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**THE STUDY OF SOME PHYSIOLOGICAL RESPONSES OF BRASSICA NAPUS L.CV.FUSIA TO CADMIUM**

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Cadmium is a toxic metal for living organisms and an environmental contaminant. Effect of cadmium on some plant morphological and physiological parameters of (*Brassica napus* L.cv.Fusia) was investigated. Plants were grown in vermiculite and irrigated with Long Ashton nutrient solution containing (0,200,400,600 and 800  $\mu\text{M CdCl}_2$ ). The results obtained showed that Cd-induced a decrease in seed germination and decreased root and hypocotyl growth in *B.napus* seedling. Exposure to cadmium significantly increased the amount of cadmium in both roots and leaves. In addition, decrease occurred in the concentration of Fe, K, Ca in roots, while Zn had no significantly decreased. In leaves Ca content reduced significantly. Various concentration of cadmium did not decreased significantly content of Fe, K and Zn. Cadmium exposer significantly decreased root and leaves fresh and dry weight, leaf area, total chlorophyll, chlorophyll a, b and carotenoid content in treated plants. Cadmium in high concentration (600 and 800  $\mu\text{M CdCl}_2$ ) increased soluble reducing sugars content in roots and leaves. This increase is probably an adaptive mechanism for maintenance of osmotic potential or cell base metabolism in stress condition. In leaves, various concentration of cadmium had no effect on decreasing content of ethylene. Cadmium enhanced the level of lipid peroxidation in treated plants. The toxic effect of cadmium on antioxidative enzymes in roots and leaves such as peroxidase (POX), ascorbate peroxidase (APX) and polyphenol oxidase (PPO) was investigated. The result showed that in leaves, various cadmium concentration, caused the APX activity to enhance while increased in POD and PPO activity only at 800  $\mu\text{M Cd Cl}_2$ . In roots at 800  $\mu\text{M CdCl}_2$ , in POX and PPO activity observed was increased but no significantly increase in APX activity was not observed. Cadmium decreased ascorbate content and increased dehydroascorbate content in roots and leaves of treated plants. The result showed that *B. napus* is not a hyperaccumulator plant. The significant increase in MDA content and decrease in antioxidant production may be the indication of which *B. napus* is among sensitive plants to cadmium.

Keyword: Cadmium, Malondealdehyde, Peroxidase, Ascorbate peroxidase, Polyphenol oxidase, *Brassica napus*.

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**BIOACCUMULATION OF CHEMICAL ELEMENTS IN NATIVE TREE LEAVES FOR BIOMONITORING PURPOSES IN AN ATLANTIC FOREST HOTSPOT**

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Due to the high level of species endemism and the constant habitat reduction, the Atlantic Forest is one of the hottest hotspots in terms of the biodiversity conservation. The Parque Estadual Carlos Botelho (PECB) is a representative conservation unit of this biome, being chosen for the implementation of a long-term plot, in which all trees of diameter at breast height larger than 5 cm were mapped, labeled and identified. Multidisciplinary studies have been conducted in this long-term plot aiming at the understanding of diversity, dynamics and conservation of the biodiversity. Besides the soil contribution, the atmosphere may act as an important source of chemical elements (essential and trace) for the ecosystem. Therefore, this work encompasses a biomonitoring approach for assessing the environmental quality of the PECB long-term plot based on the capability of native tree leaves in accumulating chemical elements. The uptake is active, that is, plants are able to maintain the chemical concentrations in a specific range in leaves. Instrumental neutron activation analysis (INAA) was employed for chemical characterization of leaf and soil compartments. Sampling was conducted in the period of 2002-2004. Results indicated a low level of pollution because the major part of the studied species has showed chemical concentrations within the expected range in leaf compartment. However, by estimating leaf-soil bioaccumulation factor (LSBF), some species were found to accumulate nutrients (Co, Na, Se and Zn), trace elements (Br, Ba, Cs, Hg, Rb, Sc and Sr) and lanthanides (Ce, La and Sm). Maps of distribution of chemical elements were obtained for the long-term plot, which is an approach quite novel for the Brazilian biomonitoring studies. In fact, monitoring of chemical elements has been restricted to the environmental evaluation of heavily impacted areas and aquatic ecosystems. This study corroborated the use of native species for environmental quality assessment in natural areas. It demonstrated the importance of chemical characterization for biodiversity conservation in a multidisciplinary overview. Moreover, the definition of reference standards for the environmental impact studies can be estimated through the achieved concentrations, facilitating the detection of future impacts on the vegetation.

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**A MODIFICATION IN INSTITUTO NACIONAL DE SEGURIDAD E HIGIENE EN EL TRABAJO BLV OF MERCURY**

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Until 2006, the Spanish Biological Value Limit (VLB), established by Instituto Nacional de Seguridad e Higiene en el Trabajo, for workers exposed to mercury was 35  $\mu\text{g Hg/g creatinine}$  in urine samples taken prior to shift, specifying that these samples were to be taken 'after two days without exposure', which means at least 48 hours or, in practice, Monday morning for workers having a 8 hours day shift and resting Saturdays and Sundays.

However, American Conference of Governmental Industrial Hygienists, even though they propose the same urinary concentration in their BEI's table, the proper time to take the sample is established as 'after 16 hours without exposure'.

This disagreement gave rise to the present work in which all urines from 13 workers, exposed to elemental mercury in chloroalkali cells with mercury cathode, were analyzed along two weeks comprising three weekends. The whole number of samples was 1700 in which total inorganic mercury and creatinine were determined.

Results were subjected to statistical analysis and allowed to recommend the use of ACGIH BEI, being much closer to experimental data.

As a consequence of the present work, for internal use until now, Instituto Nacional de Seguridad e Higiene en el Trabajo (INSHT) modified in 2006 its VLB value regarding to the time of urine sampling, settled now at 16 hours after shift.

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**DIETARY INTAKE OF ESSENTIAL AND TOXIC ELEMENTS IN DEVELOPING COUNTRIES**

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Trace element nutrition as a public health issue has a very low priority in many developing countries in Asia, Africa and Latin America. According to a recent World Health Organization (WHO) report, trace element deficiencies are widespread, but unrecognized in many countries of the world with low socio-economic status. A lack of characteristic signs and symptoms and analytical techniques is the main reason that such deficiencies are not identified at an early stage. It is reported that nearly a third of the current world's population suffer from the deficiency of iron, iodine and probably other essential elements such as zinc and selenium. At the same time, there is growing evidence suggesting a high exposure to toxic metals such as lead, cadmium and mercury in some developing countries. In the present study, we have investigated the food habits of 13 countries in the world. The major emphasis of the study was on the intake of minor and major trace elements from normal prepared meals for consumption. The diets were collected employing a standardized duplicate portion dietary sampling technique. A total of 1300 samples were collected. Blood samples from adults and children in New Delhi (India) and Lahore (Pakistan) were also collected for the analysis of lead. The results indicated that the intake of potassium and magnesium was very low in most of the diets. Pure vegetarian diets were richer in these elements than the common diets. The intake of zinc, copper, iron and selenium in some developing countries was much lower than the current recommended values. The levels of lead in the blood of children and adults in Delhi and Lahore were much higher than that were observed in the same age groups of affluent countries. It is well-known that the high intakes of lead can interfere with the absorption of essential elements such as iron and zinc. Occupational medicine with monitoring systems for industrial exposure to toxic substances hardly exists in many developing countries. From a public health point of view, it is important to assure the general population that the intake of essential trace element is adequate to meet the requirements. At the same time it is also important to make sure that the adverse effects of high toxic metals do not cause additional problems to the health status of the population in general. Vulnerable groups such as children, pregnant women and the elderly may be more at risk than the general population in developing countries.

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**UPDATING AND STUDY OF NORMAL LEVELS OF COPPER, ZINC AND SELENIUM IN SERUM OF PREGNANT WOMEN**

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Objective: Establish some updated biological reference intervals for copper, zinc and selenium levels in serum in pregnant women.

Methods:

-The study group consisted of 166 pregnant women, who did not suffer from pathologies.

-Zinc and copper determinations in serum were made using Flame Atomic Absorption Spectroscopy (AAS) through Perkin Elmer 1100B equipment and selenium in serum was determined by Electrothermal Atomic Absorption Spectrometry (ETAAS) method with Zeeman's background correction and graphite furnace through Perkin Elmer's 4110 ZL equipment. All samples were analysed in duplicate.

-The SPSS program, version 13.0 for windows was used to process the statistics data. The Pearson Correlation was applied.

Results and discussion:

- The concentrations of copper, zinc and selenium averaged  $73.61 \pm 43.67$  microg/dL,  $65.37 \pm 12.87$  microg/dL and  $99.59 \pm 21.74$  microg/L, respectively, in pregnant women.

- There was no significant correlation between zinc and selenium levels. A significant correlation was found between serum levels of copper and selenium serum levels ( $p < 0.05$ ) and between copper and zinc ( $p < 0.001$ ).

- Varying differences were noted in these oligoelements according to week of gestation. Copper serum levels were higher than zinc levels in all pregnant women.

- In pregnancies at term were observed levelness.

Conclusions:

- There are diversity of values according age of gestation.

- The need to study more advanced considered the clinic history of pregnancies and different treatments and supplements during pregnancy.

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**IODINE AND SELENIUM DEFICIENCY IN PREGNANT WOMEN OF AMUR-RIVER REGION**

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Increased content of Fe, Mn, deficiency of iodine and selenium and other essential elements misbalance in the environment are the peculiarities of the Amur-river region, and other regions of Russia also. Technogenic pollution resulted in increased levels of marginally permitted concentrations of some trace elements (Zn, Cu, Cd, Pb, Hg, Ni, Li and etc.).

Specific features of environment complex factors may be one of the reasons for anemic state formation in pregnant women. This is one of the most common extra genital pathology. During past 15 years, the frequency of such pathology in pregnant women of Khabarovsk territory increased 2,1 times, anemia dependent confinement complications - 4 times.

Trace elements misbalance, influencing eritrone system function, appears under some environment factors action. 509 pregnant women from industrial center (Khabarovsk city) were examined. 80,3% of women in group with normal blood analyses and Ferro dynamic status iodine deficiency in the whole blood revealed. In anemia group iodine deficiency revealed in 91,6%. Severe iodine deficiency revealed in 59.8% in comparative group, 74.7% in Fe-deficiency anemia group, and 83.1% in Fe-saturated anemia group. Blood serum Selenium deficiency in 67.5% of comparative group pregnant women accompanied with blood cells Selenium deficiency in 30% of cases.

In the anemia group, Selenium deficiency in serum revealed in 58%, in blood cells in 76% of pregnant women, independently of Fe content.

Represented investigations illustrated the environment influence at the trace elements status in pregnant women, resulting in Iodine and Selenium deficiency.

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**EVOLUTION OF THE HABITUAL VALUES OF PB LEVELS IN BLOOD IN THE PROVINCE OF ZARAGOZA (SPAIN)**

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Objectives:

- 1) Establish some updated biological reference intervals for Pb levels in total blood in the province of Zaragoza to help diagnose possible intoxications by Pb correctly.
- 2) Carry out a differentiation by genders, in order to demonstrate the existence of significant differences.

Methods: The samples of people referred to the "metal" reference unit of the Biochemistry Service, who did not suffer from important pathologies and with normal values of the ALA-dehydratase enzyme (inhibited due to the presence of high Pb levels), were analysed. In all, between the months of January and July 2006, 156 samples of total blood were processed, of which 83 were men and 73 women. The concentration of Pb in total blood expressed in microg/dL was determined for these samples by ETAAS (Electrothermal Atomic Absorption Spectrometry) method with Zeeman corrector and graphite chamber in the Perkin Elmer equipment 4110-ZL. The samples were analysed in duplicate. The SPSS program, version 13.0 for Windows was used to process the statistics data. Student's t-test was applied to assess the possible influence of the gender on Pb levels in blood, that is, comparison of means and variances in two independent groups of individuals. Results: The following habitual interval was obtained for the total of 156 total blood samples analysed:  $2.94 \pm 2.02$  microg/ dL of Pb where the typical error of the mean was 0.16; and a value of the median of 2.43 microg/dL of Pb. Distinguishing between genders some habitual values of:  $2.29 \pm 1.64$  microg/ dL of Pb were found for women (73) with a standard error of the mean of 0.19, whilst for men (83) there was a habitual range of:  $3.51 \pm 2.16$  microg/ dL Pb, with a standard error of the mean of 0.24. A significance of  $p < 0.001$  was verified by means of the t-test for independent samples, so there were statistically significant differences between both genders. Conclusions: An incipient decrease of the Pb levels in blood is observed, confirming our initial suspicions. The habitual values are:  $2.94 \pm 2.02$  microg/dL of Pb at the present time, compared with  $13.27 \pm 3.47$  microg/dL of Pb in 1989. The need to differentiate the habitual values by gender is made clear as women always have lower levels of Pb than men, i.e., the average plumbemia of males differs in a statistically significant manner from the average plumbemia of women.

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**TRACE ELEMENT DETERMINATION IN BLOOD SERUM FROM AN ELDERLY POPULATION OF SÃO PAULO METROPOLITAN REGION, BRAZIL BY USING INSTRUMENTAL NEUTRON ACTIVATION ANALYSIS**

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Trace element determinations in serum samples are increasing and becoming an important research in medicine, due to the fact that levels of certain elements are related to various pathological conditions in human beings. The objective of this study was to investigate the trace element levels of a healthy elderly population residing in the So Paulo Metropolitan region, So Paulo, Brazil. Blood samples were collected from 47 healthy subjects, aged 60 to 91 years, included in a program "Successful Ageing" from the Hospital das Clínicas, So Paulo University Medical School. All participants signed an informed consent approved by the Ethics Committees. The whole blood collected in heparin free tube without additive was centrifuged and the obtained serum was freeze-dried prior the analysis. Haemolyzed samples were excluded for the analyses. The serum samples were analyzed by instrumental neutron activation analysis method. Samples and element standards were irradiated at the IEA-R1 nuclear research reactor for short and long irradiations under a thermal neutron flux of  $5 \times 10^{12} \text{ n cm}^{-2} \text{ s}^{-1}$ . After adequate decay times the gamma activities were measured using an HGe detector coupled to a gamma-ray spectrometer. Element concentrations were calculated by comparative method. Ca, Cl, Na, Rb, Se and Zn concentrations were found within the range values established by clinical laboratories or published data for blood serum, indicating that the selected population did not present deficiency or excess of these elements. A comparative study based on two different age groups of healthy elderly indicated that the Br, Ca, Fe, Na, Rb and Zn concentrations in sera from group aged 60 to 70 years did not present significant difference from those found for the group of 75 to 91 years ( $p = 0.05$ ). Only for Se, the group aged 75 to 91 years presented lower concentrations than those of the group of 60 to 74 years. Concentrations of elements in serum of males and females indicated significant difference only for Br and Fe ( $p = 0.05$ ). In males, Br and concentrations were lower but Fe concentrations were higher than those found for females. To validate the analytical methodology the certified reference materials (CRMs) NIST 1566b Oyster Tissue and NIST 1577b Bovine Liver were analyzed. Results obtained for CRMs analyses showed good precision and accuracy. Acknowledgments: To FAPESP and CNPq for financial support.