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## NUTRITION PHYSIOLOGY

### THE EFFECT OF DRIED STRAWBERRY LEAVES ON HAEMATOLOGICAL PARAMETERS OF RABBITS

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The aim of this study was to determine the effect of dried strawberry leaves inclusion on selected haematological parameters of rabbits: white blood cell, red blood cell, haemoglobin, haematocrit, mean corpuscular volume, mean corpuscular haemoglobin, mean corpuscular haemoglobin concentration, platelets, mean platelet volume, red cell distribution width, lymphocytes, mid cells total count, granulocytes, haematocrit, platelet distribution width. Thirty rabbits of broiler line Californian were used in this experiment. The animals were divided into the four groups, four animals in each one (control group C and experimental groups E1, E2 and E3). Animals were fed *ad libitum* using KKV1 feeding mixture (FM) with or without strawberry leaf inclusion as follows: group E1 received feed mixture with concentration of 0.5 % strawberry leaves group E2 1.0 % and group E3 1.5 %. Blood was collected into tubes and the parameters were analysed using Abacus Junior Vet. Statistical analysis showed a significant change ( $P < 0.05$ ) in mean platelet volume between group C and E1 and between group C and E2. Increase of this parameter was detected in all groups in comparison with the control group. Other haematological parameters were without significant differences ( $P > 0.05$ ). Strawberry leaves as a source of antioxidants altered haematological parameters according to our expectations. This study presents only partial results of continuing experiment.

**Keywords:** haematological parameters, strawberry leaves, rabbit

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### THE EFFECT OF SINGLE NICKEL AND COMBINED NICKEL AND ZINC PERORAL ADMINISTRATION ON HAEMATOLOGICAL PARAMETERS IN RABBITS

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The aim of this study was to determine the effect of single nickel ( $\text{NiCl}_2$ ) and nickel in combination with zinc ( $\text{ZnCl}_2$ ) on selected haematological parameters of rabbits: white blood cell, red blood cell, haemoglobin, haematocrit, mean corpuscular volume, mean corpuscular haemoglobin, mean corpuscular haemoglobin concentration, platelets, mean platelet volume, red cell distribution width, lymphocytes, monocytes, eosinophils, neutrophils, basophils. Twenty rabbits of broiler line Californian were used in this experiment. The animals were divided into the five groups, four animals in each one (control group K and experimental groups E1, E2, E3 and E4). Animals were fed *ad libitum* using KKV1 feeding mixture (FM) with or without nickel and zinc addition for 90 days follows: group E1 received 17.5 g of  $\text{NiCl}_2 \cdot 100 \text{ kg}^{-1}$  FM; group E2 35 g  $\text{NiCl}_2 \cdot 100 \text{ kg}^{-1}$  FM; group E3 17.5 g  $\text{NiCl}_2 + 30 \text{ g ZnCl}_2 \cdot 100 \text{ kg}^{-1}$  FM and group E4 35 g  $\text{NiCl}_2 + 30 \text{ g ZnCl}_2 \cdot 100 \text{ kg}^{-1}$  FM. The parameters were analysed using Advia – 120. Blood was collected into tubes containing anti coagulant agents K – EDTA. Statistical analysis showed a significant change ( $P < 0.05$ ) in haemoglobin, haematocrit and percentage of eosinophils. Decrease of all of this parameter was detected in group E2. The significant increase ( $P < 0.05$ ) of haemoglobin and haematocrit was detected in group E4 in comparison with the group E2. Other haematological parameters were without significant differences ( $P > 0.05$ ). Nickel has negative effect on some haematological parameters, but zinc can eliminate its influence.

**Keywords:** haematological parameters, nickel, zinc, rabbit

**Acknowledgments:** This work was financially supported by VEGA scientific grant 1/0084/12 and KEGA grant 030SPU-4/2012

## THE INFLUENCE OF UV RADIATION ON REDUCED GLUTATHIONE CONTENT IN EYE LENSES OF ETHANOL DRINKING MICE

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The experiment was conducted on adult male mice, body weight of 25-26 g. Animals were bred in constant light 12:12 and fed with standard diet. The animals were segregated into one control and three experimental groups. Each group consisted of 5 specimens, n=5. In the first part of the experiment animals of the experimental groups drunk 5%, 10% and 15% ethanol solutions for 10 days and individual daily doses of ethanol were 48, 84 and 118 mg respectively. After 10 days of the experiment animals were decapitated and the lenses were taken immediately. Next the lenses were put into Petri dish filled with physiological saline and placed under UV lamps. The UV system emitted both UV-A and U-B radiation. The lamps were placed 24 cm above the Petri dishes and the lenses were shielded by WG 295 SCHOTT filters which cut off the waves shorter than 295 nm. The biologically effective irradiances of the UV system measured from a distance of 24 cm was 0.00000112 W/cm<sup>2</sup> and 0.0000042 W/cm<sup>2</sup> for UV-A and UV-B respectively. The lenses were irradiated for 3 hours. These gave biological effective doses of 0.12 kJ/m<sup>2</sup> and 0.45 kJ/m<sup>2</sup> for UV-A and UV-B respectively. After the exposure the lenses were homogenized in phosphate buffer containing EDTA (pH=7.4). The reduced glutathione content was estimated with Elman's method using color reactions of thiol groups with DTNB. The method was adapted to microplate reader. Statistical analysis was performed using MANOVA test followed by Tukey's test. We have found statistically significant interactions between UV and ethanol influence on GSH content in mice lenses (F=4.059; p=0.01). Control animals exposed to UV radiation had significantly lower GSH content of reduced glutathione in eye lenses (p=0.01). This effect did not occur in lenses of animals drinking ethanol and exposed to UV radiation. This suggests protective effect of methanol against UV induced drop or reduced glutathione in mice lenses. Probably alcohol drinking before the exposure to UV could increase activity of antioxidative system, which diminished UV influence on glutathione content in lenses of tested mice.

**Keywords:** UV radiation, mice, eye lenses, reduced glutathione

## ACCUMULATION OF MERCURY IN WOMEN IN RELATION AGE AND STATE OF HEALTH

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Considerable concentration of mercury in the tissue is a factor which may also lead to disorders in the antioxidant barrier – another factor which is conducive to the formation and development of cancer. The aim of the study was to determine the content of mercury both in cancerous and healthy women in relation age and state of health. The samples coming from women were divided suitably into 2 age classes: <50 years and >50 years. The content of mercury in the samples was measured using CVAAS. This method enabled us to conduct the precise measurement directly in the tissue. The fragments of esophagus, stomach, small intestine, large intestine, liver, pancreas, kidney, bladder and skin tissues (healthy tissues) and stomach, large intestine, kidney and bladder (cancerous tissues), were placed in a special crucible directly after defrosting and weighing. The measurement was repeated three times for each sample. The average content of mercury was almost identical comparing cancerous tissues of women from both age classes (0.037 ppm and 0.036 ppm). In healthy >50 years old women the average content of mercury was significantly higher (0.008 ppm) comparing to healthy woman <50 years old (0.0002 ppm).

**Keywords:** mercury, esophagus, stomach, small intestine, large intestine, liver, pancreas, kidney, bladder, skin, neoplasm, heavy metals

## USE OF ISCADOR, AN EXTRACT OF MISTLETOE (VISCUM ALBUM L.), IN TREATMENT

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The functional role of oxidative stress in cancer pathogenesis has long been a hotly debated topic. A study by Goh et al., directly addresses this issue by using a molecular genetic approach, via an established mouse animal model of human breast cancer. More specifically, alleviation of mitochondrial oxidative stress, via transgenic over-expression of catalase (an anti-oxidant enzyme) targeted to mitochondria, was sufficient to lower tumor grade (from high-to-low) and to dramatically reduce

metastatic tumor burden by >12-fold (Goh et al., 2011). The oxidative stress directly contributes to tumor progression and metastasis. The damaging effects induced by ROS and by other free radicals include a number of oxidative modifications and/or alterations of critical molecules in a complex reactive scheme, which is defined as oxidative stress (OS). Molecular targets of ROS include unsaturated phospholipids, proteins, carbohydrates and nucleic acids (DNA or RNA). Consequently, the structure and viability of cell functions become compromised. Therefore, it is generally accepted that OS is involved in the physiopathology of degenerative diseases, including the ageing process and cancer. These result have important clinical and translational significance, as most current chemo-therapeutic agents and radiation therapy increase oxidative stress, and, therefore, could help drive tumor recurrence and metastasis. Similarly, chemo- and radiation-therapy both increase the risk for developing a secondary malignancy, such as leukemia and/or lymphoma. To effectively reduce mitochondrial oxidative stress, should be now re-consider the use of natural products as a component of patient therapy and cancer prevention. In support of this idea, vegetarians, who consume a diet rich in antioxidants, have reduced rates of cancer incidence, have longer life expectancies, and suffer less from dementia (Fraser, 2009). Currently, health beneficial roles of natural products attract much attention and diverse functional ingredients have been extensively studied their preventive effect in many diseases such as cardiovascular diseases and cancer. Iscador preparations are used as complementary therapy in the conventional anticancer treatment (Klopp et al., 2005). These are aqueous extracts of mistletoe (*Viscum album* L.) parasitizing apple tree (Iscador M), oak (Iscador Qu) or pine tree (Iscador P). They contain a variety of bioactive substances. The greatest therapeutic effect, particularly in the anticancer therapy, has been associated with viscumins and viscotoxins. As shown on various cells lines in culture, Iscador preparations are cytotoxic to cancer cells but have little effect on normal cells (Hubert et al., 2006). The aim of the present study was to investigate the antioxidant capacity and the possible protective effects of Iscador on the antioxidant system in mice. The experiments were carried out on male mice, average body weight 25–26 g, bred in the constant light conditions LD 12:12 and fed with standard diet with unlimited access to water. The animals were divided into four groups: one control and three experimental groups. The control mice were administered physiological salts. The first experimental group was administered iscador Qu at 5 mg/kg b.w. for 4 days, the second group: iscador M at 5 mg/kg b.w. for 4 days, while the third group was administered iscador P at 5 mg/kg b.w. for 4 days. All injections were administered intramuscularly at the volume of 100 µL. Thirty minutes after the fourth injection animals were anaesthetized and decapitated. The blood samples were collected from the carotid artery. CAT, SOD and GPx activity, and GSH concentration in the blood serum were determined. Levels of glutathione (GSH), glutathione peroxidase (GPx), catalase (CAT) and superoxide dismutase (SOD) activity were measured as surrogate markers of oxidative stress. The analysis of the markers of oxidative stress in blood serum has shown an increase their activity after injections of Iscador Qu, M and P as compared to the control group, with the highest increase after the administration of Iscador Qu. The analyzed studies give

some evidence that Iscador treatment might have beneficial effect on antioxidant system in organism.

**Keywords:** Iscador, cancer, oxidative stress, mice

## T-2 TOXIN AND ITS EFFECT ON THE STRUCTURE OF RABBIT LIVER

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The objective of the present study was to determine the effects of the T-2 toxin and quercetin (Q) on the structure of rabbit's liver. T-2 toxin is a member of the fungal metabolites known as the trichothecenes. Quercetin belongs to a large number of flavonoid compounds commonly found in a variety of fruits and vegetables. These flavonoid compounds have manifold biological properties. We observed the influence of this flavonoid on rabbit's liver after mycotoxin exposure. Adult female and male rabbits of the meat line M91 were used in this experiment. Animals were divided into three groups: control group, T-2 group (1000 µg/kg), and T-2 toxin combined with quercetin (T-2+Q) (1000 µg/kg and 0.3 mg/kg). Light microscopy revealed the most pronounced changes in the T-2 group in the portobiliar spaces of the rabbit's liver. They were dilated and contained inflammatory cells. The inflammation was not located only in these spaces, but was spread along the lobules. In these areas the marked proliferation of progenitor cells, oval cells were observed. These cells were oval, with light-staining cytoplasm and pronounced euchromatic oval shaped nucleus. Hepatocytes located at the borders of portobiliar space showed marked morphological changes. They were large, pale with round euchromatic nuclei. Many of them had two nuclei. The histological changes in the T-2+Q group were moderate in comparison with changes observed in T-2 group. We observed only moderate to slight inflammation in the portobiliar space. Sinusoids were slightly dilated and contained lymphocytes and Kupffer cells. Hepatocytes were pale with round nuclei. The number of binuclear hepatocytes increased considerably compared with T-2 group. In our study we observed partial protective effect of this dietary antioxidant to liver. Quercetin reduced the intensity of inflammation in the portal spaces. Rapid regeneration parenchyma by of activation of hepatocytes and oval cells was also seen.

**Keywords:** T-2 toxin, quercetin, liver, structure, rabbit

**LIVER, ONE OF THE TARGET ORGAN OF PESTICIDES**

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In our previous works we observed the morphological changes in the rabbit's liver for the period of 3, 10, 20 and 30 days after bendiocarb exposure. The most frequent change was the inflammatory process which reached the highest intensity on day three of administration of bendiocarb. In the present study we observed the ultrastructural changes in the rabbit's liver after 10-day of bendiocarb exposure, at a dose 5 mg/kg of body weight. On the tenth day of bendiocarb exposure we did not observe prominent changes in the rabbit liver. The size and shape of hepatocytes were not markedly changed. Their nuclei were centrally located, euchromatic. Intercellular contacts between adjacent cells showed no visible changes. Hepatocytes were located close to each other without extended intercellular spaces. The most numerous organelles in the hepatocytes were mitochondria. They were round or ovoid-shaped with visible cristae. Rough endoplasmic reticulum (RER) was closely associated with the mitochondria without visible dilatation. In some hepatocytes amount of glycogen was reduced. In these cells we observed dilatation of peripheral cisternae of RER was observed. Liver acts as a barrier or filter between the digestive system and the rest of the body and has essential role in metabolism of many chemicals and toxic substances entering the organism through the gastrointestinal system. Our study demonstrates that bendiocarb on day 10 caused less prominent ultrastructural changes in the rabbit's liver. Inflammation, accumulation of Kupffer cells and necrotizing hepatocytes were frequently observed by light microscopy. The electron microscopy revealed less pronounced changes in ultrastructure of the hepatocytes.

**Keywords:** bendiocarb, liver, ultrastructure, rabbit

**NEW TRENDS IN NUTRITION PHYSIOLOGY RESEARCH**

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Within solutions of new problems in nutrition physiology, mainly research of metabolic processes of cells and tissues, their regulation mechanisms, the study of the actions of some enzymes, unsaturated n-3 and n-6 fatty acids, or specific hormones, essential substrates, which are precursors of other biologically active substances are dominating. Interest in knowledge of the importance of minerals and trace elements as active ions across cell membranes and tissue mediators is also increasing. Recent findings in physiology of vitamins are concentrated mainly on their absorption in the digestive tract of man (the absorption of vitamin B12, folic acid, pyridoxine, and some others). Research in molecular and physiological genetics significantly extends the knowledge in the issue of galactosaemia, phenylketonuria and disorders of homocysteine metabolism. After the finding that hyperhomocysteinemia contributes significantly not only to the occurrence of cardiovascular diseases, but also has a direct correlation with factors initiating several civilization diseases, attention has been started to pay to study of physiological factors affecting and regulating the levels of this amino acid in the human body.

**Keywords:** physiology of nutrition, enzymes, vitamins, homocysteine, civilization diseases

**THE ACTIVITY OF SUPEROXIDE DISMUTASE AND GLUTATHIONE PEROXIDASE IN KIDNEYS AND LIVER OF MICE EXPOSED TO ACRYLAMIDE**

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Acrylamide monomer causes neurotoxicity, male reproductive toxicity and endocrine – related tumors in rodents. Acrylamide was found in food, heat-processed potato products, coffee, bread and has been classified as probable human carcinogen by IARC. Daily intake from foodstuff was estimated in the range of 0.3-0.8 mg/kg bw per day (Seal et al., 2008). Glutathione peroxidase catalyzes the reduction hydrogen peroxide by glutathione. Extracellular superoxide dismutase catalyzes the dismutation of superoxide radical to hydrogen peroxide and oxygen. The activity of superoxide dismutase and glutathione peroxidase has been examined. The research was conducted on SWISS mice 8 week old, weight 26 g. Decapitation was carried out after 48, 72 and 192 hours after acrylamide injection. Animals received two doses of acrylamide 20 mg/kg and 40 mg/kg with intraperitoneal injection three times a week. Control group received physiological saline 3 times a week. The activity of superoxide dismutase was higher in the kidneys than in the liver. The activity of glutathione peroxidase was reported higher in the kidneys than in the liver.

**Keywords:** acrylamide, superoxide dismutase, glutathione peroxidase

## ACCUMULATION OF METALS IN HAIR AND NAILS OF WOMEN SMOKING CIGARETTES

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During the combustion of tobacco nicotine is formed and are released other alkaloids, tar, proteins, fatty acids and carbohydrates, purine bases and amine compounds, pectic substances and essential oils. You can also meet other poisons such as hydrogen cyanide, carbon monoxide (II), methyl and ethyl alcohol, or hydrogen sulfide. All of these substances, through the blood, are distributed throughout the body and cause harmful effects. Any substance that is inhaled with cigarette smoke affects the human body. In the same way are exposed active and passive smokers. Material consisted of hair and nails collected from two group of women: smokers and non-smokers. These women came from Małopolska region and ranged in age from 18 to 70 years. In the test samples, determined the contents of heavy metals: cadmium, lead, nickel, magnesium, zinc, iron and copper. Hair and nail samples were weighed and mineralized. Metal determinations were made using the method of flame atomic absorption spectroscopy (FAAS). Statistical analysis was performed using analysis of variances ANOVA. Differences were considered statistically significant at  $p < 0.05$ . On the basis of studies show that smoking has an effect on the accumulation of metals in hair and nails of women. The concentration of metals in hair and nails are different in women who smoke and in those non-smoking. These differences are statistically significant in the case of magnesium, nickel, cadmium, iron and lead. No statistically significant differences was found in the accumulation of copper and zinc. More cadmium, zinc, and copper accumulates in the hair than in the nails regardless of women smoked cigarettes or not. In contrast, in the case of magnesium, nickel, iron and lead higher concentrations of this metals detected in the nail than in the hair. Smoking affects the greater accumulation of metals both in hair and in nails, but it is not the only factor that is responsible for this. Also the conditions in which the person lives, diet, age, and even gender can also affect the accumulation of metals. Metals accumulate in the hair and nails of women irrespective of whether they use the stimulants like cigarettes or not. If a person does not smoke cigarettes does not mean that it is not a passive smoker.

## THE ROLE OF SELECTED MICRONUTRIENTS ON MALE FERTILITY

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Semen is a complex mixture containing a variety of organic and inorganic compounds. While the process of semen production is well understood, studies focused on the essential trace elements necessary for a successful sperm cell production and function are not deeply studied yet. Chemical micronutrients do have an indirect effect on male reproduction, as an unbalance in their amount may indirectly lead to defective spermatogenesis, reduced libido, and consequently, impairment of male fertility. Dietary and feeding supplementation have the ability to increase male reproductive performance and the effects of minerals in diet cannot be ignored. This review will provide information to a better understanding of the essential participation of selected micronutrients on male reproductive processes and functions.

**Keywords:** micronutrients, semen, fertility.

## THE EFFECT OF NON-ANTIBIOTIC STIMULATORS ON SOME PARAMETERS OF ENERGETIC METABOLISM OF FEMALE JAPANESE QUAILS

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The aim of this work was to investigate the effect of non-antibiotic probiotic stimulator with two strains composition (*Bacillus subtilis*, *Lactobacillus paracasei*) and non-antibiotic stimulator with humic acids as effective substances on some parameters of energetic metabolism (glucose, total proteins, triglycerides, total cholesterol, LDL-cholesterol and HDL-cholesterol) of female Japanese quails. Quails (n=60) were divided into three groups (C, control; E1 and E2 experimental groups). Experimental quails received the non-antibiotic

additions in complete feed mixture. Control quails received complete feed mixture without non-antibiotic additions. These preparations caused a significant decrease ( $P < 0.05$ ) of LDL-cholesterol content in comparison to the control group. Serum HDL-cholesterol and total cholesterol content was decreased in E1 and E2 groups when compare with the control group but without significant differences ( $P > 0.05$ ). In other observed parameters any significant changes ( $P > 0.05$ ) were found. The research on the field of non-antibiotic stimulators will be worthy of further investigation.

**Keywords:** quails, *Bacillus subtilis*, *Lactobacillus paracasei*, humic acids, lipids metabolism

#### THE ACTIVITY OF SUPEROXIDE DISMUTASE AND GLUTATHIONE PEROXIDASE IN KIDNEYS AND LIVER OF MICE EXPOSED TO ACRYLAMIDE

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#### ABSTRACT

Acrylamide monomer causes neurotoxicity, male reproductive toxicity and endocrine – related tumors in rodents. Acrylamide was found in food, heat-processed potato products, coffee, bread and has been classified as probable human carcinogen by IARC. Daily intake from foodstuff was estimated in the range of 0.3-0.8 mg/kg bw per day (Seal et al., 2008). Glutathione peroxidase catalyzes the reduction hydrogen peroxide by glutathione. Extracellular superoxide dismutase catalyzes the dismutation of superoxide radical to hydrogen peroxide and oxygen. The activity of superoxide dismutase and glutathione peroxidase has been examined. The research was conducted on SWISS mice 8 week old, weight 26 g. Decapitation was carried out after 48, 72 and 192 hours after acrylamide injection. Animals received two doses of acrylamide 20 mg/kg and 40 mg/kg with intraperitoneal injection three times a week. Control group received physiological saline 3 times a week. The activity of superoxide dismutase was higher in the kidneys than in the liver. The activity of glutathione peroxidase was reported higher in the kidneys than in the liver. Studies in *Drosophila melanogaster* have shown that acrylamide causes oxidative stress and clearly enhances reactive oxygen species and interferes of oxidative enzyme activity (Prasad and Muralidhara, 2012).

**Key words:** acrylamide, superoxide dismutase, glutathione peroxidase

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#### THE EFFECT OF METABOLIC DISORDERS OF DAIRY COWS ON MILK QUALITY: REVIEW

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Milk is a food product completely responsible for all dietary requirements of juveniles. The components of milk (proteins, fat, minerals, vitamins, sugars) are characterized by high biological value and utility. For nutritional, as well as economic reasons, it is more and more important to increase milk production. The increasing milk production of dairy cows leads to increasing demands for optimal intake of suitable nutrients. If it is not paid attention to these demands, it can create space for the development of many metabolic disorders. These may be presented in the composition and quality of milk. The aim of this study is to present basic information and the cause of metabolic disorders in dairy cows, methods of their detection and mainly to gather the latest knowledge of the effect of metabolic disorders of dairy cows on milk quality. Specifically, we deal with acidosis, alkalosis and ketosis as the most frequent metabolic diseases of dairy cattle.

**Key words:** milk quality, metabolic disorders, metabolic test, acidosis, alkalosis, ketosis