and decrease the potential forming of biliary stones.

**Keywords:** antidiuretic hormone, bile lipid fractions, cholesterol, cholesterol esters, free fatty acids, phospholipids

### P-10-338-1

#### Destabilization of deoxyribonucleic acid by lead nitrate characterized by Fluorescence Spectroscopy and Thermal Denaturation

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Lead is one of the poisoning heavy metals that is widely distributed in the environment and represent a significant health hazard. At the chromatin level, the most important effect of lead is on DNA replication and mutagenesis. Therefore, study of the interaction of DNA with lead

provides useful information about the mechanism of this metal action at the genome level. In this study soluble chromatin, prepared from rat liver nuclei, and calf thymus DNA were treated with various concentrations of lead nitrate and the complex was analyzed using fluorescence spectroscopy and thermal denaturation techniques. The results show that the fluorescence emission intensity of DNA was increased upon increasing lead concentration. At low concentrations ( $< 1/2:1$  Lead/DNA), the emission intensity was more significant than when higher concentrations of lead was used. This is in agreement with the thermal denaturation results indicating that the binding of lead to DNA destabilizes double helix in a dose dependent manner ( $T_m$  reduction by  $23^\circ\text{C}$  at DNA-Lead ratio of 1:4). In order to compare the results with chromatin, soluble chromatin was incubated with various concentrations of lead nitrate under the same conditions used in DNA-Lead interaction. Upon addition of lead to chromatin solution precipitation occurred which could be monitored at 400 nm. From the results it is concluded that the interaction of lead nitrate with DNA destabilizes DNA which is a result of producing single strand or nicks on DNA molecule but in the case of chromatin the protein moiety may participate in Lead-chromatin interaction.

**Keywords:** chromatin, DNA, fluorescence spectroscopy, lead nitrate, thermal denaturation

### P-10-88-2

#### Copper kinetic effect on low density lipoprotein oxidation

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The susceptibility of low density lipoprotein (LDL) to oxidation is believed to be an important factor in the process responsible for foam cell formation and atherosclerosis. Therefore, in this study we investigated kinetics of LDL oxidation by various range of copper concentrations. LDL was isolated from plasma and its oxidation with copper was investigated by monitoring the formation of conjugated dienes. The time course of the formation of conjugated dienes observed at concentrations of 0.5 to 10  $\mu\text{M}$  copper, represented the conventional kinetics of LDL oxidation with an inhibition period followed by a propagation phase. In contrast, at concentrations of 20 to 50  $\mu\text{M}$  copper, LDL oxidation proceeded after a negligibly short lag-time followed by a distinct propagation phase. At lower copper concentrations of about 0.5  $\mu\text{M}$ , LDL oxidation can be combined in 4 consecutive oxidation phases. The results of this investigation suggest that at high copper concentration of about 20  $\mu\text{M}$  ( $\sim 200$  copper/LDL) and 50  $\mu\text{M}$  ( $\sim 500$  copper/LDL) would have the advantage of given lag-times very close to the minimum lag-time, which can be considered as a copper independent characteristic for LDL oxidation and lower

concentrations of copper in the range of 5–100 copper/LDL would give the more complex kinetic characteristics for LDL oxidation.

**Keywords:** kinetic, LDL, oxidation, copper

#### P-10-373-1

##### Effect of magnesium consumption on glucose concentration and formalin test in diabetic rats

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Magnesium is an essential metal in carbohydrate metabolism. It causes activation and release of insulin. Increasing of blood sugar in diabetic patients, results in a decrease of magnesium in the serum and its low concentration in urine. Measurement of glucose concentration and formalin nociception in diabetic rats after treatment with magnesium was done in 80 NMRI rats (Razi co. Iran). They were categorized in ten groups including control, diabetic without treatment of magnesium, diabetic with treatment of magnesium in one (1), two (2), three (3) and four(4) week(s). The other 4 normal groups were treated with magnesium in same timescales. In the diabetic groups, diabetes was induced with i.p. injection of 60mg/kg streptozotocin. Besides weight measurements, glucose concentrations of animals were measured with enzymatic-calorimetric method. Pain scores were measured in formalin test. Statistical analysis was carried out by ANOVA and Tukey test. The results showed that the difference in animal weight and glucose concentrations between control and diabetic groups was significant ( $P<0.0001$ ). Glucose concentrations of magnesium treated diabetic groups significantly differed between 1 and 2 ( $P<0.005$ ); 1 and 3 or 4 groups ( $P<0.0001$ ); 2 and 3 ( $P<0.001$ ) and 2 and 4 ( $P<0.01$ ). Statistical differences among control and magnesium treated diabetic groups were significant between control and 1 ( $P<0.0001$ ); control and 2 ( $P<0.05$ ). In the weight data there was no significant difference between diabetic in one side and 1 and 2 groups in other side. But difference between diabetic and the other 3 and 4 groups showed significance with  $P<0.001$  and  $P<0.0001$ , respectively. In this study results from flinching and licking responses have been evoked by formalin in biphasic model of formalin test. Magnesium consumption in diabetic groups resulted in an increase of animal weight and decrease of glucose concentration and such effects show time dependency. Although, such changes was not reached to the control measurements. Results from formalin test show hyperalgesic effects in diabetic and diabetic treated with magnesium groups in comparison with control group.

**Keywords:** diabetes mellitus, magnesium, formalin test, pain, rat

#### P-10-459-1

##### Serum calcium and zinc response following oral zinc sulfate supplement in postmenopausal osteoporotic women

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Bone loss with increasing age induces osteoporosis. Zinc (Zn) could be one of the important factors in the prevention of osteoporosis. However, there is little research on the association between zinc supplementation and calcium (Ca) and Zn concentration in osteoporotic women. The aim of the present experimental study was to examine the effect of Zn supplementation on serum Zn and Ca in postmenopausal osteoporotic women. Forty eight postmenopausal osteoporotic women referred to rheumatologic clinic in Tabriz were studied. Height and weight were measured using scales and dietary intake was assessed using 3 day food recall. Serum Zn concentration was measured using atomic absorption spectrophotometer and serum Ca using kit. Patients were randomly divided into two groups, intervention groups (n=23) receiving one capsule of 220 mg zinc sulfate contain 50 mg elemental zinc each day and placebo group (n=24) receiving placebo contain starch for two months. After 60-day intervention Trial, dietary intake, anthropometric data and serum Zn and Ca were assessed. The mean age of participant was 57.96 years. There was no significant difference in age, weight, height, menopausal age and nutrient intake, between two groups at the baseline and final of study. The mean serum Zn concentration was markedly lower than normal range at baseline ( $69.07\pm 3.8$  µg/dl), but mean serum Ca level was within normal range ( $9.2\pm 0.19$ mg/dl). The administration of zinc sulfate caused a significant elevation in serum Zn concentration and while the decrease in serum Ca concentration was not significant. The results of the present study demonstrate that postmenopausal osteoporotic women show zinc deficiency and zinc supplementation could be beneficial.

**Keywords:** serum zinc, serum calcium, zinc supplementation, postmenopausal osteoporotic, dietary zinc

#### P-10-459-2

##### Change in serum zinc and alkaline phosphatase activity in the effect of zinc sulfate supplement

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Zinc (Zn) is an essential nutrient for many physiological function including immune function and bone metabolism in humans and animals. Zinc takes part in the metabolism of bone as a constituent of the matrix and as an activator of several metalloenzymes such as alkaline phosphatase (ALP). The present study was conducted to investigate the effects of Zn supplementation on serum Zn and ALP activity in patients with bone fracture. This randomized, double-blind, placebo controlled clinical trial was conducted on 60 patients with bone fracture referred to Shohada hospital of Tabriz. Subjects were randomly divided into 2 groups, case group (n=30) receiving one capsule of zinc sulfate each day, control group (n=30) receiving placebo. Subjects received supplement for 60 days. Physical activity, individual and clinical information was determined by questionnaire

and nutritional intake by 3 days food records at the beginning and the end of trial. Serum Zn concentration was measured by atomic absorption spectrophotometer and serum ALP by using Pars Azmoon kit. From 60 patients 39 people were male and 21 female. There was no significant change in the physical activity and sex between groups. The change of Mean nutrient intake from diet during the trial was not significant. Mean of Zn serum concentration at the beginning of study was significantly lower than normal values. A positive correlation was observed between serum Zn and serum ALP level but was not significant. After 60 days supplementation the concentration of serum Zn and ALP increased, significantly: Zn (69.78±4.8 vs. 133.12±11.35µg/dl), ALP (103.46±19.9 vs. 137.58±24.98U/l). The results of the present study indicated that Zn supplementation during 60 days increase concentration of serum Zn and ALP, and improved Zn deficiency. Due to role of ALP on bone modeling and Zn deficiency in patients with bone fracture, Zn supplementation can be useful.

**Keywords:** serum zinc, serum alkaline phosphatase, bone fracture, zinc supplementation

#### O-10-450-1

##### **Cadmium up-regulates MMP9 and TIMP1 levels and affects protease-antiprotease balance**

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Cadmium is an extremely toxic metal commonly found in industrial work places, a food contaminant and a major component of cigarette smoke. Cadmium can severely damage several organs including kidney, lung, liver and central nervous system. In this work we have studied cadmium toxicity on U937 monocytoid cells and its influence on matrix metalloproteinase 9 and its tissue inhibitor (TIMP1) levels. U937 cells were cultured and treated with cadmium chloride concentrations from 1µM up to 100µM. The cytotoxic effects of each concentration were analyzed by activity assay of LDH released into culture medium after 24 hours incubation. Levels of released MMP9 and TIMP1 were determined by ELISA and zymography methods. Doses of 10 µM cadmium and higher induced a dose dependant LDH release to the extra cellular medium. Total MMP9 and TIMP1 levels measured by ELISA showed a significant 20 percent increase (P-value<0.01) following exposure to all concentrations. Zymographic results agreed with ELISA data in which cadmium treatment increased MMP9 activity in culture supernatant in all concentrations. These results suggest that a significant underlying mechanism of detrimental effects of cadmium is cellular damage and uncontrolled metalloproteinases activity and consequent imbalance between proteases and antiproteases produced by inflammatory cells. The persistent inflammation is due to accumulation of cadmium which in organs such as lungs leads to pulmonary emphysema and COPD.

**Keywords:** cadmium, MMP9, TIMP1, zymography

#### O-10-268-1

##### **Distribution of Titanium in serum and tissues nonheme iron proteins in rats with chronic titanium intoxication**

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Consumption of titanium and number of applications of Ti in industry and medicine has been increased. In vitro studies have shown that Titanium (Ti) binds to apo-transferrin. The purpose of this study was to determine presence of Ti in serum transferrin and tissue nonheme iron proteins in rats with chronic titanium intoxication. Male Wistar rats (200-250 g) were used for the experiments. Groups of animals were injected intraperitoneally for 60 days with 0.6 mg/kg as chronic doses at the end of this treatment period, blood was removed by cardiac puncture. The liver, heart, kidney, spleen and brain were removed together. The binding of titanium to serum transferrin was investigated using immuno-affinity chromatography technique. Anti-transferrin coupled to CNBr-activated sepharose 4B was used. Ion exchange chromatography was employed to separate the content of the tissues in to four chromatographic portions, notionally transferrin, ferritin, haemoprotein and haemosidrin, and these portions were quantified. Titanium and transferrin were determined. It was found that majority of serum titanium was eluted from column with serum transferrin. We conclude that titanium can be transported across the blood brain barrier as bound to transferrin, and transferrin might be involved in iron metabolism.

**Keywords:** iron, metabolism, titanium, transferrin

#### P-10-601-1

##### **Serum levels of copper, zinc and Iron in patients with cutaneous leishmaniasis in Qom province of Iran**

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Cutaneous Leishmaniasis (CL) is a chronic infectious and granulomatous disease which is transmitted by the bite of a tiny insect vector, the sand fly. The purpose of this study is to determine the serum Zinc (Zn), Copper (Cu) and Iron (Fe) concentrations in patients with Cutaneous Leishmaniasis. Serum Zinc and Copper levels were determined by flame atomic absorption spectrophotometer, and serum Iron concentration was determined by the Ferrozine method with a commercial kit which was carried out by using an automatic analyzer. A total of 160 subjects were selected in the study, 60 of who were patients and the rest were healthy persons who were not exposed to CL. They were selected from the central hospital in Qom province, one of the provinces of Iran. Serum Copper concentrations and Cu/Zn ratio of the patient group were significantly higher than those of the healthy group (P<0.001). On contrary, Zn and Fe levels of the former group were significantly lower than those of the latter one (p<0.01). Our results showed that serum concentrations of essential trace elements

like Zn, Cu, Fe, and Cu/Zn ratio had changed in these patients. The changes may be a part of defense strategies of organisms and are induced by immunoregulatory cytokines.

**Keywords:** atomic absorption, cutaneous leishmaniasis, trace element

#### P-10-601-2

##### Evaluation of zinc, copper, and iron levels as well as copper: zinc ratio in the sera of Cutaneous Leishmaniasis patients before and after antimonial therapy

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Cutaneous leishmaniasis (CL) is spread through some of the urban and rural regions of Iran which is a vector-borne protozoa infection of the skin. The aim of this study was to investigate the changes of zinc (Zn), copper (Cu) and iron (Fe) concentrations in CL patients before and after the therapy. Cu and Zn were determined by atomic absorption spectrophotometry using an air/acetylene flame, and Fe was determined by the Ferrozine method with a commercial kit carried out by using an automatic analyzer. Sera of 60 patients with cutaneous leishmaniasis were obtained from the central hospital in Qom province of Iran. The serum levels of trace elements were measured before and after antimonial therapy. Our results showed that Zinc serum levels and Cu: Zn ratio significantly increased and decreased after the treatment phase, respectively ( $P < 0.001$ ). On the other hand, we understood that after therapy the changes of iron and copper were increased and decreased, respectively, but not significantly. Measuring the serum levels of zinc and Cu:Zn ratio, along with other examinations would help physician in prognosis and monitoring of the treatment of cutaneous leishmaniasis.

**Keywords:** antimonial therapy, atomic absorption, cutaneous leishmaniasis, trace element

#### P-10-637-1

##### Aluminum toxicity on serum, liver, and brain high and low molecular weight alkaline phosphatase of rat

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Alkaline phosphatase may be resolved into two bands on polyacrylamide gel electrophoresis; a high-molecular weight form and a low-molecular weight form. The relationship between aluminum treatment and changes in the activity of serum, liver and brain high- and low- molecular weight alkaline phosphatase has been investigated in this study. It was found that every other day, intraperitoneal injection of 186  $\mu\text{mol/kg}$  of aluminum as  $\text{AlCl}_3 \cdot 6\text{H}_2\text{O}$ , in male rats for 2 weeks resulted in the decrease of level of liver and brain alkaline phosphatase by 14.9% and 9.9 %, respectively, whereas an elevation of serum level of this enzyme by 21.1% was seen in comparison to untreated controls ( $p < 0.05$ ). Long-term exposure (7 weeks) of 74.5  $\mu\text{mol/kg}$  of this salt, showed a

statistically significant reduction in liver and brain levels of alkaline phosphatase by 15.8% and 12.3%, respectively, and an increment in serum activity of the enzyme by 30.9% in comparison to control ( $p < 0.05$ ). Gel filtration chromatography technique with sephacryl S300 showed that, in comparison to control groups, serum and liver homogenates from aluminum treated groups had a significant level of high molecular weight alkaline phosphatase ( $p < 0.05$ ) that might be considered as an biological indicator for aluminum toxicity.

**Keywords:** aluminum, alkaline phosphatase, high molecular weight alkaline phosphatase, liver, brain

#### P-10-217-1

##### Antioxidant activity of dipyrindamole against extracellular/intracellular free-radical scavenging

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Dipyrindamole (DIP), 2,6-bis(diethanolamino)-4,8-dipiperidinopyrimido[5,4-d]pyrimidine, is widely used in clinics for the treatment of several cardiovascular diseases because of its vasodilating and antiplatelet properties. The role of DIP as an antioxidant has been also suggested to be relevant for its antithrombotic and vasodilating activities; the scavenging of oxygen free radicals has been reported to play a role in cardiovascular diseases, platelet activation and regulation of vascular tone. In this way, the free radical scavenging capacity of Dip has been studied by the help of ESR, uv-vis spectroscopy, reducing power assay, cell viability and intracellular ROS depletion as well as direct electrochemical oxidation/reduction of DIP, in order to bring better understanding about its chain breaking mechanism. Results indicate antioxidant property of DIP is highly solvent dependent such that it behaves as a very poor antioxidant in alcohol and DMSO while in water it has higher reducing power even more than Trolox. We could easily detect DIP radical ( $\text{DIP}^\cdot$ ) as the intermediate molecule by Fenton reaction via ESR technique. Cell viability and intracellular ROS assay show that DIP is capable of protecting L6 cells from induced cumene hydroperoxide radicals. Electrochemical studies by cyclic voltammetry showed red/ox potency of DIP is reversible but in water it prefers to be easily oxidized and during this process it donates 2 electrons. All together DIP has high free radical scavenging property in cellular medium instead of its highly hydrophobic property.

**Keywords:** ESR, free radicals, ROS, dipyrindamole, reducing power

#### P-10-720-1

##### Survey on prevalence of copper deficiency in urban and rural areas in Tehran

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Due to the importance of copper in human nutrition and in view of lack of information in this area, this study was carried out at the household level as to the epidemiology of copper deficiency. In this descriptive

survey, 321 urban and 291 rural Tehrani subjects (265 men and 347 women) in the 7 to 83 years of age were selected by cluster and systematic random sampling. Demographic, economic and medical information was recorded using a questionnaire. Weight was measured by a digital balance with minimum clothing and height by a wooden device. Twenty-four hour dietary recall questionnaire was filled for food consumption. Serum copper was measured by atomic absorption spectrophotometry. Prevalence of deficiency was determined with 95% confidence interval in the population. Prevalence of copper deficiency based on serum level was 60% (55% in men and 64% in women). The highest prevalence was in the 13-19 year old girls (76%). Villagers were more deficient than the urban dwellers (66% versus 55%,  $P < 0.005$ ). Serum copper was  $70.7 \pm 25.6$   $\mu\text{g/dl}$  and copper intake was  $1.60 \pm 0.66$  mg per day. Seventy four percent of the subjects had consumed less than 80% of their RDA for copper. Significant correlation existed between serum level and family size ( $r = -0.19$ ,  $P < 0.01$ ) as well as with BMI ( $r = -0.11$ ,  $P < 0.05$ ). In this study copper deficiency was high. The prevalence although in accordance with food consumption data, calls for further studies with more precise indicators.

**Keywords:** copper, dietary recall, prevalence, copper deficiency

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#### P-10-720-2

##### Serum zinc concentration in obese and non-obese patients with non-insulin dependent diabetes mellitus

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Zinc is known to have important effects on insulin activity and to increase the body fat deposition. This study was carried out on the blood zinc concentration in obese and non-obese patients with non-insulin dependent diabetes mellitus (NIDDM) in Varamin, Iran. 105 patients with NIDDM (aged 30–75 years) with a mean duration of diabetes of  $6.9 \pm 3.6$  years were selected. Diabetic persons with ketosis, microvascular complications and nephropathy were excluded from the study. Eighty nine healthy subjects were studied for comparative analysis. Subjects were subdivided into obese and non-obese. Diabetic subjects were also subdivided into controlled and uncontrolled groups; control was based on fasting blood glucose. Serum zinc concentration was assayed by atomic absorption spectrophotometry. Serum zinc level was similar in diabetic and non-diabetic subjects, while it was significantly lower in obese diabetics ( $92 \pm 23$   $\mu\text{g/dl}$ ) compared to the non-obese diabetics ( $146 \pm 22$   $\mu\text{g/dl}$ ). None of the non-obese subjects had zinc deficiency, while 14% of the obese diabetic and 11% of the obese healthy subjects were zinc deficient. Age, sex, duration and control of diabetes did not influence zinc concentrations. We conclude that zinc level is not altered in diabetes mellitus, but the decreased zinc concentration found in obese diabetics in our study merits further investigation on the relationship between zinc and obesity in NIDDM.

**Keywords:** zinc, diabetes, obesity

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#### P-10-720-3

##### Comparison of micronutrient deficiency prevalence in males over 50 years of age in urban and rural areas in Tehran district

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In view of the importance of micronutrients in metabolism and their critical role in health improvement, this study was carried out to determine the deficiencies of micronutrient in men 50 years of age and over in Tehran district. 55 subjects in the city (44%) and 31 subjects in villages (56%) were randomly selected by cluster sampling. Individual questionnaires on demographic data were filled. Then 10 ml of blood samples were assayed by atomic absorption spectrophotometry. The results showed that the micronutrient deficiencies were highly prevalent in Tehran. Mean serum iron was  $116 \pm 38.6$   $\mu\text{g/dl}$ , magnesium  $1.7 \pm 0.44$  mg/dl and serum manganese  $46 \pm 10.7$  ng/dl. No difference existed in mean concentrations of these three nutrients between urban and rural areas. Mean serum copper was higher in the city compared to the villages ( $76 \pm 27.5$  vs.  $66 \pm 23.2$   $\mu\text{g/dl}$ ) while mean serum zinc was significantly higher in rural ( $146 \pm 32.6$ ) compared to urban areas ( $94 \pm 27.5$   $\mu\text{g/dl}$ ). No one had zinc deficiency in rural areas while 21% of the city dwellers were zinc deficient. Iron and manganese deficiency was higher in urban compared to rural areas (13% and 3% for iron, 42% and 26% for manganese, respectively). Rural men were more deficient as far as copper and magnesium was concerned compared to urban subjects (50% and 58% for copper, 42% and 48% for magnesium, respectively). Because of the high prevalence of the deficiencies of these micronutrients in the aged, further studies in other districts and surveys on the etiology and curative measures are recommended.

**Keywords:** zinc, copper, manganese, iron, magnesium

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#### P-10-817-1

##### Headspace solid-phase microextraction of tetramethylthiuram disulfide with polypyrrol film coupled to ion mobility spectrometry

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Tetramethylthiuram disulfide (TMTD) is a dimethyl dithiocarbamate compound used as a fungicide to prevent crop damage in the field and to protect harvested crops from deterioration in storage or transport. TMTD is also used as a seed protectant and to protect fruit, vegetable, ornamental and turf crops from a variety of fungal diseases. It also causes cancer in animals and human in long exposure time. A number of methods such as spectrophotometry, chromatography, voltammetry, polarography, capillary electrophoresis have been reported for the detection and analysis of TMTD1. In this work the electrochemical fiber coating (EFC) technique was used for the preparation of dodecylsulfate-doped polypyrrole (PPy-DS), and applied as a fiber for solid-phase microextraction (SPME) 2 combined with ion mobility spectrometry (IMS) system. To the best of our knowledge there is no published HS-SPME-IMS method for TMTD determination in water, canola crops and soil samples. Parameters like pH, extraction time, ionic strength, and temperature of the sample were studied and

optimized to obtain the best extraction results. The calibration graphs in water and soil were linear in the range of 10 to 200 ng.ml<sup>-1</sup> ( $R_2 > 0.99$ ) and 300 to 2000 ( $R_2 > 0.99$ ), respectively. Detection limit in water and soil samples were 5.8 and 60ng.ml<sup>-1</sup>, respectively. Finally, the HS-SPME/IMS was successfully applied for analysis of TMTD in real samples (canola crops, soil and water).

**Keywords:** dimethyl dithiocarbamate, TMTD, electrochemical fiber coating

#### P-10-669-1

##### Developing a method based on polypyrrole coated Quartz Crystal Nanobalance for detection and determination of Arsenic (III) in solution

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Determination of trace toxic species in environmental and biological materials is an important screening procedure in the studies of environmental pollution and occupational exposure. Long term exposure to arsenic contaminated hot spring mineral waters may lead to various diseases such as conjunctivitis, hyperkeratosis, hyperpigmentation, cardiovascular diseases, disturbance in the peripheral vascular and nervous systems, skin cancer, gangrene, leucomeiosis, hepatomegaly and splenomegaly. The toxicological and physiological behavior of arsenic depends on its oxidation state. The determination of arsenite (As III) in hot spring hydrothermal aquatic systems is of particular interest due to the fact that it is ten times more toxic than arsenate (AsV). The aim of the current investigation was to develop a sensor based on quartz crystal nanobalance (QCN) system for detection of As(III) in solution. Due to some advantages including low cost, portability and easy on-line analysis, the QCN sensor is extensively used as a sensor and biosensor to detect toxic compounds in environmental studies. A thin layer of Polypyrrole (PPy) was electrochemically deposited over the gold crystal electrode. The PPy-modified electrode was then used to determine As(III) in solution. It was found that the frequency shifts were linear against the concentration of As(III) in solution. Using this method the As(III) can be measured in the range of 0.5-3.5 ppm. The lower limit of detection (LLD) of 0.27 ppm and the sensitivity factor of 61.97 Hz ppm<sup>-1</sup> were obtained for the sensor. Among some possible interference tested, no major interference was involved in the performance of the sensor except for Cu(II) ions.

**Keywords:** hot spring hydrothermal water, nanosensor, polypyrrole, quartz crystal nanobalance (QCN), toxic As (III) ions

#### O-10-917-1

##### Different behavior effects of selenium on erythrocyte Sodium-Lithium Countertransport activity in Rabbits

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The effects of selenium on erythrocyte sodium-lithium countertransport (SLC) activity have not been studied in full detail. In the present study the relationship between selenium and SLC activity was investigated. Male rabbits weighing 1350±50g were divided into four groups (5 in each). For in vivo studies selenium dioxide was administered intraperitoneally on alternate days for 2 weeks as acute dose (250µg/kg body weight) and for 7 weeks as chronic dose (125µg/kg body weight). The control groups for each doses received deionized water at the same time. For in vitro experiments, RBCs were prepared from intact rabbits. Cells were incubated with different concentrations of selenium (1 up to 100µM) and the erythrocyte SLC activity was determined according to the method of Varesangthip. The results showed that the acute dose of selenium decreased SLC activity and Vmax/Km, but the Km of the transporter was increased ( $p < 0.05$ ). The chronic dose of the metal increased SLC activity, Vmax/Km and Vmax, but it decreased Km of the transporter ( $p < 0.05$ ). In vitro studies showed that, the metal at low concentration (1µM) can lower SLC activity but at high concentration (50 and 100 µM) increases the SLC activity ( $p < 0.05$ ). It is concluded that selenium at high concentration and chronic dose increases the SLC activity. But at low concentration and acute dose decreases the activity of this transporter that will have a beneficial effect to the health.

**Keywords:** sodium-lithium countertransport, selenium

#### P-10-1049-1

##### Inhibition of liver toxicity by derivatives of 3-hydroxypyridinones in iron overloaded rats

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3-Hydroxypyridinone (HPOs) derivatives have been extensively investigated as orally active iron (III) chelating agents for treatment of iron overload in thalassaemic patients. The liver toxicity of several 1-aryl-3-hydroxypyridin-4-ones in overloaded rats was studied. The compounds were administered intraperitoneally to iron overloaded and non iron overloaded rats (as control group) at a dose of 200 mg/kg/day for a total of 15 days. After 15 days, blood was collected into labeled tubes. Iron concentrations in the liver and serum concentrations of urea, creatinine, albumin, total bilirubins, AST, alkaline phosphatase, and total proteins were analyzed in rats either by atomic absorption or by standard kits. No statistically significant differences were observed between control and chelator-treated rats for any values except for albumin and alkaline phosphatase which were higher than that of the control values for all HPOs under study ( $p < 0.05$ ). Significant reduction in Hb and white blood cells, however, were observed. Liver mobilizing iron with the HPOs ranged from 40-65% compared to 49% removal by desferrioxamine B. There were no deaths in either iron-overloaded animals receiving any of the HPOs or

the control group. In conclusion, this study confirms that HPOs (200mg/kg/day) are at least as effective as desferrioxamine at mobilizing iron and reducing liver toxicity.

**Keywords:** desferrioxamine, 3-hydroxypyridinones, iron overload

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**O-10-1098-1**

**Cadmium accumulation in the muscle of Common carp fish (*Cyprinus carpio*) during short and long periods, an in vitro study**

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Cadmium (Cd+2) mainly exist in water and then large amount of this can be accumulated in liver, kidney, muscle and bone. Cd+2 has now been well documented to cause number pathophysiological damages in human. The aim of this investigation was to study the muscle accumulation of Cd+2 in fish. In this project *Cyprinus carpio* fish with average weight of 5gr was selected. Cd+2 doses were within the range of 0-0.1 ppm. After 30, 60 and 90 days from starting experiment, 5 fish were sampled from every series and fish were killed, and 1 gr of dorsal muscle was then separated. Samples were ash at 550-600 °C and then dissolved in HCl. Then Cd+2 concentrations in this solution were determined by Potentiometric Stripping Analyzer Ion. Exposure of fish to 0.01 ppm Cd+2 as cadmium chloride for 30, 60 and 90 days increased Cd+2 muscle accumulation by 30, 75, 145 µg of Cd+2 per Kg of dry weight, respectively. Treatment of fish with dose of 0.05 and 0.1 ppm increased muscle cadmium by 797 and 1543 µg of Cd+2 per Kg of dry weigh, respectively. Accumulation of Cd+2 in muscles has been increased with increasing dose and duration of Cd+2 exposures. The result showed that Cd+2 accumulations in muscle is not only a dose dependent process but also depends on the treatment time.

**Keywords:** accumulation, cadmium, *Cyprinus carpio* (common carp)

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**O-10-4-20**

**Effects of free fatty acids, palmitate and oleate, on PTP1B gene expression in C2C12 cells**

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Skeletal muscle accounts for the majority of insulin-stimulated glucose uptake and is the major site of insulin resistance. In muscle insulin resistance, an impairment of glucose utilization and insulin sensitivity has been related to the accumulation of free fatty acids (FFAs) within the muscle cells. Increased FFA attenuates insulin signaling by interfering with the initial steps of the insulin signaling cascade, but the exact target molecules in the pathway are not clearly known. Moreover, the level of protein tyrosine phosphatases increases in obesity, type 2 diabetes, insulin resistance states and animal model on high fat diet. Therefore, in this study we aimed to investigate the

effects of FFAs on these regulators, particularly, protein tyrosine phosphatase 1B (PTP1B). To assess the role of FFAs on insulin signaling, we investigated the mRNA level of PTP1B in C2C12 murine muscle cell line under treatment with different concentrations (0, 0.25, 0.75 mM) of palmitate and oleate at different intervals (6, 12, 24 h) using real-time RT-PCR. The results showed that palmitate and oleate induce PTP1B mRNA levels, time and dose dependently, in C2C12 cells. The maximum effect of FFAs on PTP1B mRNA was observed with 0.75 mM of both FFA at 24h. These data suggest that enhanced FFAs levels in muscle cells inhibit insulin signaling pathway, partly by inducing PTP1B gene expression. Therefore, inhibiting PTP1B could potentially provide a promising therapeutic target for decreasing muscle insulin resistance in type 2 diabetes, obesity and insulin resistance states.

**Keywords:** free fatty acids, mRNA, oleate, palmitate, PTP1B