

Session 12. PHARMACOLOGY AND THERAPEUTICAL APPROACHES OF METAL IONS

CHROMIUM, GLUCOCORTICOIDS, INSULIN SENSITIVITY AND WEIGHT CONTROL

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The demonstration of the effects of chromium on weight control and lean body mass originated from two placebo controlled studies involving young men who were training to become competitive college athletes. There were highly significant effects of supplemental Cr, 200 µg/d, on lean body mass and body fat within 6 weeks. The results appeared to be greater than would be expected and have been difficult to reproduce. However, others studies of longer duration, more than 12 weeks, and higher levels of Cr, at least 400 µg/d, have also reported significant effects of Cr on body weight and composition. In addition, several animal studies involving primarily pigs and goats have documented the effects of Cr on lean body mass and composition. There were significant increases in weight gain and feed consumption in goats consuming a low Cr diet compared with those of the controls with corresponding doubling in circulating insulin. The increases in weight gain were

attributed to the antilipolytic effects of insulin leading to accumulation of triglycerides in the adipose tissue. Elevated insulin levels in the low Cr animals would also lead to decreased glucagon. Since glucagon stimulates lipolysis, decreased glucagon may lead to decreased lipolysis and subsequent accumulation of body fat and weight gain. Glucocorticoid administration also increases insulin secretion leading to increased body fat and decreased lean body mass and also increased Cr losses. Supplemental Cr leads to a reversal of the negative effects of glucocorticoid administration and Cr has also been shown to reverse steroid-induced diabetes. In summary, the effects of Cr on lean body mass and weight control can be explained in part by the effects of Cr on insulin sensitivity. This also helps to explain why the effects of chromium on weight control are variable since the effects on weight and lean body mass would be regulated by insulin sensitivity which varies greatly.

EXPERIMENTAL STUDY ON THE EFFECT OF METALLIC COPPER ON FRACTURE HEALING IN CHICKEN

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Material and methods: 160 growing chickens aging 70 days were fed in 32 cages, five each. The fracture with 1-2 mm defects at bilateral radius of wings was created by osteotomies. The chickens were then divided into four groups, 40 each. Every morning, the first group chickens, as the control, were fed orally with 0.8% Na-CMC solution (sodium carboxymethyl cellulose), the other three groups with copper-Na-CMC suspension (copper powder suspended in 0.8% Na-CMC) of different doses: 20, 40 and 80 mg Cu/kg body weight. All the chickens had free access to water and diet containing Cu 5.4 mg/kg diet. Ten chickens of each group were sacrificed at the 14, 21, 28, and 35th day postoperatively. Liver was taken for analysis of Cu and Zn content. Both radiuses were removed by dissection. Computed tomography scan (CT) was performed for measuring gray values of callus quantitatively. The biomechanical properties of the healing radius were analyzed by a three point bending test. Afterwards, the contents of calcium, magnesium, phosphorus, copper, zinc, iron and hydroxy-

proline in callus were determined.

Results: The gray values of callus increased along with the increase of copper dose and the observing duration. At the 21 and 35 day after operation, the gray values of callus in high-Cu group were significantly higher than that in the control respectively (909±221 vs. 597±155; 973±100 vs. 763±179 HU p<0.05). The calcium and magnesium in callus 35 days post operation was found to be much higher in middle and high Cu groups than that in the control respectively (Ca: 177±26.7, 176±20.5 vs. 137±34.7 mg/g; Mg: 2.98±0.56, 3.06±0.46, vs. 2.43±0.53 mg/g P<<0.05). The contents of hydroxyproline in callus 35 days post operation in high-Cu group were significantly higher than that in the control: 34.23±1.96 vs. 32.17±1.93 mg/g, P<<0.05. The biomechanical properties of repaired radius had the same tendency.

Conclusion: Copper is helpful in fracture healing. However, the mechanism of the effect of copper on fracture healing is still to be further identified.

ANTICARCINOGENIC AND ANTITUMOR ACTIVITIES OF GERMANIUM-SELECTIVE DRUGS OF GINSENG

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Germanium in micro-trace quantities have been reported to have immuno-stimulatory, free radical scavenging and antitumor actions. We examined the anticarcinogenic and antitumor effects of germanium-selective drugs of ginseng. The drugs, panaxel and panaxel-5, were produced from biomasses of tissue cultures of the strain of *Panax ginseng* root cultured on the standard mediums enriched with organic compounds of germanium, accordingly 2-carboxyethylgermanium sesquioxide (Ge-132) and 1-hydroxygermatran-monohydrat. The germanium content of panaxel and panaxel-5 was 10×10^{-3} and 2.2×10^{-3} mg % to ash, respectively. Anticarcinogenic effects of the drugs were studied in models of murine tumors induced by chemical carcinogens. Antitumor effects of the drugs were studied in mice transplanted with sarcoma-180 or Lewis lung carcinoma. Panaxel and panaxel-5 were given to animals perorally, as ethanol extracts, after carcinogen exposure or tumor transplantation. The both drugs inhibited the development of the mammary adenocarcinomas and fibroadenomas induced by intramammary injections of N-methyl-N-nitrosourea (MNU) in rats, the development of the brain and spinal cord gliomas induced by transplacental administration of N-ethyl-N-nitrosourea (ENU) in rats, and the development of the uterine cervix and vagina adenocarcinomas induced by

intravaginal applications of 7,12-dimethylbenz(a) anthracene (DMBA) in mice. Panaxel and panaxel-5 inhibited the growth of sarcoma-180 or Lewis lung carcinoma in mice. The drugs also decreased a number of lung metastases of Lewis lung carcinoma transplanted into pad of mice. Thus, panaxel and panaxel-5 have anticarcinogenic and antitumor actions. The organogermanium compounds potentiate the efficacy of biologically active substances of ginseng. The germanium-selective drugs of ginseng appear to hold considerable promise for cancer chemoprevention and chemotherapy.

Germanium-containing remedies became popular in the 1970s in Japan and later in other countries, as drugs for certain diseases, for example cancer and AIDS [7]. Germanium is not an essential element. Organic germanium compounds in trace quantities have immuno-enhancing, free radical scavenging and antitumor activities [2]. Ginseng has been used as a tonic, adaptogenic, prophylactic and restorative remedy. More recently, it has been reported that ginseng has cancer chemopreventive [8] and therapeutic actions [6]. The purpose of our work was study of anticarcinogenic, antitumor and antimetastatic activities of biotechnological germanium-selective drugs of ginseng and comparison of them with a drug of ginseng without germanium.

FE, CU, CO, VIT.C AND FOLATE INTAKE TOGETHER WITH BASIC FOOD RATION USED IN ALIMENTATION OF SOLDIERS DOING MILITARY SERVICE IN POLISH ARMY, AND BLOOD HEMATOLOGICAL PARAMETERS OF SOLDIERS – BLOOD DONORS

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The aim of the work was estimation of iron, copper, cobalt, vitamin C and folate (as factors influencing on hematological parameters of human organism), in basic food ration planned for alimentation for young men doing military service. Values of hemoglobin, haematocrit, number of erythrocytes, leucocytes and thrombocytes in blood soldiers fed this diet and being blood donors were estimated as well. Based on obtained parameters rates of MCV (Mean Corpuscular Volume), MCH (Mean Corpuscular Hemoglobin) and MCHC (Mean Corpuscular Hemoglobin Concentration) were calculated.

Estimation of iron, copper, cobalt, vitamin C and folate content was done using FOOD 2 calculation software and Tables of Content and Nutritive Value of Food Products. Hematological parameters were determined according to methodology obligatory in Poland.

It was found that iron met the requirements in 123%, copper from 76.8% to 96.0%, vitamin C 232.8% and folate 206.7% of obligatory in Poland recommended norm for young men working hard, including technological losses. Planned food ration contained 76.36 mmg cobalt. Examined hematological indicators of 400 do-

nors who gave their blood just after joining the army and among 400 who gave their blood after few months of being fed m/a diet were similar. They were included in proper values limits.

Performed researches allow to state that planned in

food ration content of examined elements, except copper, influencing on hematological parameters were included in amounts meeting the requirements for young men working hard. Copper amount should be taken into consideration during alimentation planning.

LYPOSOMIC FORMS OF RHENIUM CLUSTER COMPOUNDS IN MODELS OF HAEMOLYTIC ANEMIA

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To continue our investigations of biological activity of cluster compounds of rhenium, lyposomic forms were necessary to obtain and to investigate their structure as many of potentially active compounds had low solubility. UV-spectra of lyposomic forms of the substances with organic acids, amino acids and adamantanic acids were investigated, some results about coordination of the compounds with lipid components were obtained. Among the range of cluster compounds of rhenium with organic ligands two ones were chosen for following experiments in vivo according to their ability to interact with biological membranes in vitro: I — dichlorotetra- μ -(i-butirato)dirhenium(III), II — tetrachlorodi- μ -(γ -aminobutirato)dirhenium(III) chloride. Two models of

haemolytic anemia was used: A — on rabbits by introducing of PbAc₂ — solutions; this model permits to investigate dynamics of anemia in one experimental animal; B — on rats by introducing of phenylhydrazine chloride. I and II were administrated as in solution as in lyposomic forms. Administration of I and II led to: increase of haemoglobine and resistance of erythrocytes and to prolonging of life for haemolytic animals; significant decrease in quantities of MDA and increase in quantities of reduced glutathion (GSH), glutathionreductase (GSR) and glutathionperoxidase (GSP) in tissues of anemic animals. The most effective was I in lyposomic form. Comparison of two modes of administration of II showed be results for lyposomic form.

CALCIUM, MAGNESIUM, COPPER AND ZINC IONS IN THE COMPLEX PROPHYLAXIS OF GENERALIZED PARODONTITIS IN POSTMENOPAUSAL FEMALES

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Systemic osteoporosis caused by estrogen deficit affects teeth and jaws and is marked by roentgenologically confirmed reduction of the alveolar process of the mandible and clinical manifestation of inflammatory dystrophic process in the paradontium. To prevent the development of pathological changes a group of patients received daily 1.5 g of calcium perorally and additionally they were applied electrophoresis with calcium, copper, zinc and magnesium. The results of the performed treat-

ment were assessed by roentgenological, echoosteometric and absorbometric methods. The dynamics of oral state was assessed by means of objective methods of the study, by the determination of the hygienic indices and quantity of gingival liquid. The effect of such metallic ions as calcium, copper, zinc and magnesium on the female organism by physiotherapy methods results in the osseous tissue during the first year of the postmenopausal period.

CALCIUM AND VITAMIN D₃ INTAKE WITH DIET AND OSTEOPOROSIS PROBLEM AMONG INMATES OF MILITARY PENSIONER HOUSE

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The aim of the work was estimation of calcium and vitamin D₃ content in food rations planned for consump-

tion for inmates of Military Pensioner House. Osteoporosis occurrence among 31 women and 26 men, inmates of

that House, was estimated at the same time.

Decade menus including two diets, general and light one, were the bases for calcium and vitamin D₃ content estimation. Calculations were done using calculation software FOOD 2 and Tables of Nutritive Value of Food Products. Obtained results were compared to obligatory in Poland norms for these elements for men and women aged over 60. Osteoporosis occurrence was estimated by measuring bones density on the left forearm of examined persons, using densitometry method.

It was found that average planned calcium content in general diet was 1214.9±204.9 mg and in light one 1142.4±178.0 mg. General diet met the requirements of Polish norm in 110.4% for women and 135.0% for men and light diet in 103.8% for women and 126.9% for men. Taking into consideration technological losses during meals preparation calcium content in general diet met

the requirements in 99.4%, and in light one in 93.5% of recommended norm for women and 121.5% and 114.2% for men respectively. Average vitamin D₃ content in general diet was 3.53±1.21 µg what made 70.6% of its safe level and 35.3% of recommended norm for both men and women. Average vitamin D₃ content in light diet was 2.86±0.89 µg what made 57.2% of its safe level and 28.6% of recommended norm.

Osteoporosis occurrence was found among 71% examined women and 42.3% examined men. Osteopenia was found among 25.8% women and 34.6% men. Proper bones density indicated 23.1% of examined men and only 3.2% of examined women.

Discovered deficiencies of calcium for women and vitamin D₃ for men and women may be one of the main reasons of osteoporosis and osteopenia occurrence among inmates of Military Pensioner House.

EFFECT OF CADMIUM, A METALLOTHIONEIN INDUCER, ON CARDIAC ISCHEMIA-REPERFUSION

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Background: Metallothionein (MT), a rich cysteine residue protein, is induced in different organs in response to heavy metals (such as cadmium) and oxidative conditions. The antioxidant properties of MT and the possible implication of oxidative stress in cardiovascular diseases suggests to study the role of MT in the cardiovascular physio-pathology.

Aims: In the present study, we investigated whether increased level of MT by cadmium (Cd) administration affords protection against cardiac ischemia-reperfusion injury in isolated rat heart.

Methods: Male Wistar rats, (250–300 g), received an intraperitoneal injection of 0, 1, 1.5 or 2 mg/kg Cd 48 h prior to heart perfusion according to the Langerdorff technique. After 10 min of perfusion, a global total ischemia (30 min)–reperfusion (30 min) sequence was performed. Heart rate (HR), coronary flow (CF), left ventricular systolic pres-

sure (LVSP) and left ventricular end diastolic pressure (LVEDP) were measured throughout the experiment. Left ventricular diastolic pressure and functional recovery were calculated as follows: LVDP = LVSP-LVEDP; FR = [(LVDP_{TPx} × HR_{TPx}) × 100] / (LVDP_{TP8} × HR_{TP8}).

Results: During reperfusion, a significant increase of CF (16 ± 1 vs 11 ± 1 ml/min at the end of 30 min reperfusion) and LVDP (82 ± 14 vs 50 ± 5 µHg at the end of 30 min reperfusion) was observed in the heart of rat pretreatment by 2 mg/kg of Cd. HR was not modified. Therefore the FR was significantly improved by Cd administration (115 ± 23 vs 52 ± 6 % at the end of 30 min reperfusion).

Conclusions: Cd, a well-known MT inducer, improve the FR of post-ischemic rat heart. However, the mechanisms underlying this beneficial effect remain to be determined.

A POSSIBLE NEGATIVE EFFECT OF IRON-CONTAINING SUPPLEMENTS FOR IRON INSUFFICIENCY CORRECTION

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Most of the children with decreased hemoglobin level (less 120 g/l) had the combined deficiency of B group vitamins and carotenoids while they were sufficiently supplied with vitamin C. Children's antioxidant status worsening took place more often under the similar iron fumarate intake (Fe²⁺ 15–18 mg/d.) combined with Cu, Zn, Mn, I, Mo, and Cr despite 2–5 fold raised vitamins-antioxidant content (C, A, E) as compared with RDA. The

presence of complexone EDTA or serine and folic acid and vitamin B₁₂ high doses in iron sulfate (Fe²⁺ 20–34 mg/d) containing supplements as well as the additional multivitamins intake not only deteriorated antioxidant status indexes but lead to malonaldehyde serum content decrease in 50–80 per cent of the examined children. Antioxidant status deterioration has been found more often under the combined iron and other minerals intake. Neg-

ative influence of iron intake on oxidative damage indices decreased under additional vitamins administration in particular vitamin B group. Liquidation of existing

vitamin deficit which may be considered as risk factor of iron deficiency development is one of the benefits of the combined iron and vitamins intake.

THE EFFECT OF DENTAL METALLIC MATERIALS ON HOMEOSTATIS IN THE ORAL CAVITY IN POSTMENOPAUSAL FEMALES

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With age fibrillar structures, cellular elements and the basic substance of the periodontium connective tissue (mucous membrane of the gingiva, periodontium and jaw bone) in humans undergo quantitative and qualitative changes. Electrochemical processes, which take place in the oral cavity, play a very important part and affect the development of periodontium pathology.

It has been determined that the increase in the number of metal-containing prostheses in the oral cavity intensifies electrochemical processes which in many ways depend on the temperature regime, the polishing class of metallic prostheses and amalgam restorations, pore presence in them, heterogeneity of metals and saliva chemism, a complex electrolyte, which composition is determined by general health and the state of the oral cavity.

We have studied three groups of females from 45 to 55 years of ages who were in postmenopausal period. Their case histories had no recordings of any diseases that could result in metabolic disturbances. They did not take any preparations to treat hepatic ailments or diseases of the thyroid gland that could lead to the increase of microadmixture quantity in the saliva.

The first control group consisted of 25 females who had no metallic structures in the oral cavity. The second group comprised 63 females who had oral inclusions made

of precious metals (gold, silver – palladium alloy) and amalgam fillings. The third group consisted of 58 females. They all had prostheses of cast metallo-ceramic structures and had no amalgam restorations. It has been revealed that apart from various microelements the saliva of the females in the first control group contained 1.1×10^{-7} % of Au, Cu content was 0.9×10^{-6} %, Ag amount was 2.3×10^{-6} %. The saliva of the females in the second group was found to have respectively 9.8×10^{-7} % Au, Cu content was 5.7×10^{-6} %, Ag content was 9.7×10^{-6} %. The corresponding values for the third group were Au — 1.5×10^{-7} %, Cu — 1.9×10^{-6} %, Ag — 3.3×10^{-6} %.

Clinically the state of the oral cavity was characterized by the following alterations in the first group the oral mucosa and periodontium mucosa were within the normal values, the females of the second group had complaints of the presence of metallic taste in their oral cavity, burning and pain in the tongue, hypersalivation. On examination in 95 of the cases hyperemia of the mucosa was observed. The females of the third group had hyperemia in 12 of the cases.

Therefore, in postmenopausal period the females are advised to replace amalgam restorations by composite ones and metallic prostheses with heterogeneous metals are better to be replaced by cast metaloceramic and porcelain structures.

THE STUDY OF THE STIMULATING EFFECT OF SOME METALS ON THE EXPERIMENTAL REPARATIVE OSTEOGENESIS

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Up to now the problem of reparative osteogenesis is the most acute question in clinical stomatology. This fact makes dentists seek for various effective methods of treating diseases that occur during the reconstruction of the alveolar jaw border in the pathological changes of the parodontium. Parodontitis is a primary nosology that may be localized in the area of one or two teeth or it may have a generalized character.

In postmenopausal period in 67% of the females generalized parodontitis of various severity is observed. Anabolic function of the hormones in such cases is diminished, this results in a relative prevalence of catabolic processes over anabolic ones, particularly in the

osseous tissue. It is well known that estrogens are potent stimulators of proliferation in the tissues of target-organs and cause the similar although less marked action practically in all tissues.

We have performed an experimental study on 68 white female rats of Wistar line. After a prolonged period following castration and in the presence of histologically confirmed involution changes in the parodontium tissues the rats were introduced the preparation made on the base on hydroxyapatite and containing high content of estrogen. 35 out of 68 experimental animals received daily 5 mg of zinc in their feeding. In addition to zinc this group of animals was given 200 mg of

magnesium and 500 mg of calcium to stimulate reparative osteogenesis.

The results of the experiment have demonstrated that in the animals that received magnesium and calcium the condition of the parodontium become stabilized, and only in 20% of these animals generalized osteogenesis in the mild form has developed. In 80% of the animals no pathological changes were registered. During the same period 48.5 % of the animals in the control group

developed generalized parodontitis in moderate degree, 18.2 of them developed generalized parodontitis in the severe form, 27% — in the mild form. 6% of the animals had no symptoms of parodontium inflammation.

Thus, the use of zinc, magnesium and calcium in the complex prophylaxis of parodontitis in the laboratory animals following castration resulted in the prevention of the inflammatory processes in the parodontium.

EFFECTS OF A FORTIFIED BISCUIT WITH VITAMIN A AND IRON ON VITAMIN A STATUS AND ANEMIA IN PRIMARY SCHOOL CHILDREN IN VIETNAMESE SUB-URBAL AREA

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Background: Iron and vitamin A deficiencies are still important public health problem in Vietnam. The data of National Survey in 2000 showed that 34.1% of children under 5 suffered from anemia and 12.4% had low serum vitamin A levels. This survey also indicated that lack of vitamin A and daily iron intake are major causes of these deficiencies.

Aims: to assess the effects of micronutrient- fortified biscuit on vitamin A, iron and physical status of 6 and 7 year old children.

Methods: A double-blind community trial was conducted at a suburban of Hanoi. 230 primary school children were divided into two groups in paire-matched on age, sex, nutritional status: the children in group that received fortified biscuits (FORT, n=115, 30 g biscuits/day having 5.1 mg Iron, 356 µg Retinol); and the children in other group that received unfortified biscuits (CTRL, n=115). The biscuits were distributed daily during the school week after the first two hours of the school day. Micronutrient status was assessed at base-

line and after 6 months: serum Retinol (HPLC analysis), Hemoglobin (Cyamethemoglobin method), serum Ferritin (ELYZA method). Physical status (weight, height) was assessed monthly of the intervention.

Results: The increased of Hemoglobin and Ferritin levels ($X \pm SD$) were significantly higher in FORT group compared with CTRL group (Hb: 17.7 ± 16.7 g/L, $P < 0.05$ vs. 13.7 ± 12.7 g/L in CTRL; and Ferritin: 33.7 ± 41.7 mmg/dL, $P < 0.001$ vs. 4.3 ± 5.1 µg/dL in CTRL). Average increases of serum vitamin A was not different between groups, however the low serum vitamin A (< 30 µg/L) rate was significantly lower ($P < 0.05$) in FORT (45%) compared with 62% in CTRL at the end of the study. The increased growth attributable to the fortification assessed by multivariate regression analysis was 0.23 kg ($P > 0.05$) and 0.63 cm ($P < 0.001$) during 6 months of the study.

Conclusions: Supplementation of fortified biscuit with vitamin A and iron improves the vitamin A, iron and physical status of Vietnamese school children.

ESSENTIALITY OF MAGNESIUM IN REPRODUCTION

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Magnesium is an important activator ion in the function of many enzymes involved in phosphate transfer. It is therefore indispensable in cell function. Many conditions like muscle contractility and nerve conduction, which are associated with the overloading of intracellular Ca^{2+} and cAMP are both blocked by Mg^{2+} yet no role has been assigned to Magnesium in male reproductive tract. In the female there is no definitive role for Magnesium as a Calcium channel blocker and therefore used as anticonvulsant to prevent eclamptic fits and as a tocolytic to abort preterm uterine contraction. Objective of a series of study was to determine the essentiality of human and animal reproduction.

Methodology: In a series of studies, we determined the role of hypomagnesaemia in sexual and sperm dysfunction, like premature ejaculation, impotence, during sperm transport and capacitation of sperm. We tested the hypothesis that changes in Mg^{2+} content of the seminal fluid would affect sperm transport in the vas deferens and sperm motility in the vas deferens is modulated by the Mg^{2+} content of the seminal fluid. Fifteen men with genuine premature ejaculation were evaluated in comparison with men with normal sexual satisfaction and normozoosperma, oligozoospermia and impotence, Zinc, Copper, Selenium and Magnesium were determined by AAS in both serum and semen of groups.

Intervention involved treatment with Magnesium for 4-6 weeks and sexual function evaluate the influence of external Mg^{2+} concentration on reactivity of the vas deferens was studied in the Sprawley-Drew rat, with different concentrations of Ca^{2+} and Mg^{2+} in the tissue bath. The possible role of Mg^{2+} and IL-4 as decapacitators of sperm was investigated in 45 men with normal sperm quality.

Result: Mg^{2+} regulate the contractility of the vas deferens and hypomagnesaemia may lead to premature

ejaculation and impotence. Magnesium may therefore be involved in the modulation of sperm transport. Intracellular Mg^{2+} concentration is dependent on extracellular concentration Mg^{2+} is an important decapacitator of sperm.

Conclusion: Magnesium is essential in the maintenance of erectile function, sperm transport in the vas deferens and in the female reproductive tract. In this regards Magnesium has important role as sperm decapacitator.

FERRIC-ADENOSINE 5'-TRIPHOSPHATE COMPLEXES AS CHELATORS IN THALASEMIA

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The interaction of adenosine 5'-triphosphate disodium salt (ATP) with the trivalent $FeCl_3$ iron trichloride salt was investigated in aqueous solutions. Fourier Transform Infrared (FT-IR) spectroscopic studies showed that $FeCl_3$ perturbs the vibrational spectra of the above nucleotide, in particular the phosphate modes and the

imidazole ring. The changes in the spectra indicate that $Fe(III)$ cations interact with ATP forming a very stable complex. From the FT-IR spectra it was shown a direct $Fe(III)$ -phosphate bonding at neutral pH values. It was also found from thermal analysis data that the formed complex was a dehydrated compound.

BIOLOGICAL ACTIVITY OF SODIUM SALTS D,L-AMINOACIDS, CONTAINING TETRAHYDROPYRANE RING

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In continuation of our work on the application of substituted epoxytetrahydropyranes (I) in the synthesis of biological active compounds we about a new approach to the fused sodium salts of the N-tetrahydropyranil-D,L-amino acids (III a-g) via a reaction of the 4-Methyl-3,4-epoxytetrahydropyran (I) with neuractive

D,L-amino acids (II a-f: γ -aminobutyric (a); glycine (b); β -alanine (c); taurine (d); glutaminic (e); aminosuccinic (f) and methionine (g)).

On the purpose to create new psychotropic means a pharmacological screening of sodium salts of compounds III (a-f) has been carried out.